Maine Yankee Decommissioning Experience Report

Detailed Experiences 1997 - 2004

CITATIONS

This report was prepared for EPRI and Maine Yankee by

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REPORT SUMMARY

Several U.S. nuclear power plants entered decommissioning in the 1990's. Based on current information, the next group of plants whose license will expire will not begin decommissioning for nearly a decade. This report provides detailed information on the decommissioning of one power reactor – Maine Yankee, in order to provide their experience for future plants.

Objective
To summarize the decommissioning experience of a power reactor in the end stages of decommissioning and to provide lessons learned for future plants entering decommissioning.

Approach
The project team gathered survey information from managers at current decommissioning facilities to determine areas of interest to future decommissioning managers. Information on these areas of interest was obtained from Maine Yankee. The information gathering included onsite interviews with several Maine Yankee managers, as well as review of information provided by Maine Yankee, and information obtained through other sources. In particular, information was gathered on specific lessons learned for future plants entering decommissioning and recommendations for current operating plants to improve performance for future decommissioning.

Results Summary
The decommissioning experience and lessons learned of Maine Yankee is presented in the areas of:

- Pre-shutdown actions and analyses
- Transition activities from operations to decommissioning
- Use of Decommissioning Operations Contractors
- Fuel Storage Options
- Regulatory and Stakeholder interaction
- Specific Technologies used
- Site closure issues

In addition, the report provides recommendations from Maine Yankee staff on actions that currently operating plants can take now to assist in eventual decommissioning activities. These

include enhancing stakeholder relations, improving contamination control both inside and outside restricted areas including strong document control, building a strong historical site assessment and enhanced ground water monitoring,

ACKNOWLEDGMENTS

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- Mike Meisner – Vice President & Chief Nuclear Officer
- Micky Thomas – Vice President & Chief Financial Officer
- Eric Howes – Public & Governmental Affairs Director
- Bill Henries – Decommissioning Director
- Tom Williamson – Nuclear Safety & Regulatory Affairs Director
- Mike Whitney – Regulatory Affairs Director
- Jim Connell – Radiation Protection Manager
- George Pillsbury – Final Status Survey Principal Engineer

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CONTENTS

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LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

Over the past eight years, EPRI has developed and published a number of lessons learned documents and workshop proceedings related to decommissioning.

These lessons learned documents and workshop proceedings have provided a sound reference base for reactor facilities that will eventually undergo decommissioning. Many of these experience reports and workshops were developed in conjunction with U.S. nuclear plants currently in different phases of decommissioning.

As of 2004, many of these reactor facilities have completed a large portion of the required decontamination and remediation and anticipate the full conclusion of the decommissioning projects in the near term. Based on currently announced or submitted license extension applications, only five additional U.S. reactors will enter decommissioning prior to 2020, with the next planned shutdown not occurring until 2011.

In order to capture additional essential experience for future decommissioning projects, EPRI began a pilot effort to gather selected detailed information from a current site in the latter stages of decommissioning. An initial listing of "essential information" to be gathered was developed. This initial listing is provided in Appendix A. In order to validate this list, individuals from two facilities currently undergoing decommissioning were asked to rank the information topics on their relative benefit to future decommissioning projects.

It is interesting to note in the development of the initial listing of "essential information" the expected outcome would focus on detailed project plans, schedules, engineering analysis or similar "nuts and bolts" activities in decommissioning. These types of tasks were certainly necessary for effective and efficient decommissioning. However, there is a second level of information that is deemed significant to the efficient conduct of the decommissioning project. The information areas in this group were so-called "soft areas" including stakeholder interaction, regulatory interaction, and project decision methods (e.g., use of decommissioning operations contractor or not, wet or dry spent fuel storage, or decommissioning approach). Therefore, the information being capture was directed to both hard project data and those "soft" tasks which influence the effective conduct of the overall decommissioning project.

Maine Yankee Atomic Power Company (MYAPC) agreed to be the host site for this pilot detailed experience report. In order to gather the detailed information identified, site interviews were conducted at the Maine Yankee site and corporate offices in October 2004. Supplemental telephone interviews were conducted in November 2004. Interviewees included the President & Chief Executive Officer, Vice President & Chief Nuclear Officer, Chief Financial Officer, Regulatory Affairs Manager, Public Affairs Manager, Site Decommissioning Manager, Engineering Manager, Radiation Protection Manager and selected staff members. In addition to the interviews, certain documentation was provided by MYAPC personnel in addition to information gathered from other sources. A summary of information sources used is provided in Section 10.

In addition to addressing questions regarding specific decommissioning experience, the MYAPC personnel were asked questions regarding how their decommissioning experience might be useful for currently operating nuclear reactors as well as for those contemplated to be built in the future. Their insights on these questions are also provided in this report.

The remainder of this document provides a brief summary of the MYAPC decommissioning project followed by summaries of the interview results and documentation reviews for each of the following topics:

- Pre-Shutdown Issues
- Transition Activities
- Use of a Decommissioning Operations Contractor (DOC)
- Fuel Storage Options
- Regulator and Stakeholder Interaction
- Engineering and Use of Technology
- Site Closure Issues

Each of the following sections begins with a brief listing of decommissioning lessons learned from Maine Yankee. In addition, a specific listing of recommendations for operating plants which would improve performance in future decommissioning is provided in Appendix F. Other items included in this report include:

- A summary project schedule is provided in Attachment B;
- A project timeline is provided in Attachment C;
- A summary of radiation exposures per major task is provided in Attachment D;
- A summary of radioactive and non-radioactive waste shipped is provided in Attachment E; and,

Maine Yankee Overview

Maine Yankee was owned by a consortium of 10 New England electric utilities representing consumers in Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island. Maine Yankee, a single unit facility was located on a 820 acre site in Wiscasset, Maine and housed a three-loop pressurized water reactor rated at 2,700 MWt and 860 MWe. The reactor was designed by Combustion Engineering and the plant was built by Stone & Webster.

The following five figures provide the location of the plant as well as a site layout.

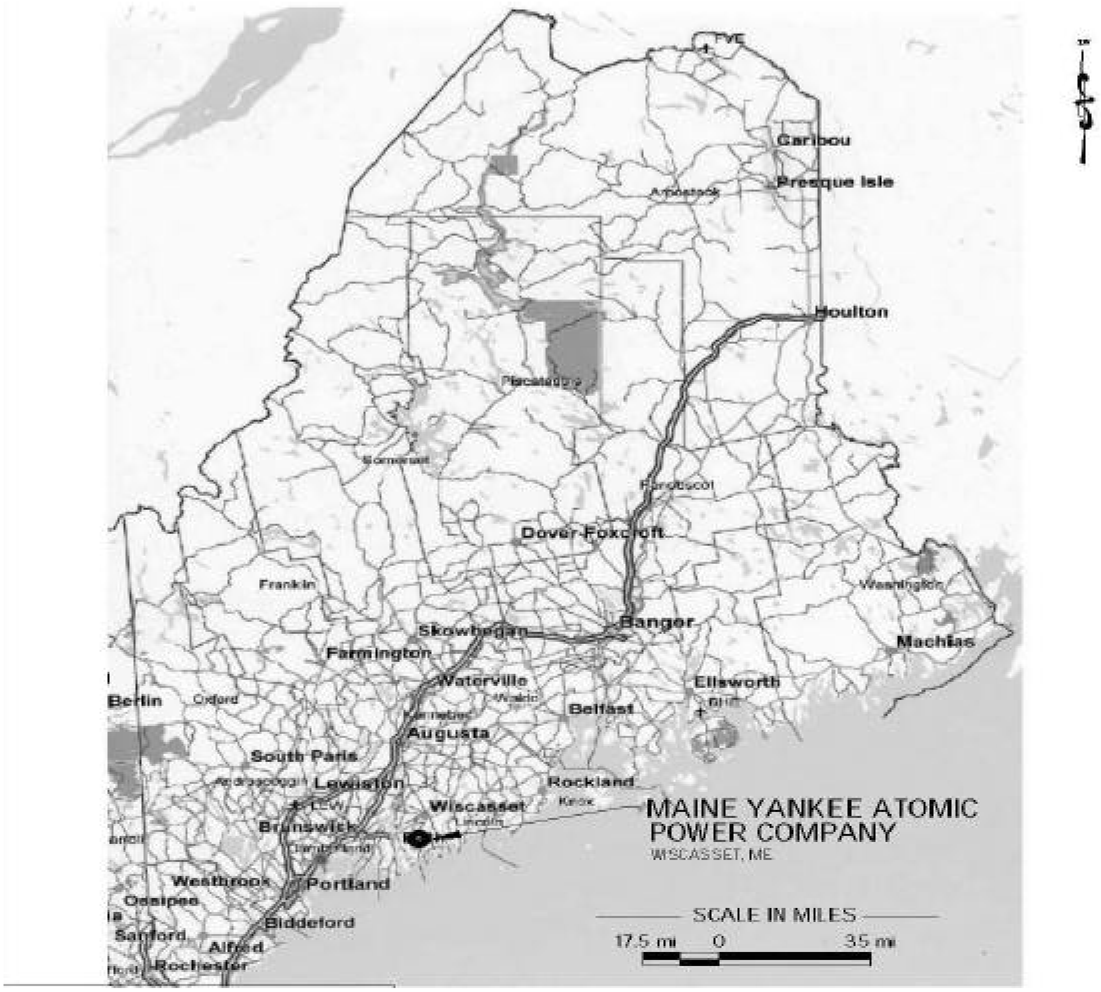


Figure 1-1 Maine Yankee Location Within Maine

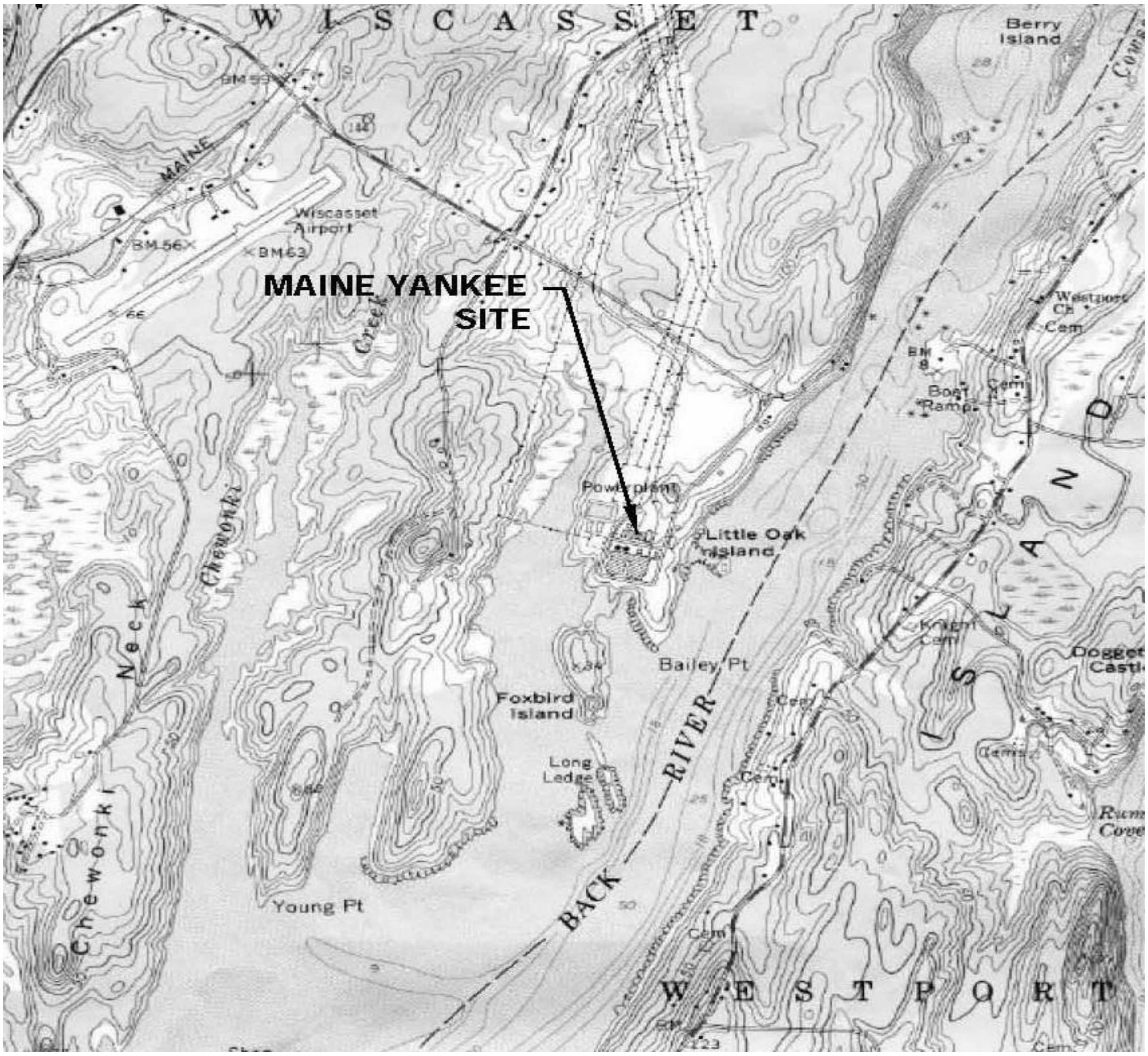


Figure 1-2 Maine Yankee Local Location

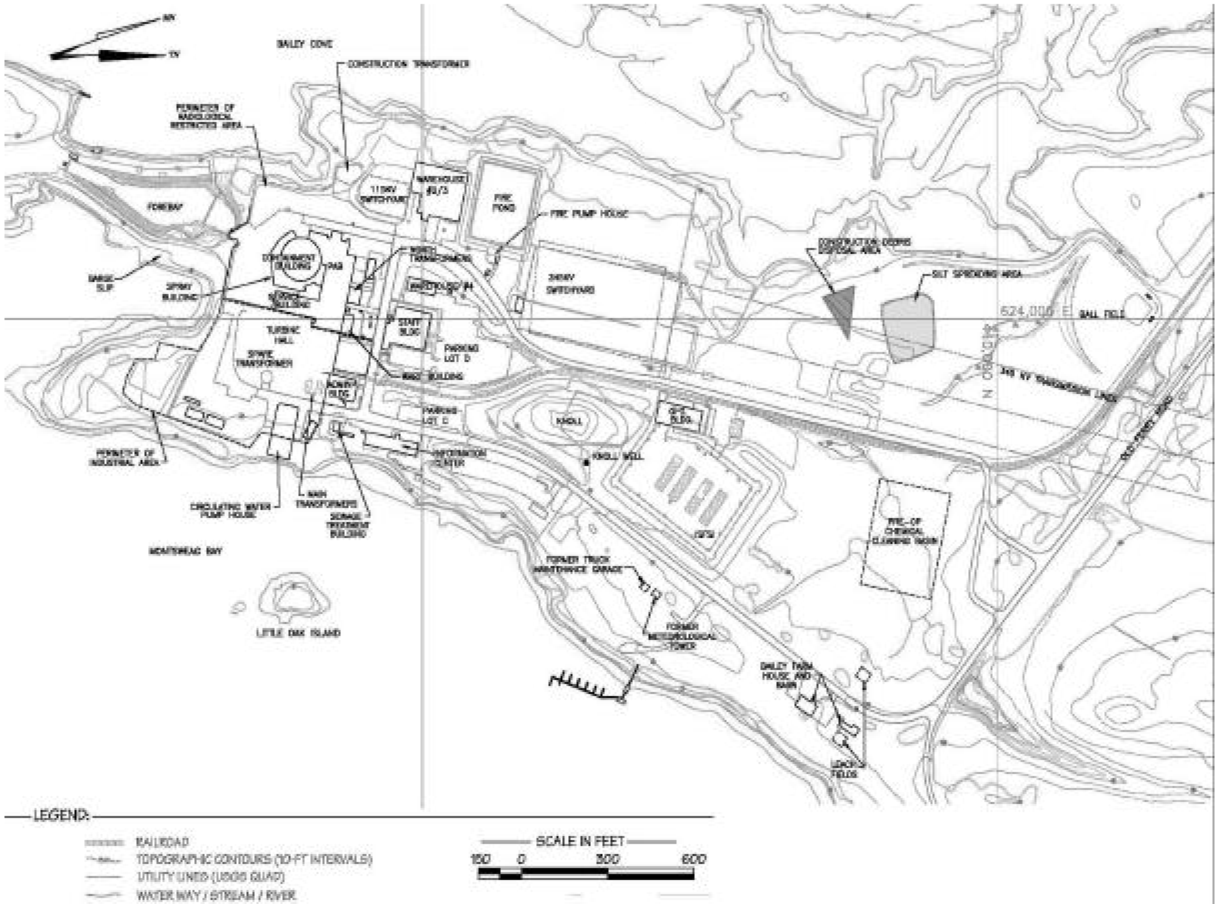


Figure 1-3 Maine Yankee Site Area Layout

Figure 1-4 Maine Yankee Aerial View

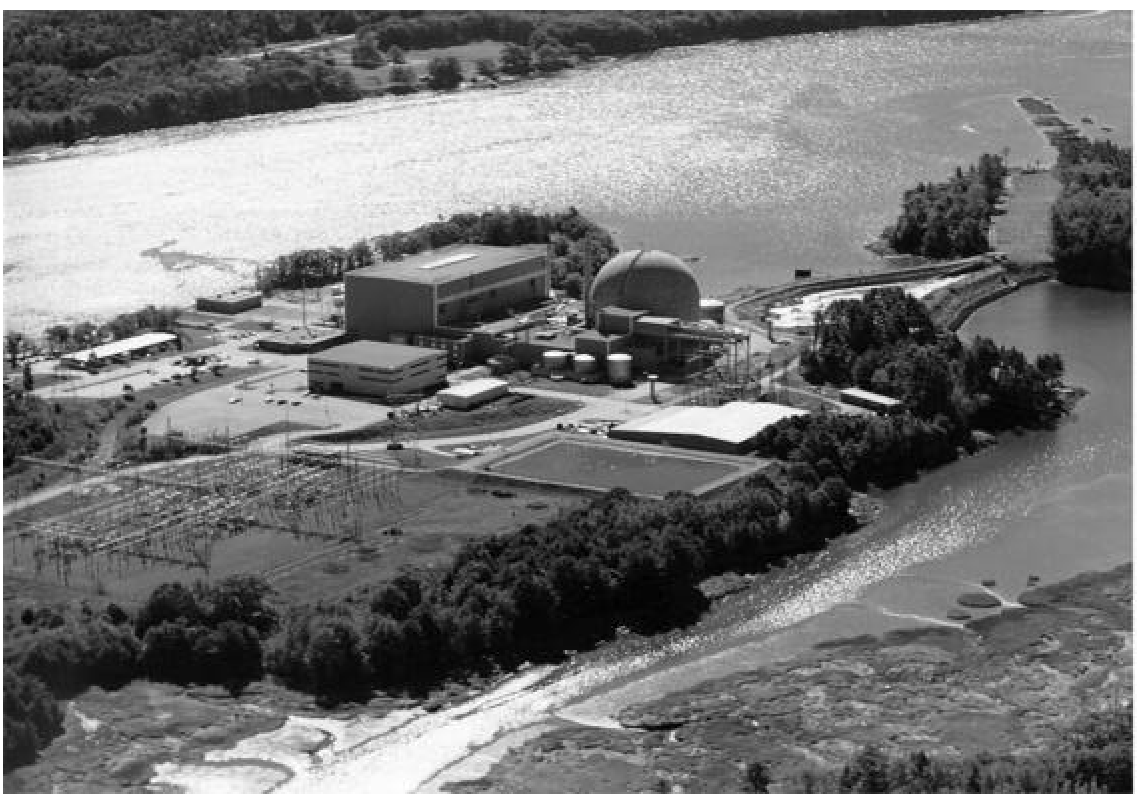


Figure 1-5 Maine Yankee Aerial View - 2

2 PRE-SHUTDOWN ISSUES

Lessons Learned/Recommendations

- If permanent shutdown is a planned evolution, pre-shutdown activities should begin in earnest approximately a year before shutdown with a dedicated team of site and corporate individuals with expertise in licensing, stakeholder interaction, engineering, project management, financial analysis, accounting and budgeting, health physics/radiation protection and human resources.

Shutdown Decision

The construction permit for Maine Yankee was issued on October 21, 1968. The Operating License was issued on September 15, 1972 allowing power operation up to 75% rated thermal power. The plant began commercial operation on December 28, 1972. In June 1973, the facility received a full power license for up to 2440 megawatts thermal (MWt), corresponding to approximately 774 megawatts electrical (MWe).

Operating license amendments were later issued allowing power operation up to 2,700 MWt. This power level corresponds to a gross electrical output of approximately 931 MWe.

In the mid 1990's, Maine Yankee encountered various operational and regulatory difficulties. In 1995 the plant was shut down for almost the entire year to repair steam generator tubes. Maine Yankee shut down for the final time on December 6, 1996 for various problems, including improper cable separation, replacement of a number of leaking fuel rods and the need to inspect the plant's steam generators. This outage was expected to last through at least August of 1997.

Based on this history, the Board of Directors conducted ongoing economic assessments of the future viability of Maine Yankee.

In May 1997, the Board of Directors announced that Maine Yankee was considering permanent closure based on economic concerns and uncertainty about operation of the plant. The Board also explored the possibility of a sale of the plant.

The results of the final economic assessment were provided to the full Board of Directors on July 30, 1997. This report noted that while there are many variables and uncertainties in the analysis, the primary ones that were found to affect the economics of the plant were:

- the projected market price of replacement power;

- the useful life of the plant;
- the unit's average capacity factor;
- the unit's variable operational costs, the costs that could be avoided if a decision is made to close the plant, and the timing and amount of decommissioning expenses; and,
- the projected restart date.

The economic assessment looked at several scenarios with three primary options being evaluated. The first option was immediate entry into decommissioning which would result in the fastest reduction in operational costs. The second option was to provide funds to preserve the plant for some months allowing for the options of plant sale or restart. The last option was to restart the unit which at that time had made substantial progress towards a target of November 1997.

The summary of the economic analysis concluded:

- The reference case assumptions (which assumed that the plant would operate until the end of its license) would result in a slight net present value (NPV) benefit to Maine Yankee's customers.
- The reference case provided the starting point for the analysis. It was not viewed as the most likely outcome.
- It was noted that each member company might conduct slightly differing economic studies, however it was believed that all the member companies would likely make the following judgments as to scenarios assumed to be more likely than the reference case, including:
  - operation of the unit for less than the remaining licensed life;
  - capacity factors below the assumed non-outage value of 95%;
  - additional capacity factor reductions to to reflect performance risks such as the extension of refueling outages or unplanned forced outages;
  - modification of the discount rate for continued operation cash flows;
  - restart later than November 1, 1997; and
  - replacement power costs 10% lower than assumed in the reference case.
- Most combinations of adjustments such as those indicated above result in substantial penalties for customers from the continued operation of Maine Yankee.

Pre-Shutdown Planning

In 1996 and 1997, initial planning efforts for decommissioning began. These efforts included:

- Drafting the Post Shutdown Decommissioning Activities Report (PSDAR);
- Beginning development of a range of exemption requests to be submitted to the NRC. These exemption requests included reductions in emergency plan requirements, reduction in

insurance requirements, and changes in technical specifications. The certifications to the NRC on permanent cessation of operations and permanent defueled status were also prepared;

- Review of a previous decommissioning cost estimate;
- Assessment of decommissioning options (prompt or deferred);
- Initial assessment of decommissioning approach – self perform or contract out (addressed in Section 4); and,
- Initial assessment of stakeholder interactions required (addressed in Section 6).

The decommissioning approach selected (prompt dismantlement) followed the economic analysis of the Board of Directors which noted that if decommissioning was the selected outcome for the site, the prompt approach was the most economically advantageous to the ratepayers.

On August 6, 1997, due to economic reasons, the Maine Yankee Atomic Power Company Board of Directors voted to permanently cease power operations and immediately initiate the decommissioning process.

3
TRANSITION ACTIVITIES

Lessons Learned/Recommendations

- Management – Select a small management group for the project with all disciplines involved for the initial decommissioning planning. It was essential to work together as a team in a generally flat organization.
- Management – Important to keep all departments involved, even when it was not obvious that the issue to address was in their area. This is because in decommissioning it is not always obvious how a seemingly unrelated task/decision could affect other departments, and also because unique and better solutions/approaches to problems were offered by those not directly related to the issue.
- Management – Over time, a generally small management team gathers sufficient knowledge about areas outside their direct management area that their insights often have the effect of adding another level of quality assurance to work activities.
- Management – In selecting personnel to remain with the decommissioning project, it is important to retain expertise and experience in construction in addition to keeping managers with operational experience. In order to support the next recommendation, it is also important to obtain personnel with expertise in construction and/or demolition experience.
- Management – A key early transition activity is moving the site mentality toward decommissioning rather than operations.
- Cold and Dark (defined in detail in the following) – Condensation made the Primary Auxiliary Building floors slippery – need to install walkway mats.
- Cold and Dark – Take specific care in the implementation of an "orange plan" (defined in detail in the following text). Lack of attention to detail can result in lines, conduit or supporting media being inadvertently cut.
- Cold and Dark – Assure low spots in lines are adequately drained. Once heat is reduced or eliminated in a facility, inadequate draining can result in fractured lines or valves due to entrained water freezing.
- Cold and Dark – Perform independent review of projects to avoid missing sneak electrical circuits from non-cold and dark buildings.

Overview

The transition period in decommissioning is generally considered the period between permanent cessation of operations and the commencement of decommissioning activities. In the case of Maine Yankee, this was the period between August 1997 and approximately July 1998 when the Decommissioning Operations Contractor (DOC) was selected. Key actions in this period consisted of:

- Submittal of various regulatory and licensing documents in order to reduce the burden of activities no longer required;
- Completion of business cases to determine decommissioning options;
- Development and submittal of Requests for Proposals (RFPs) for major decommissioning contracts;
- Planning and conduct of pre-decommissioning actions;
- Execution of critical path activities such as site assessment, reactor coolant loop chemical decontamination, and asbestos abatement;
- Selection of site personnel to remain with the decommissioning project and commencement of destaffing actions for personnel termination; and,
- Initiation of stakeholder interaction relative to decommissioning.

Transition Licensing Actions

The first licensing actions taken after the decision was announced were the submittals to the NRC certifying that Maine Yankee has permanently ceased operations and had permanently removed all fuel from the reactor vessel. These certifications were submitted to the NRC the day after the Board of Directors announced the decision to decommission.

Following these submittals, the next key step is the submittal of the Post Shutdown Decommissioning Activities Report (PSDAR). The site had PSDARs submitted by other facilities as a reference model, however needed to tailor the document to Maine Yankee site specific data such as the preliminary decommissioning schedule, cost estimate and estimates of waste volumes and radiation exposure for the project. The Maine Yankee specific PSDAR was submitted to the NRC on August 27, 1997. The PSDAR as submitted identified that license termination and site remediation should be completed approximately seven years following cessation of operations. It is noted that with the cessation of operations occurring in August of 1997, the PSDAR would suggest that the Maine Yankee decommissioning would be complete by August 2004. The current completion is scheduled for March 2005 (a schedule increase of only 8%).

After receipt of the PSDAR, the NRC conducts a public meeting in the vicinity of the reactor, normally within 90 days of the document receipt. This meeting provides the public with a summary of the decommissioning approach and timeline as provided by the licensee, and affords the NRC the opportunity to discuss the regulatory and oversight process for a decommissioning reactor. The meeting also provides an opportunity for public comment. The public meeting for Maine Yankee was held on November 6, 1997.

Licensing activities are a significant activity throughout the decommissioning project. More detail on the regulatory interactions required for Maine Yankee is provided in Section 6.

Transition Business Cases

If not already completed, several business cases or economic analyses are conducted in the transition period. These are very significant as the results form the overall approach and are the key decision inputs for the entire decommissioning project going forward.

The earliest business case is for the selection of the decommissioning approach. As noted above, the Board of Directors economic analysis had been completed for this task, resulting in the decision to proceed with prompt decommissioning.

The next significant business case is to determine the overall decommissioning project management method. The options primarily were Maine Yankee managing the project and hiring specific contractors or subcontractors as needed for project completion, hiring a general contractor who obtained all necessary subcontractors or hiring a Decommissioning Operations Contractor (DOC). The DOC approach is similar to hiring a general contractor. A general contractor provides all the labor and skills specified in the contract for a pre-set rate per labor hour (so-called “time and materials” contract). The DOC differs from the general contractor approach in that the DOC accepts some portion of the risk on a fixed price basis for the project from the licensee, in addition to providing all necessary labor and skills for the job. As discussed in Section 4, Maine Yankee selected the DOC approach.

Another business case which is typically initiated in the transition period is the approach to be taken for storage of spent nuclear fuel. At the time of Maine Yankee’s shutdown, the U.S. Department of Energy (DOE) still was not in default on its contract to begin accepting spent nuclear fuel beginning January 1, 1998, but it was apparent that Maine Yankee’s spent fuel would need to be maintained on site for an extended period. DOE indicated that the Yucca Mountain repository would likely not be in operations until 2010. Assuming the facility opened on the new schedule, each power reactor in the United States is allocated space in a queue for shipment of their fuel to the final repository.

One key variable in the business case for on-site spent fuel management is the selection of a date by which all the spent fuel on site is expected to have been transferred to the DOE for permanent disposition. This economic analysis is further addressed in Section 5.

Transition Requests for Proposals (RFPs) and Projects Performed

Once the decision is made for the contracting approach, detailed RFPs are developed and offered for bid. For the DOC, this is further addressed in Section 4. Early assessment at Maine Yankee indicated that physical decommissioning work would not begin for 6 – 12 months in order to complete the business cases, develop and issue RFPs, obtain, evaluate and select contractors, and mobilize the contractors.

Maine Yankee then looked at this 6 – 12 month period as an opportunity to evaluate and conduct relatively discrete (defined scope) projects which would likely be required regardless of the contracting approach selected and would reduce the overall project risk. The discrete projects included site asbestos abatement, hot spot reduction, reactor coolant system decontamination, initial characterization surveys, and the transition of the power block to "cold and dark" status. The transition to "cold and dark" may either include the creation of a spent fuel pool island, or the spent fuel pool island creation may be a separate unique transition project.

Asbestos Abatement

During plant operations asbestos was remediated as needed to perform plant maintenance or modifications. As such, Maine Yankee had experience in contracting with appropriate asbestos remediation and disposition firms. No wholesale remediation occurred during operations. Asbestos was widely used at Maine Yankee in insulating material, fire deterrent, paint additives and in tile. This was similar to other reactors that began operations in the early 1970s. The volume of asbestos as provided in an earlier decommissioning cost estimate was 16,000 ft^3. Maine Yankee specific assessment was that approximately 28,500 ft^3 of asbestos would need remediation. It was estimated that approximately 1/3 of the asbestos was radioactively contaminated and would need disposition at a licensed low-level waste site. Non-asbestos insulation was left installed in the turbine hall to help facilitate re-powering options and/or the potential sale of turbine hall components.

The asbestos remediation project began in March 1998 and concluded in mid-December 1998. This abatement project was estimated to be at least four times larger than any asbestos abatement project ever completed in the State of Maine. It was also the largest abatement project ever performed by Maine Yankee's asbestos abatement subcontractors. The project utilized the services of over 12 subcontractors, at a peak of 145 workers, and they worked approximately 200,000 person-hours to remove ~80,000 ft^3 of asbestos containing materials.

Hot Spot Reduction

Maine Yankee viewed the reduction of radiation exposure for decommissioning as a significant objective for the overall project. Two early projects were initiated for the purpose of reducing the source term, or amount of radioactive material, in the plant to which decommissioning workers would be exposed. These two projects were Hot Spot Removal and Reactor Coolant System Decontamination.

Radiation surveys conducted during plant operation would note general hot spots in plant cubicles, pipe chases and other areas. These hot spots were often at piping elbows, valve connection points, locations in piping with flow changes, and other locations. In order to avoid unnecessary exposure to technicians, these areas were only generally located. The primary purpose of these surveys being to identify the general area of elevated exposure rates to notify workers to avoid the area.

The hot spot reduction program intended to specifically identify the hot spots to allow them to be "surgically" removed, that is cutting out the specific valve or piping section vs. removal of entire lines or components in an area.

In order to accomplish this program, the systems were drained and taken out of service. This meant that only systems no longer needed for the safe management of the fuel were available for the hot spot reduction. Maine Yankee obtained a gamma camera (Gamma Cam) to support the hot spot reduction effort. The Gamma Cam consisted of computer based video camera and radiation detection equipment. In use, the Gamma Cam would provide a black and white image of a monitored area with superimposed color areas. The color variations represent variations in radiation exposure rate. The images produced would allow clear identification of the highest activity sources in an area, which could then be removed. The process could be repeated for a given area to produce the desired dose reduction.

The site Radiation Protection Manager estimated that the hot spot reduction program likely reduced the total project exposure by ~ 150 person-rem (1.5 person-Sv).

Reactor Coolant System Decontamination

In addition to hot spot reduction, Maine Yankee also decided to perform a chemical decontamination of the reactor coolant system (RCS). The Radiation Protection Manager estimated that RCS decontamination also likely reduced the total project exposure by ~ 150 person-rem (1.5 person-Sv).

The subject of the RCS decontamination is addressed in detail in EPRI Report # TR-112092, Evaluation of the Decontamination of the Reactor Coolant Systems at Maine Yankee and Connecticut Yankee, and Report # 1003026, Decontamination of Reactor Systems and Containment Components for Disposal or Refurbishment and is summarized below.

The RCS decontamination contractor was selected to provide craft support, electrical services and waste processing services. Limited use of plant equipment was required. The reactor vessel was bypassed by the installation of a flow through nozzle dam assembly, called a spider, at the interface of the reactor coolant loops and the reactor pressure vessel. The steam generator tubes were bypassed by jumper and reduced flow rates (400 – 650 gpm) were used. Recirculation was provided by an external 600 gpm pump provided by the contractor. External heating, ion exchange vessels, chemical addition, sampling and filtration were also provided by the contractor.

The process included two separate applications or phases. Phase 1 included portions of RCS Loop 2 and 3, the letdown system, charging system, fill and drain system and pressurizer (Figure 3-1). Phase 2 included all three loops and the residual heat removal system (Figure 3-2). The process was begun on February 10, 1998 and was completed by March 7. This included two days to change over systems and two days for system clean-up at the end of the decontamination.

A total of 11 cycles were applied in Phase 1 requiring 191 hours. Phase 2 completed a total of 13 cycles in 182 hours. The results of the project included:

- 102 curies of gamma-emitting activity were removed (98% cobalt-60);
- 673 pounds of dissolved metals were removed (278 pounds of iron, 262 pounds of nickel, and 133 pounds of chromium);
- The decontamination factor (DF) over all points was 31, while the DF for points greater than 100 mR/h was 89; and,
- 535 ft^3 of ion exchange resin waste was generated from the decontamination with an additional 90 ft^3 of resin generated from the system deboration.

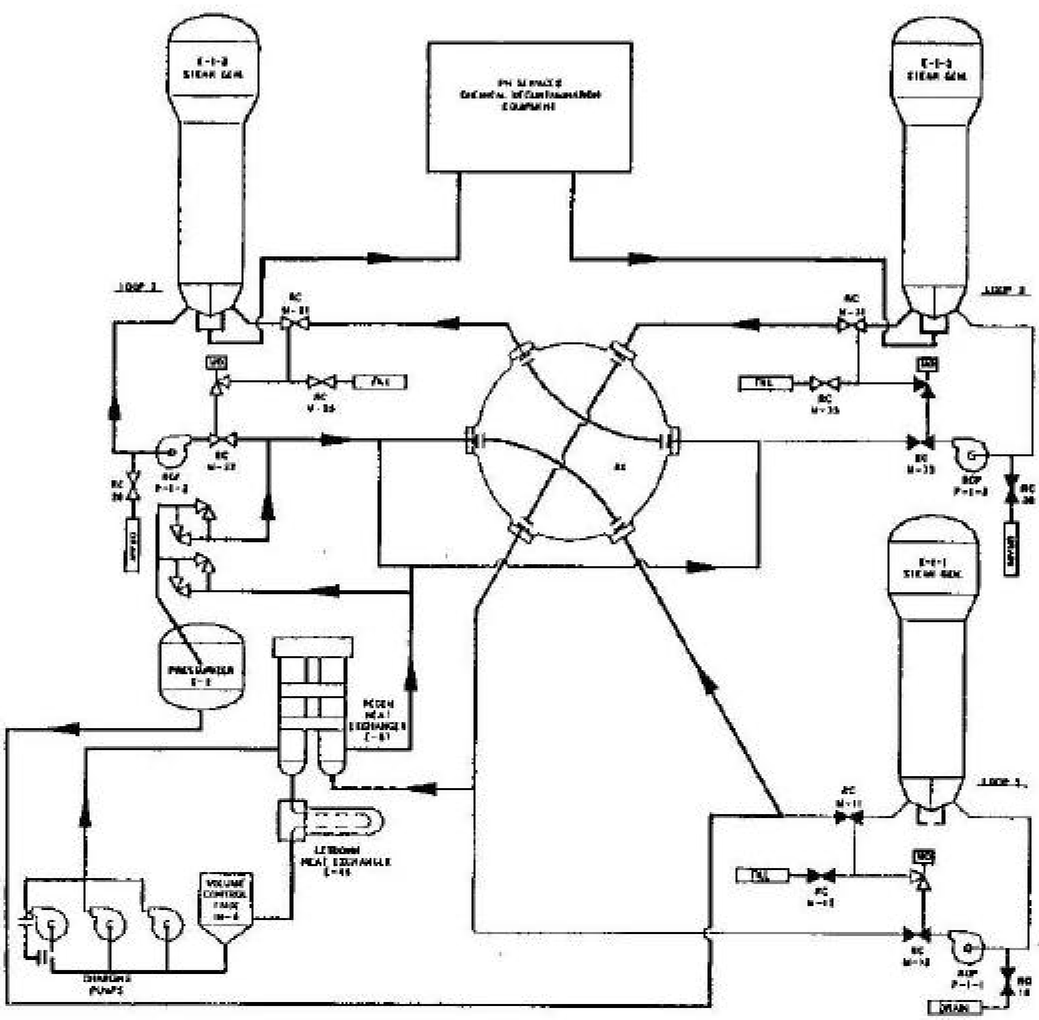


Figure 3-1 Maine Yankee RCS Decontamination Phase 1

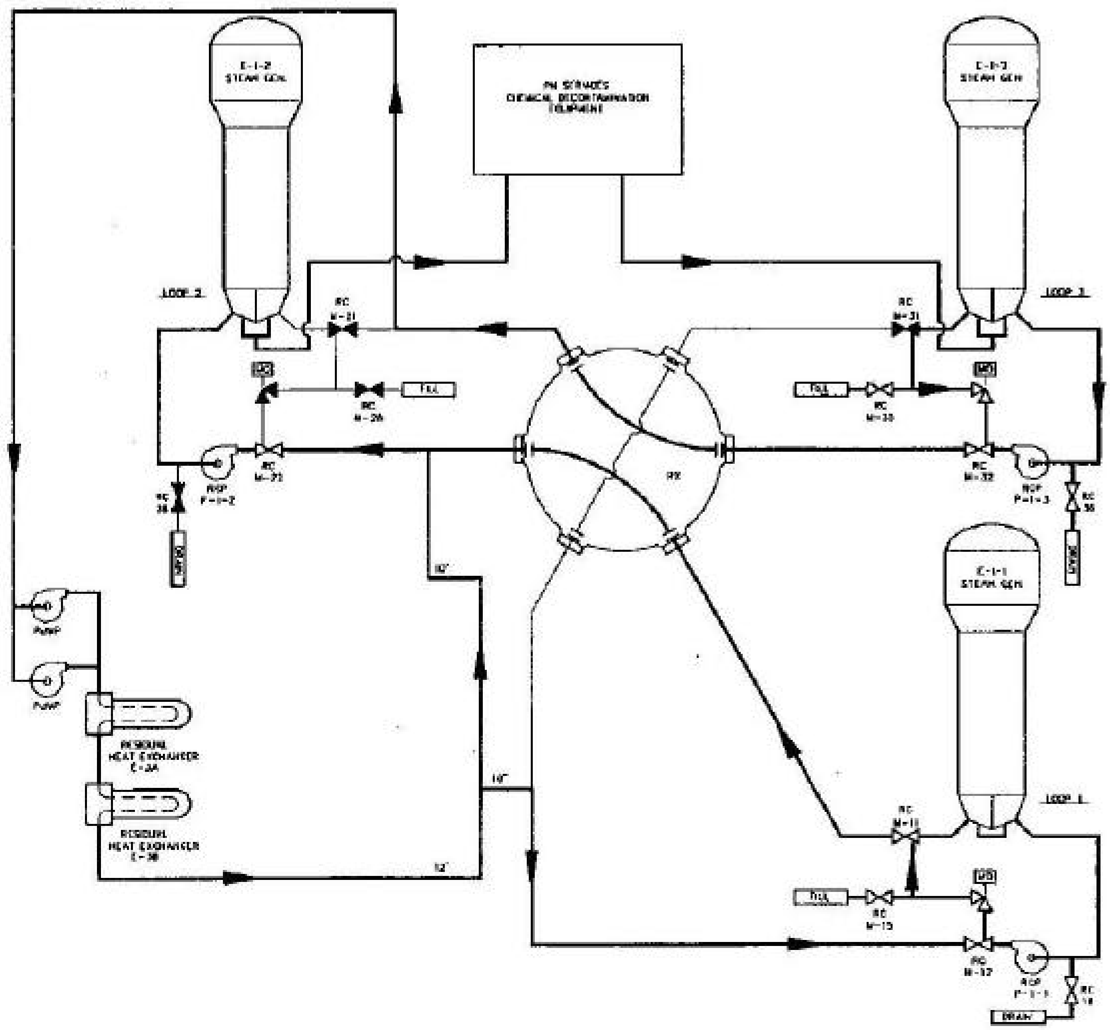


Figure 3-2 Maine Yankee RCS Decontamination Phase 2

Initial Characterization Surveys (ICS)

It was identified early on that a detailed site characterization would be essential for any decommissioning contract approach selected, as the results of site characterization support the development of detailed project plans. A site characterization contractor was selected and began site work in mid-October 1997 and completed in April 1998 with the report issued April 29, 1998. This characterization included hazardous materials as well as radioactive materials.

An interesting aspect to this project was the participation by prospective DOC bidders. Maine Yankee had decided to proceed with preparing an RFP for a DOC under a fixed-price approach. The expectation from Maine Yankee was that the DOC selected would be responsible for required remediation of contaminated materials. It was imperative therefore that the prospective bidders accept the results of the initial site characterization as their bids would in-part be based on the amount of material to remediate.

In the event that contaminated material was subsequently found that was unidentified in the initial site characterization, typical industry practice would be for the general contractor to state this was outside the initial project scope, hence would require additional cost to remediate. Maine Yankee wanted to avoid this possibility, so the prospective DOC bidders became participants in the characterization project. They reviewed the planned scope of work, suggested changes or additional areas to assess based on their experience. Each bidder provided one or two persons onsite at Maine Yankee for the duration of the characterization project at their own cost. At the conclusion, each prospective bidder was bound by the same characterization results.

In all, approximately 130,000 site measurements were taken and nearly 800 samples for laboratory analysis were taken. Interesting results include:

- Large background variations were noted across the site based on varying depths of bedrock, mineral deposition and other factors.
- Characterization found contamination in the carpet of the former visitor center – later determined to be from a piece of uranium ore used in demonstrations.
- The only real anomalous environmental result was an area at Bailey Point located south of the plant (Figure 1-3) approximately 10 ft^2 and 6 in. deep (which was remediated).
- Two marine sediment samples showed elevated levels of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) – presumed to be likely petroleum products which originated from building roofs and the parking lots.

Cold and Dark

Maine Yankee intended to proceed with a cold and dark approach for its systems and buildings. "Cold and Dark" is a phrase used to describe a facility in which virtually all liquid containing systems have been drained, and electrical power to components has been removed. The other primary alternative is to drain/de-energize systems on a schedule to match the decommissioning required. Maine Yankee decided to on the Cold and Dark approach rather than other options based on their determination that the Cold and Dark approach would:

- Provide the greatest level of nuclear security (once the spent fuel was properly isolated) by draining and de-energizing systems which could interact with the spent fuel pool;
- Provide the greatest level of industrial safety by ensuring that all energy sources were removed prior to personnel beginning decontamination or dismantlement activities; and,
- The Cold and Dark approach would be the simplest one for prospective DOC bidders to evaluate and to bid on and would likely result in a lower bid from the prospective DOCs.

Placing the plant into a cold and dark condition was accomplished with four major initiatives:

- Spent fuel pool island project (SFPI);
- System evaluation and reclassification team (SERT);
- Control room transition (CRT); and,

- Cold and dark projects

As long as spent fuel was retained in the spent fuel pool, its control and isolation was the nuclear safety focus for the project. In order to allow for decontamination and dismantlement activities to occur, the spent fuel pool must be isolated from the rest of the plant by isolating piping, electrical and control systems. This isolation of the spent fuel pool and its supporting structures from the planned decommissioning activities required the creation of a SFPI. The SFPI required the installation of an independent spent fuel pool cooling system, new electrical distribution system, new control room (away from the decommissioning area), new HVAC and radiation monitoring systems and a collapsed security boundary.

The SERT evaluated all structures, systems and components (SSC) on the site. The initial SSC list was based on the equipment and components required per the operating license. The SSC were then evaluated against the following criteria:

- Was the SSC used to prevent or mitigate the design basis accident for the permanently defueled condition;
- Was the SSC needed for the safe storage of radioactive wastes or spent fuel;
- Was the SSC needed to satisfy the plant design, licensing basis or technical specifications for the permanently defueled condition; or,
- Was the SSC needed for day-to-day plant operations during decommissioning?

Based on this evaluation each SSC was then categorized as either “available” or “ready to be abandoned”.

One result of the SFPI and SERT projects was the determination of what control and instrumentation would be needed for the decommissioning effort. This level of control and instrumentation is greatly reduced in decommissioning from that required during operations. Rather than maintain the existing operating control room using only the reduced number of controls and instruments, Maine Yankee decided to provide a completely new control room for the decommissioning effort.

The control room transition required the relocation of all alarms to the new control room. It also provided for the movement of all fire detection and suppression controls and indicators to the control room. Applicable data from the site meteorological tower was also routed to the new control room. This smaller scope control room allowed operators to more readily focus on the fewer number of critical parameters and instruments. The new control room also allowed the de-energization and dismantlement of the former operating control room.

The remaining actions in the “Cold and Dark projects” included:

- Changes to mechanical facilities;
- Changes to electrical facilities;
- Waste minimization;

- Relocation of staff;
- Initiation of the "orange plan"; and,
- Changes to fire suppression systems.

The changes to mechanical facilities provided for a relocated health physics checkpoint, and the reconfiguration of radiologically controlled area ventilation, plant sumps and drains, and site wells and potable water.

The changes in electrical facilities separated the "going forward" electrical system from the existing plant electrical distribution system. It included the repowering of essential loads (cranes, buildings to stay occupied, ventilation and construction power). Lastly it involved the reconfiguration of the external power lines feeding the plant.

Waste minimization involved removal of all unneeded chemical and oil products from the site, as well as the closure of plant sumps and redirection of water sources. Tanks were cleaned and systems were drained. Plant batteries, mercury and any chlorofluorocarbons (CFCs) were appropriately removed from site.

Staff relocation was an early challenge to the project which continued through project completion. Plant permanent staff numbers were reduced over the course of the project and numbers of contractor personnel varied widely over the project. For each aspect of the decommissioning project, appropriate office and shop space was required. Changes in telecommunications and computer services continued on virtually a daily basis throughout the project. Assuring sufficient potable water and sanitation services for the fluctuating staffing levels throughout the project also posed challenges for Maine Yankee.

Once the SERT, SFPI and mechanical and electrical facilities changes were completed, the plant was left with a relatively small set of required structures, systems, components, controls and instrumentation. It was essential that these components not be impacted by decommissioning activities. A simple method was needed to identify these components so that project personnel (Maine Yankee and contracted personnel) would not alter, or manipulate them. The "orange plan" was established for this purpose. All of these essential components were tagged with orange ribbon. All project personnel were trained to not touch orange components unless under a proper work plan. This was a good approach to communicate those remaining safety significant systems, but it is important to identify all portions of the selected systems including control and instrument cabling.

Changes in the plant fire suppression programs involved the reduction of fire loads (reduced combustibles) and a modification to the fire fighting plan and procedures to allow the draining of water-based fire systems in unheated areas and transition to dry-pipe based fire suppression systems. Appropriate changes in plant personnel training was also performed on the need to control fire loading and to provide adequate portable fire suppression (fire extinguishers).

Transition Human Resources

Beginning in the summer of 1997 and continuing into the decommissioning transition, plant staff was understandably operating with a great deal of personal uncertainly. Whether or not they would continue to be employed at the Maine Yankee site or by what company was an ongoing concern. Through this period and into the decommissioning, Maine Yankee Human Resources personnel worked to continue communications to the workforce to maintain morale and continued worker focus on the tasks at hand.

The biggest change is the cultural shift from operations to shutdown. "How does this affect me, how does this affect my job, my family, my relocation options, etc." The employees wanted specific answers, and Maine Yankee tried to provide specific answers, but in some cases management didn't yet know the answers. It was most important to maintain ongoing communications.

Maine Yankee wanted to provide some level of comfort to plant staff who were working under this level of uncertainty. One manner in which this was addressed was the issuance of a severance and early retirement program. The program was generally comparable to others from New England utilities and was on the order of two weeks of pay for every year of service with the utility. If you stayed on the project as long as the company wanted you to stay, then you qualified for a severance benefit. This gave the Maine Yankee employees a measure of financial comfort.

This program didn't change after the final shutdown and was viewed to be very important to help maintain employee trust and confidence, particularly to those who were asked to stay until the project ended.

As decommissioning planning continued, it became clearer as to the skills and quantities of skills needed from the Maine Yankee staff. Maine Yankee staffing targets were developed based on presumed DOC staffing and was projected to be:

- Final Shutdown ~ 600
- End of 1997 ~ 300
- End of 1998 ~ 135
- End of 1999 through completion of fuel transfer out of pool ~ 85

These numbers reflected the Maine Yankee staffing only and not any DOC contracted personnel.

After fuel transfer to dry storage was completed the staffing would drop as additional buildings were demolished until it would reach approximately 20 after the completion of the final termination surveys. As future staffing levels were determined, employees would be provided with their individual end date of employment. Initially, group meetings were held to discuss general staffing approaches and project plans. These were followed by department specific meetings and ultimately individual meetings between employee and supervisor. These staffing projections and end dates were revisited every three to six months. Meetings between individual and supervisor were then held to update the site staff for their particular end dates. These meetings served a valuable purpose in that plant staff continued to have clear individual end dates for the project. This minimized staff uncertainty which helped staff maintain focus on the project, rather than personal circumstances.

The union had a different severance program (but similar concept) which was in place through the existing contract. Approximately two years after the shutdown the union contract was renegotiated due to the contract expiring, irrespective of the decommissioning. In the new contract, changes were made to accommodate the changes from decommissioning including cross-training and qualifications of union personnel. This similarly reduced individual uncertainty for union personnel providing for project focus.

Maine Yankee also established a retention program primarily for key employees. The key employees were determined on a proceduralized basis and was reviewed by the CEO and CFO typically with the appropriate vice president to determine the positions most needed and when needed (for what duration). This retention program provided a certain percentage of the individual's annual salary per month the individual stayed with the project, assuming they stayed as long as Maine Yankee needed them. If individuals left prior to their agreed to end date, they forfeited their retention bonus.

This program was initially targeted for relatively few individuals, however as the project continued, two additional phases of the program were initiated. In each phase the number of individuals under the program increased. This overall increase was due to two primary reasons. The first being that as the project proceeded, the critical expertise and experience changed, requiring a review of the critical skilled needing to be retained. Secondly, as the project continued and Maine Yankee staffing continued to shrink, the relative contributions of each remaining employee became more significant to the project overall. It is therefore essential to develop a broad and robust retention program early on in a decommissioning project, but equally important to review the skill sets needed to be included in the program on a periodic basis throughout the project.

Transition Stakeholder Interaction

One of the tasks initiated during the pre-shutdown period was discussion with the State Senator from Lincoln County regarding the need for a new method for Maine Yankee to communicate with and receive input from the local community and stakeholders. This was viewed to be needed whether the site was sold or decommissioned.

One outcome of these discussions was the development of the Community Advisory Panel (CAP). The CAP is addressed in more detail in Section 6.

The first CAP meeting was held just two weeks after the shutdown decision was announced. At the writing of this document, CAP had held nearly 50 public meetings on the Maine Yankee Decommissioning project.

4
USE OF DECOMMISSIONING OPERATIONS CONTRACTOR

Lessons Learned/Recommendations

- Understand the strength of your primary contracting partner(s) both technically and financially.
- Have sufficient contract provisions that in the event of major contractor problems that provides the owner with options to effectively and safely continue the project.
- Keep or obtain the best people for the project. Often these will not be all within one organization or company.
- If you have the radiological, licensing and deconstruction expertise, it may well be reasonable and cost effective to self perform the decommissioning.

Overview

When Maine Yankee ended operations, many things in the utility industry were occurring that influenced the decommissioning contracting approach selected by Maine Yankee.

The last group of large power plants built (in the 1980's) tended to be built under traditional general contractor time and material (T&M) contracts. For several reasons, the total costs for these contracts often greatly exceeded the original estimate/budget. Maine Yankee didn't want to deconstruct the plant under the same economic model, so it pursued the fixed price contract. The decommissioning trust funds also provided a finite sum of money allotted to the project. This also supported the decision to pursue a fixed price contract.

The approach taken by Maine Yankee was that the DOC RFP was designed to shift some of the project risks to another entity that would be qualified to perform the work safely. This shift of risk was addressed in a presentation during the December 1998 EPRI Decommissioning workshop (EPRI TR-111025). The following table is derived from material in this presentation.

Table 4-1 Risk Ownership for DOC vs. Non-DOC

Task	DOC	Non-DOC
Transition management	Contractor or owner	Owner
Project management	DOC	Owner
Site management	DOC	Owner
Site Labor management	DOC	Various
Cold & Dark preparations	DOC	Owner/contractors
Primary system decon	Owner/contractor	Owner/contractor
Site characterization	Owner/contractor	Owner/contractor
Large component removal	DOC	Contractor
Commodity removal	DOC	Contractor
Waste packaging, shipping and disposal	DOC	Contractor
Licensing	Owner/DOC	Owner/contractor
Health physics	DOC	Owner/contractor
Station administration	DOC	Owner/contractor
Procurement	DOC	Owner/contractor
Fuel handling	DOC	Owner
Fuel storage facility	DOC	Owner/contractor
Final status survey	DOC	Owner/contractor
Asset recovery	Owner/DOC	Owner
Repowering	DOC	Owner

In addition to the discussion of risk transfer, the presentation addressed the perceived advantages and disadvantages of the use of a DOC and provided a listing of required strengths of potential DOCs and activities viewed by the DOC as necessary prior to contract award.

DOC Advantages

- One constructor/contractor for owner to deal with
- Fixed price
- Stronger commitment to schedule
- Shared risks
- Union concessions
- Work scope synergies
- Retraining and reuse of selected site personnel
- PUC/FERC acceptance based on presumed fixed cost for decommissioning
- Advantages available from lessons learned
- Savings for owner

DOC disadvantages

- Up front characterization and bid cycle time
- Loss of owner control
- Owner pays for unused contingencies
- Potential cost of changes beyond contract

DOC required strengths

- Large plant management capability
- Nuclear licensing
- Safety evaluations
- Nuclear engineering/mechanical design
- Contaminated equipment removal/disposal
- ISFSI casks/shipping containers/crane evalations
- Procurement/contractor management
- Construction labor/union management
- Radiological analysis/design/planning
- Plant systems understanding
- Decommissioning process optimization capability
- State and Local regulatory agency licensing capabilities

Prerequisites to DOC contract

- Site characterization
- Cold & dark strategy
- Fuel storage strategy
- Primary side decontamination
- Site plant data/drawing package

In addition to the selection of a DOC, Maine Yankee also had a decision to make regarding the Maine Yankee management. Earlier in 1997, Maine Yankee had contracted with Entergy Nuclear, Inc. (ENI) to provide management services to the plant. This was part of the efforts taken to restart the plant and institute comprehensive site improvement plans. Several of the key Maine Yankee managers at the time of permanent shutdown were actually employees of ENI.

In November 1997, it was announced that Maine Yankee had amended the contract with ENI to continue its management services in the conduct of the decommissioning project. A management contract with ENI has continued to the present.

Selection of DOC

Maine Yankee issued the RFP for the DOC on April 17, 1998 with bids due by May 29, 1998. The RFP included certain options for the bidders including repowering the site, spent fuel management/storage, and meeting a 15 mrem/y + ALARA release criteria.

Initially Maine Yankee had approximately 6 bidders on the project, who were generally large leader companies with smaller subcontractors jointly bidding on the job. An initial critical review was performed of the submitted bids to determine if the bidder fully met the bid qualifications and requirements. After this initial review, detailed bid reviews were performed.

The bid evaluation was conducted by Maine Yankee and a team of third party experts. The experts included financial analysts, low-level waste experts, general contracting, and repowering experts. Based on request by the CAP, an expert in economic redevelopment also participated in the bid review process. The bid evaluation used a structured decision analysis process which was weighted on factors significant to successful decommissioning. The options in the bids were evaluated against the most competitive base bid.

The bid evaluation criteria included:

- Safety history (industrial and radiological);
- Experience in nuclear environment;
- Experience on similar deconstruction projects;
- Qualifications/credentials of key personnel;

- Bidder financial condition including credit rating; and,
- Innovation of decommissioning approach.

Maine Yankee received very competitive bids, in part because it was believed that there would be a near term market for firms with large decommissioning project experience. The successful bidder would be viewed as having a competitive advantage for future decommissioning projects.

On August 4, 1998, Stone & Webster Engineering Corporation (SWEC) was awarded the first turnkey, fixed-price contract where the contractor takes the financial risk for executing the decommissioning project. The SWEC contract was for a total of ~ $250 million of a total estimated decommissioning cost of $541 million (1998 dollars).

Several provisions in the contract eventually proved particularly useful to Maine Yankee. These include:

- The contracts between subcontractors and the DOC could be assumed by Maine Yankee on the same terms and conditions without new contracts being let.
- A substantial amount of performance and payment bonds were specified in the contract with the DOC
- Very tight financial controls were mandated in the contract including review of DOC payments to all subcontractors on the job.
- There were contract provisions that if the DOC became financially insolvent, that the contract could be terminated

The primary financial management system used between Maine Yankee and the DOC dealt with "earned value". Earned value was used in both labor and service contracts and for the project as a whole. The original concept was to tie all project elements as designed in the work breakdown structure (WBS elements) to each WBS element's budget and the respective payment to the DOC.

Each work task was assigned a particular budget (money or labor hours). Progress on each work task then drove payments to the DOC. An example is noted below for the licensing of the spent fuel cask system.

WORK PACKAGE PERCENT COMPLETE - WPPC
FORM 1

PMP 11.0 FORM1

PROJECT: MAINE YANKEE DECOMMISSIONING

WORK PACKAGE NO. **J.C.D.ISFS.0065** Activity # **ISFSI65**

WORK PACKAGE DESCRIPTION:
Cask Vendor Licensing

EARNED VALUE BREAKDOWN

	Cask Vendor Licensing Activity	% OF TOTAL	COMPLETE	EARNED	MY APPROVAL
1	1032 negotiate cask vendor contract	2.0%	Y	2.00%	RCH
2	1085 Prel eval of MY non-std Fuel	3.0%	Y	3.00%	PP
3	1096 Validate Design with drop test	4.0%	Y	4.00%	RCH
4	0008I perform storage source term analysis	2.0%	Y	2.00%	RCH
5	0024I perform transport source term analysis	2.0%	Y	2.00%	RCH
6	0005I perform storage criticality analysis	3.0%	Y	3.00%	RCH
7	0022I perform transport criticality analysis	3.0%	Y	3.00%	RCH
8	0026I perform transport shielding analysis	3.0%	Y	3.00%	PP
9	0028I perform transport thermal analysis	2.0%	Y	2.00%	RCH
10	0010I perform storage shielding analysis	3.0%	Y	3.00%	PP
11	0014I perform site dose analysis	2.0%	Y	2.00%	PP
12	1059 prep/submit amendment for storage non std fuel	10.0%	Y	10.00%	PP
13	1064 prep/submit supp/ for transport non std fuel	5.0%	Y	5.00%	RCH
14	0016I perform storage thermal analysis	2.0%	Y	2.00%	RCH
15	0019I perform storage structural analysis	2.0%	Y	2.00%	RCH
16	0030I perform transport structural analysis	2.0%	Y	2.00%	RCH
17	1140 NRC review amentment non-std fuel storage	4.0%	Y	4.00%	PP
18	1155 NRC review Amendment for fuel Transp	3.0%	Y	3.00%	PP
19	1065 Receive RAI for fuel transp	1.0%	Y	1.00%	PP
20	1066 Respond to RAI Fuel Transp	4.0%	Y	4.00%	PP
21	1060 Receive RAI non std fuel storage	1.0%	Y	1.00%	PP
22	1062 Respond to RAI on Non-std Fuel Storage	7.0%	Y	7.00%	CO
23	1146 NRC Rev 1st Round Resp Fuel Transp	1.0%	Y	1.00%	PP
24	1137 NRC Review RAI Response Non-std Fuel Storage	2.0%	Y	2.00%	PP
25	1055 NRC Issue Transport CoC	4.0%	Y	4.00%	PP
26	1067 NRC issue draft SER(Non Std Fuel)	10.0%	Y	10.00%	PP
27	1068 Rule making on Amended Storage CoC	3.0%	Y	3.00%	PP
28	1134 Receive Amended CoC non std fuel Storage & Transp	10.0%	Partial	7.58%	DR
TOTAL		100.0%		97.583%	

Figure 4-1 Example of Earned Value Report

In the figure above, the first activity, “Negotiate cask vendor contract” was evaluated to require two percent of the effort required for the overall work package “Cask vendor licensing” to be completed. Once the specific task was complete and approved by Maine Yankee, the contractor would have been deemed to have earned two percent of the fees associated with the work package. Using this process provided direct contractor compensation to match the project management work plans and schedule.

DOC Removal and Transition to Self-Performance

In the latter part of 1999, Maine Yankee began to receive complaints from the DOC subcontractors that they were not receiving timely payments from the DOC. In addition, reports in industry trade journals suggested that some other DOC projects (primarily overseas) were experiencing problems which could adversely affect the DOC's financial condition.

In early 2000, work activities at Maine Yankee also began to have some problems. One cause of the problems was perceived to be a lack of resources applied by the DOC to the project. These problems resulted in meetings between senior management at Maine Yankee and the DOC. After these meetings between MY and the DOC, the contractual financial controls were tightened by contract amendment. This included a further DOC parent company guarantee.

In late 1999, the DOC also began an effort to sell certain corporate assets. In April 2000, the DOC had to restate previous corporate earnings. On May 4, 2000 Maine Yankee terminated the DOC contract based on performance issues with the contract including contractor insolvency provisions. Less than a week later, the DOC announced that it would file for corporate reorganization under Chapter 11 of the U.S. bankruptcy code.

In order to continue project activities smoothly, a separate interim contract was issued to the DOC for the period from May 4, 2000 through June 30, 2000. This provided a time period for Maine Yankee to take over direct management of the project rather than just the project oversight. Maine Yankee began serving as the DOC (so called "self-performing) effective July 1, 2000. During this period Maine Yankee made the decision to stop work on some non-critical path tasks that could be easily done once the contract issues were sorted out and focused on keeping the critical path work moving forward.

A near-term action after the DOC was terminated was the review of all subcontracts to determine those that would stay in place. The objective at the time was to avoid if possible, the costs of demobilization of current contractors and mobilization of any new contractors. As noted earlier, most subcontracts were directly assignable to Maine Yankee. This made the transition much easier as the time could be spent determining the subcontractors to retain, without the need for obtaining new contracts with each subcontractor.

This interim period also allowed Maine Yankee to issue an RFP for a new DOC. Essentially Maine Yankee invited bidders to "step into the DOC's shoes to finish the project". The Maine Yankee intent was for the subsequent DOC to also perform to a fixed price contract.

In the time between the initial DOC contract and the time of contract termination, the market had changed substantially. No longer was there an expectation that there would be a large number of nuclear plant closures. Secondly, there were a lot of lessons from the Maine Yankee experience to the industry as to how complex decommissioning projects really were.

The bids submitted to Maine Yankee were of a "fixed-price nature", but not as comprehensive in scope or as fixed a price as Maine Yankee would have hoped. The Maine Yankee management team wanted to continue with the approach (fixed price) used with the former DOC, but the bidders took a larger number of exceptions with the RFP, to protect themselves. The risk sharing equation shifted for this bid back toward Maine Yankee.

Maine Yankee began the management of the decommissioning activities on July 1, 2000 with a focus primarily on the dry cask storage system implementation and reactor vessel internals segmentation. These two major tasks were the primary drivers of the overall project critical path. Maine Yankee personnel assured that these two tasks continued, as others were allowed to slip in schedule or were deferred entirely until the project management issue had final resolution.

During this period, Maine Yankee gained experience with project management and completed the assumption of the former DOC subcontracts it felt appropriate to continue. In addition to the new DOC bids, Maine Yankee prepared a bid itself to provide to the Board of Directors.

In January 2001, the Board of Directors directed Maine Yankee to continue the management of the overall project through its completion. Maine Yankee continues the management of the project currently and will complete the project early in 2005.

5 FUEL STORAGE OPTIONS

Lessons Learned/Recommendations

- It clearly would have been preferable to have an operational Independent Spent Fuel Storage Installation (ISFSI) prior to beginning decontamination and demolition. Significant time and legal interaction was necessary to secure a state permit for the facility. Substantial engineering work was required to assure Spent Fuel Pool Island (SFPI) safety while decommissioning occurred. Decommissioning is a much simpler project when fuel is fully out of the pool before physical decontamination or dismantlement begins
- Plants with any history of fuel damage should prepare special contingency plans in case fuel pellets or other damage is found during final fuel inspection. Maine Yankee evaluated both radiological and safeguards issues to see what options would be available for storage in other locations than a Dry Cask Storage (DCS) canister.
- Evaluate other special sources that may exist onsite, e.g., plutonium-beryllium (Pu-Be) or americium-beryllium start-up sources, boronometers or other similar Greater Than Class C (GTCC) materials. Maine Yankee ultimately applied to the DOE orphan source program. It took about four years to get DOE to take the source. You need to evaluate whether the selected spent fuel cask system can store the sources for future disposal. Maine Yankee got an early legal opinion that the Pu-Be source was not "associated with the fuel" so couldn't put into a cask. A sound knowledge base for all items in the spent fuel pool and recent inspection of each is vital before proceeding with a comprehensive dry storage plan.
- Even though shutdown, it is important to maintain good fuel pool chemistry to support fuel handling and transfer operations.

Introduction

In the Maine Yankee PSDAR, dry cask storage (DCS) was assumed for planning purposes. The fact hat DCS was an approach for planning only, was reiterated in the PSDAR public meeting in November 1997. It was presumed at that time that the DOE would not begin accepting spent fuel in accordance with its contract with Maine Yankee and that some form of interim storage would be required.

The DOC RFP required the bidders to submit approaches for interim onsite fuel and Greater Than Class C (GTCC) waste storage. The DOC bidders generally teamed with existing providers of DCS systems and included DCS in their bids as one of the contract options to Maine Yankee.

In the first meeting of the Community Advisory Panel in late August 1997, Maine Yankee management stated that initially, Maine Yankee would modify the existing spent fuel pool support systems to allow decommissioning to begin and that the longer term storage approach (wet vs. dry), had not yet been decided. These discussions continued with the CAP until nearly the middle of 1999.

Spent Fuel Pool Island (SFPI)

Similar to several other permanently shutdown power reactors, Maine Yankee initially opted to modify the existing spent fuel pool support systems for storage of spent nuclear fuel until an approach could be selected which would provide for safe storage of fuel until the DOE fulfilled its contractual obligations and removed the spent fuel and GTCC materials.

These modifications typically provide self contained fuel pool cooling and cleanup systems as well as monitoring, controls and electrical power. These modifications effectively isolate the spent fuel pool from the remainder of the plant structures, systems and components forming a "nuclear island". This approach allows decommissioning to begin on the remainder of the plant while the fuel is safely maintained. EPRI report # 10003424, Spent Fuel Pool Cooling and Cleanup Systems – Experience at Decommissioning Plants, provides a summary of a number of shutdown power reactors who have stored fuel in this manner. The information and figure below are excerpts from this document.

The Maine Yankee SFPI used two separate pool cooling loops using an intermediate cooling loop to exchange heat with air-cooling fan units. It used a single spent fuel pool heat exchanger. The lowest piping connection in the system was located above the top of the fuel assemblies to preclude a siphon event from uncovering the spent fuel. Backup power was provided by a dedicated diesel generator which was not specifically required by license requirements or accident analysis.

The spent fuel pool cooling and intermediate loops were located in the spent fuel pool building. The fan powered air coolers were located outside adjacent to the spent fuel pool building. The cooling loops were designed for a maximum pool heat load of 3.3E6 BTU per hour and a maximum heat up rate without cooling of 1.08 degrees Fahrenheit per hour.

The cleanup system consisted of surface skimmers feeding a single purification pump. The water was then filtered with a 0.2 micron pre-filter and a 6 micron post-filter. Further cleanup was provided by an in-pool 28 ft^3 mixed bed demineralizer with an internal pump and motor to circulate the pool water.

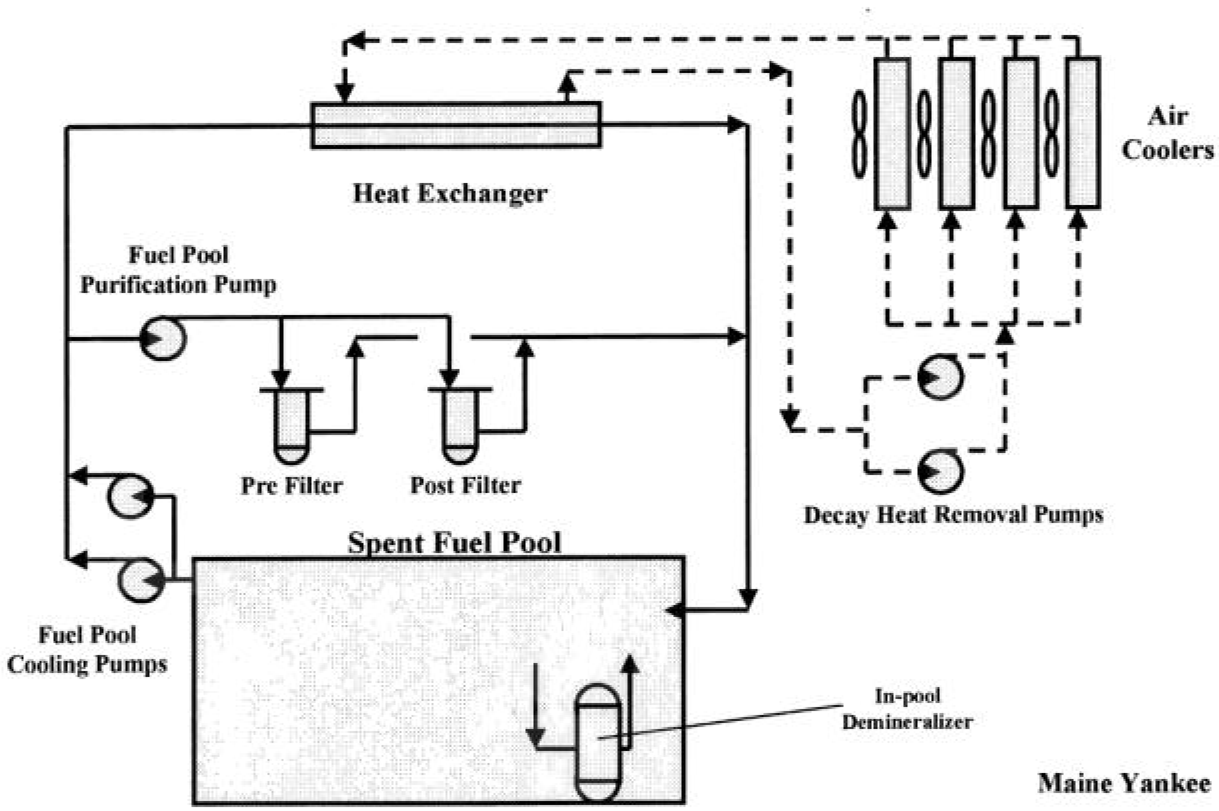


Figure 5-1 Simplified Maine Yankee SFPI Schematic

Parameters monitored in the SFPI included:

- Pool water temperature, level and boron concentration;
- Cooling and purification system temperature, pressure, radiation levels, and makeup capability; and,
- Fuel Pool Building radiation levels, ventilation flows, sump levels and fire detection.

In May 1998, the SFPI became operational with an unexpected problem which led to substantial stakeholder interaction. The fans used for air cooling the intermediate heat exchanger would operate at all times, and as sound surveys later showed, they increased the ambient noise levels at distances of up to one mile from the site by 10 decibels (DBA).

The increased noise levels were cause for substantial concern to the plant neighbors and other local residents. The Maine Yankee Public Affairs Director began receiving a number of calls asking when the noise would end. The correct answer of “about five years” was certainly not what the public would want to hear.

This challenge actually posed an early opportunity for a Community Advisory Panel (CAP) success. The CAP process provided a ready vehicle to frequently gather community input and for Maine Yankee to address the public. The meeting of June 24, 1998 was very well attended with much input from the public on the issue. Based on the number of community complaints, Maine Yankee was able to announce at the CAP meeting that options were being evaluated to reduce the noise including fan motor replacement or construction of acoustic barriers.

By the July 1998 CAP meeting, Maine Yankee had determined that the only viable solution was to replace the fans with quieter ones. This modification, which cost approximately $160,000 couldn't be implemented until after the end of summer, due to the quieter fans being less effective at exchanging heat. The cooler fall – winter weather and lower spent fuel heat load due to fuel decay would allow use of the quieter fan motors. The modifications were completed in September of 1998.

The SPFI continued to operate successfully thereafter until the completion of the transfer of all spent fuel and fuel pool components to alternate storage or disposition.

Selection of Fuel Storage Approach

One of the business cases that is routinely performed early in the decommissioning process is the evaluation of long term fuel storage options. The storage period in question is the time between final shutdown and the expected time for DOE to complete the transfer of spent fuel and GTCC wastes from the site. This case typically becomes a decision between storage in a spent fuel pool island or a dry cask system (DCS), usually referred to as a "wet vs. dry" analysis.

The wet vs. dry analysis is relatively straight forward. Maine Yankee used the following inputs for their analysis:

- Financial inputs
  - Annual operating cost (all factored for inflation and discount rates)
    - Wages
    - Taxes
    - Utilities
    - NRC fees
  - Capital expenditures (cost of casks, canisters, ISFSI construction, modifications to spent fuel pool)
  - Decommissioning impact cost
- Risk Analysis – Time dependent issues
  - DOE not taking fuel by 2023
  - Cask fabrication delays
  - Cask licensing delays

The inputs were developed for each type of storage over the projected period of time that fuel was anticipated to be onsite. Variations on each input parameter are used to determine which factor(s) provide the greatest impact to the decision. The primary driver is the expected year in which fuel transfer will be completed. This is because typically, wet storage requires a lower capital expenditure than dry storage, but requires higher annual operating and maintenance costs than dry storage. The results of Maine Yankee's analysis resulted in DCS being economically preferred, provided that the DOE would not fully remove spent earlier than 2019.

Once the original DOC bids were reviewed, additional information for the analysis became known; namely that the capital costs of DCS were higher than Maine Yankee's original assessment, and based on the overall integrated project schedules provided, the use of wet storage precluded decommissioning completion within seven years as targeted.

The selection of fuel storage approach can be solely made on technical and economic parameters, however Maine Yankee chose to also include stakeholder input into the fuel storage selection decision. This approach of obtaining stakeholder input at critical project milestones became the common practice throughout the Maine Yankee project.

In March 1998, Maine Yankee began the detailed discussion of fuel storage with the CAP and indicated that it wanted CAP and community input on the decision. At this CAP meeting Maine Yankee suggested that capital costs for DCS were approximately $40 - $50 million and would require 45 – 65 casks depending upon the cask design chosen. Operating costs were projected to be $40 million over the period of 2003 – 2023. Similar discussions were also held with the governor and other elected officials.

In order to gather community input on the decision, Maine Yankee conducted a public opinion poll on DCS issues. This was conducted in the April of 1998 with approximately 800 people. The results showed Maine Yankee and the CAP that any spent fuel storage option selected would require substantial public education. In order to better educate the CAP members, they traveled to existing dry cask storage facilities at three power reactors (two operating and one shutdown). Fuel storage was a continuing topic at the approximately monthly CAP meetings for several months. This communication effort led ultimately to the CAP stating in June 1999 that if spent fuel had to remain onsite for an interim period, that they preferred the DCS approach.

Dry Cask Storage Activities

The primary tasks for the dry cask storage project were to procure the appropriate number of fuel storage casks and to construct an appropriate storage location or pad upon which the filled fuel storage casks would be placed. The storage pad is typically referred to as an ISFSI pad (Independent Spent Fuel Storage Installation pad).

Siting and construction of the ISFSI pad presented another opportunity in stakeholder interaction. This is discussed in Section 6. The dry cask storage system provider that teamed with the DOC was NAC International. The selected cask system was the NAC-UMS Transportable Storage Canister (TSC) system, a multi-purpose canister system designed to contain 24 spent fuel assemblies. At the time of selection the vendor had not yet received certification by the NRC.

The DOC subcontract with the cask provider was to provide hardware only. The DOC intended to perform the cask loading in the spent fuel pool and transfer the loaded casks to the ISFSI pad. The DOC was also to construct the ISFSI pad. At the time that the DOC contract was cancelled, the ISFSI pad had not been built. Maine Yankee subsequently contracted for its construction (for an estimated contract value of $6.5 million). Maine Yankee also took over the DOC subcontract with the fuel cask provider in May 2000 and in late 2000 extended the scope to include fuel transfer activities.

The loading and transfer of Greater Than Class C (GTCC) materials (a total of four canisters) to the ISFSI pad began in January 2002. On August 24, 2002, Maine Yankee, with assistance from their cask contractor, transferred the first of 60 spent fuel canisters for storage at their ISFSI. After loading the canister with spent fuel, a shield lid was welded on and the canister was pressure-tested, dewatered, and vacuum dried. The canister was then backfilled with helium, the vent and drain ports were sealed, the canister was leak-tested, and a structural lid was welded onto the canister. The canister was then placed into a vertical concrete cask (VCC) for shielding and transferred to the ISFSI concrete storage pad.

All major fuel loading, packaging, and transfer activities were directed by trained and qualified Cask Operations Shift Supervisors. Throughout the fuel transfer strict use and adherence to procedural guidance was enforced. Work was frequently stopped to resolve questions, concerns, or to evaluate work progress. Detailed radiological control planning was evidenced by the integration of as-low-as-is-reasonably-achievable (ALARA) controls in procedures and work practices. The first pool-to-pad fuel transfer evolution was accomplished for a total radiation exposure of less than 200 mrem (2 mSv).

The original fuel transfer schedule had a total of ~ 18 months to offload the spent fuel pool. Overall fuel transfer project delays were threatening the total project schedule, so Maine Yankee purchased a second fuel transfer cask in order to work on more than one canister at a time. One canister could be loaded in the spent fuel pool while a second, filled fuel canister could be vacuum drying. The use of the second transfer cask was expected to reduce the fuel transfer effort to ~ 12 months.

Over the following five months, eleven canisters were transferred to the ISFSI pad. In January 2003, Maine Yankee terminated the existing contract with the cask provider as they were unable to perform under the existing contract. Maine Yankee took over fuel loading and transfer operations while options were evaluated for the project completion. In April 2003, a new contract with the cask provider was issued for the remaining dry cask hardware for the project. Maine Yankee continued to perform fuel management and transfer operations. Fuel transfer activities concluded in late February 2004. A total of 60 spent fuel canisters and four GTCC canisters were stored on the ISFSI pad. The average cask loading rate for the Maine Yankee team was just under eight calendar days per canister with those toward the end of the project being loaded and transferred in approximately five days.

The completed ISFSI pad and fuel canisters are seen in the following figure.

Figure 5-2 Maine Yankee ISFSI Pad and Dry Storage Casks

Additional Fuel Related Issues

Maine Yankee had fuel failure issues early in plant operation. This required that when the detailed fuel inspection and verification occurred that the plant have in place a contingency program to deal with any fuel fragments/pellets found. This contingency program needed to deal with both radiological and safeguards issues. This inspection and verification program was conducted prior to any fuel canister loading could be performed.

Of the total 1436 fuel assemblies that were transferred to the ISFSI, nearly 300 of them were considered "non-standard" fuel by virtue of actual or potential fuel failures. Specific reviews were essential with the dry cask system provider to assure the canister/cask system was correctly licensed for all the materials to be stored within, including GTCC and non-standard fuel.

Maine Yankee had a boronometer source which posed a special disposition challenge. This source was a plutonium-beryllium (Pu-Be) neutron source. Other facilities also have these sources or americium-beryllium (Am-Be) sources for boron concentration measurement or for other use as neutron sources. In the case of Maine Yankee, they received a legal opinion that the boronometer source was not "associated with the fuel". As such, it could not be disposed of in a

DCS canister. The source activity was such that it could also not be disposed of in available low-level waste burial sites. Maine Yankee then applied to the DOE orphan source program. Ultimately, this was successful, but the source disposal required four years of interaction with DOE to accomplish.

6 REGULATORY AND STAKEHOLDER INTERACTION

Lessons Learned/Recommendations

- In addition to addressing radiological decommissioning issues it is equally important to address non-radiological issues in decommissioning.
- Early in the project, Maine Yankee didn't fully appreciate the level of non-radiological stakeholder and regulator interaction that would be necessary to accomplish the decommissioning.
- It is essential to build trust with the various project regulators.
- Develop and get agreement on conditions for the site characterization before samples and measurements are taken.
- Include reduction in records retention requirements among the various regulatory exemption requests to be submitted.
- Negotiation is often better than litigation. Although the various negotiated settlements for Maine Yankee required additional tasks to be performed, Maine Yankee's assessment was that if litigation was the overall project selected approach, that the project completion would have been delayed up to two years.
- Get agreement on nuclide fraction (NF), dose pathways, and what to do when you find different NFs during characterization.
- Get regulators and stakeholders involved with the Data Quality Objective (DQO) process earlier in the decommissioning project. Set up a DQO organization with primary stakeholders – essentially when final shutdown occurs. Meet on a monthly basis similar to CAP, on the technical matters that are needed for the License Termination Plan.
- If you have an engineer who can discuss technical issues in a manner people can understand and can provide answers, it is a great asset toward moving community opinion.
- If you initiate a program similar to CAP, it is essential that top management accept, or buy into the program in order for the organization to give it the appropriate level of attention.

Introduction

It may be reasonable to expect that interactions with regulators are separate from those with stakeholders, however this was seldom the case for Maine Yankee. During its operating life, Maine Yankee was the object of three Maine state referendums that attempted to shut the plant down. In each case, Maine voters chose to keep the plant open, however this demonstrated the level of stakeholder interest in the facility.

Many key decommissioning project regulatory decisions were impacted by stakeholder input. This section provides a discussion of the Maine Yankee interaction with both regulators and stakeholders in the following project topics:

- Federal Energy Regulatory Commission (FERC) Rate Case;
- ISFSI Pad Permitting;
- Rubblization Decommissioning Approach; and,
- Site Release Criteria.

In order to address regulators and stakeholders, it is important to understand all the potential participants. Maine Yankee is regulated by both federal and state government agencies. These agencies and organizations include:

- U.S. NRC;
- U.S. EPA;
- U.S. FERC;
- Maine Department of Human Services (DHS), Division of Health Engineering;
- Maine Department of Environmental Protection (DEP);
- Maine Public Advocates Office;
- Maine Public Utilities Commission.
- Maine Nuclear Safety Advisor – A liaison to the Governor and the Maine legislature;
- Maine Advisory Commission on Radioactive Waste and Decommissioning; and,
- Maine Governor's Technical Advisory Panel – Provides independent evaluation of technical decommissioning issues and to advise the Governor accordingly.

In addition to these regulatory groups, Maine Yankee also had a number of groups who intervened in regulatory matters, the most notable of these being the Friends of the Coast – Opposing Nuclear Pollution (FOTC). This organization had been an active anti-nuclear group opposing Maine Yankee for a number of years during its operation.

One specific issue early on in the decommissioning project which required regulator interaction only was records retention and disposition. During plant operations, a wide range of records are required to be maintained onsite and accessible. Requirements for records retention are contained in 10CFR50, Appendix A, Criterion I which states:

> "Appropriate records of the design, fabrication, erection and testing of structures, systems and components important to safety shall be maintained by or under the control of the nuclear power unit licensee throughout the life of the unit."

This is relatively clear for plant operation, but becomes far less so during decommissioning. As decommissioning continued, it became a greater burden to maintain all plant operational records in a manner consistent with regulation. Maine Yankee became aware of a letter from the NRC Office of General Counsel (OGC) to the Trojan Nuclear Plant in March 2003 which stated the OGC opinion that all the records should be maintained until the NRC license was terminated.

On a practical matter, it didn't seem to be reasonable to be required to maintain all quality assurance required documentation on a reactor coolant system whose components resided at the Barnwell and Envirocare low level waste burial sites. Consequently, Maine Yankee submitted its own interpretation of the regulations to the NRC, asking that if the NRC disagreed with the Maine Yankee position, that the NRC consider their interpretation as a formal Exemption Request. OGC responded by reiterating the position stated in the Trojan letter that records were required to be maintained until license termination, and that the request would be processed as an Exemption Request.

In November of 2003, the NRC approved the Maine Yankee Exemption Request allowing for the disposal of a wide range of record no longer necessary based on the condition of the facility.

FERC Rate Case

When Maine Yankee shutdown in August 1997, its decommissioning trust fund was insufficient to pay for the decommissioning which was estimated to cost $380 million over seven years plus an additional $128 million for spent fuel storage and management. On November 5, 1997 Maine Yankee applied to the FERC to increase its annual decommissioning collections from ratepayers from $14.9 million to $36.4 million.

Various Maine agencies and an environmental organization, along with representatives from other states in New England, intervened in the FERC process. The Maine Public Utilities Commission, the Maine Office of Public Advocate, and FOTC were intervenors from Maine. By intervening, each group earned the right to participate in the FERC negotiations with Maine Yankee. Maine Yankee could have proceeded to FERC for a hearing, but instead chose to negotiate with the intervenors.

In mid-January 1999 a settlement agreement was reached. In June 1999 FERC approved the settlement agreement. The settlement stipulated the following:

- $33.6 million will be collected annually and allocated as follows:
  - $26.8 million for dismantlement activities
  - $6.8 million for construction and operation of the on-site storage facility for used fuel.

Additionally, the settlement agreement stipulated that Eaton Farm, including approximately 200 acres of Maine Yankee property, will be donated to a non-profit environmental organization or school for environmental education, a nature preserve and public access. A $200,000 grant will also be provided by Maine Yankee to the non-profit organization for the project.

The settlement required Maine Yankee to re-file a rate case by January 1, 2004 to recover the future costs of managing spent fuel left on site after decommissioning. The settlement also resolved an investigation in the prudency of the Maine Yankee's pre-shutdown operation. Maine Yankee's shareholders' return on equity was reduced from 10.65% to 6.50%. In addition, any gain on the sale, lease or disposal of land would be flowed through to customers instead of shareholders. Maine Yankee agreed in the settlement to continue to pursue all legal claims it may have against the DOE regarding spent fuel.

Maine Yankee agreed to manage expenditures to a budget of $446.3 million (in 1998 dollars) through December 31, 2004, to pay for all decommissioning and ISFSI related costs. If Maine Yankee's expenditures are less than $436.3 million then Maine Yankee shareholders have an opportunity to earn incentives. If the expenditures are over $456 million Maine Yankee shareholders will be required to pay 10% of the net overage even if the overages are prudently incurred. Any imprudent expenses would not be recoverable.

In addition, Maine Yankee is subject to financial penalties if the radiation exposure for all of the decommissioning work exceeds the generic environmental impact statement total site dose or if the industrial safety performance (recordable incident rate) exceeds 2 per 200,000 hours worked during decommissioning.

In addition, Maine Yankee reached a separate agreement with FOTC in the rate case, which provides:

- That Maine Yankee will conduct a field survey of off site marine sediments;
- That Maine Yankee will provide FOTC with information regarding any water transport of heavy components;
- That Maine Yankee will split ground water samples with FOTC;
- That Maine Yankee will impose a restriction against future use of the site for nuclear power purposes; and,
- Maine Yankee also agreed to use its best efforts, in conjunction with the development of the ISFSI, to oppose any expansion of the ISFSI facility beyond that necessary for the storage of waste generated by Maine Yankee.

ISFSI Pad Permitting

The construction of the ISFSI pad required that Maine Yankee obtain various building permits. The first meetings with the Wiscasset Planning Board occurred in early March 1999. Maine Yankee was also required to submit a Site Development Application Amendment to the Maine Department of Environmental Protection. This was submitted in early May 1999. The application was transferred to the Maine Board of Environmental Protection (BEP) in August 1999. BEP assumed jurisdiction for the permit and issued notice of its receipt intending to conduct public hearings on the requirements for the ISFSI, including radiological requirements. Intervenor status was granted to Wiscasset and FOC.

In this case, Maine Yankee sought the litigation approach to determine if BEP had jurisdiction on the radiological aspects of the ISFSI. This action was taken in early September 1999. In January

2000, the case had not been resolved, and the lack of a construction permit was directly affecting the schedule for the project. In March 2000, two federal judges recused themselves from the case. In order to move forward, Maine Yankee asked BEP to immediately proceed with a hearing while the jurisdiction case proceeded. This hearing was scheduled for May 10, 2000.

On May 5, 2000 a federal court ruled that the state had no jurisdiction over radiological issues related to the project. This limited the BEP role to soil, wetlands and visual impact. The only BEP outcome at the hearing was for Maine Yankee to improve the visual screening for the ISFSI.

Maine Yankee received the requisite construction permits from the state and Wiscasset in July 2000. In September 2000, the ISFSI construction contract was issued and ISFSI pad construction was begun.

Rubblization Approach to Decommissioning

One aspect of the DOC contract was for the DOC to determine the specific decommissioning strategy within the general constraints provided by Maine Yankee in the contract. The decommissioning strategy selected by the DOC included removing all above ground concrete, remediating the concrete to appropriate radiological criteria, and using the concrete for fill material in below grade open structures. Maine Yankee pursued this approach with appropriate regulators and stakeholders.

The first public discussion of this rubblization concept was during the CAP meeting on September 17, 1999. The rubblization approach was discussed in the DOC prepared draft License Termination Plan (LTP). The DOC intended for the LTP to be submitted to the NRC in November. The CAP members had a number of questions and concerns with the approach and this CAP meeting and those that followed had “spirited” discussion of the rubblization approach. Many CAP members took the view that this approach was in essence onsite disposal of radioactive materials given that the concrete may have detectable levels of radioactivity although below the limits specified in the LTP.

In this case, Maine Yankee interviewees stated that they did not sufficiently prepare or educate the CAP members on the rubblization approach prior to the CAP members reading the draft LTP chapters.

In general, CAP members and the public were widely against the approach. Maine Yankee continued to pursue the option by including it in the Revision 0 LTP which was submitted to the NRC on January 13, 2000. This was a new issue for the NRC and prompted the staff to issue SECY-00-0041, Use of Rubblized Concrete Dismantlement to Address 10 CFR Part 20, Subpart E, Radiological Criteria for License Termination. In the purpose to the SECY it states that rubblization,

> "appears compatible with the radiological performance criteria for license termination. However, it was not specifically considered in the "Statement of Consideration" to the final rule, and is somewhat controversial.”

Various actions were taken by the state in an attempt to stop the rubbization approach. For example, the state (having large latitude in waste characterization) indicated that the rubblized concrete would not be considered Construction and Demolition Debris (CDD), that the concrete would be considered "special waste" with its own requirements for disposal as it was produced in "unusual quantities". This would increase the costs of the concrete disposal.

Additionally, the state could have taken action which would have required Maine Yankee to removal all sub-surface foundations, not just removal to three feet below grade. Maine Yankee estimated that if this were to become a requirement, it would increase the total decommissioning project cost by approximately $100 million.

In March 2000, state legislation was introduced which would require State of Maine monitoring of the Maine Yankee decommissioning. It also defined concrete as special waste and would impose a state limit of 0.05 mrem/y (0.5 µSv/y) for any residual radioactivity on site.

As an outcome of other stakeholder interactions, Maine Yankee had agreed to an enhanced cleanup level of 10 mrem/y (0.1 mSv/y) through all pathways and 4 mrem/y (40 µSv/y) through the groundwater pathway. This agreement was noted in the LTP submitted to the NRC in January 2000, and reflected in the ultimate state legislation passed in April 2000.

Although the state legislation would still have allowed rubblization under certain restricted conditions, based on the wide ranging stakeholder concern, the rubblization approach was abandoned. As noted by Maine Yankee personnel during interviews for this report, ultimately there was likely no significant difference between rubblizing and not. If the rubblization approach was pursued, it would require substantially more concrete surveying and remediation than by simply demolishing and shipping to an appropriate disposal site.

Site Release Criteria

The aspect of decommissioning which required the greatest interaction with regulators and stakeholders was not surprisingly the final criteria the site must meet to be "clean". Maine Yankee began the decommissioning project with the intent to conduct remediation sufficient to meet the NRC requirements of 25 mrem/y (0.25 mSv/y) through all pathways and the demonstration of ALARA requirements. No remediation was expected due to EPA requirements. The final criteria ultimately required were substantially more restrictive.

As noted above, the initial License Termination Plan (LTP) was submitted to the NRC in January 2000 and included the enhanced radiological cleanup criteria of 10 mrem/y for all pathways and 4 mrem/y for the groundwater pathway. This was the result of long interactions with stakeholders beginning in August 1997 when the FOTC asked that Maine Yankee meet the EPA proposed radiological release criteria of 15 mrem/y + 4 mrem/y groundwater.

Discussion at CAP meetings continued into 1998 on the differences in the NRC and EPA approaches to dose limits, discussion of dose pathway analysis, and other aspects. In an effort to help educate the CAP members on the technical aspects of surveys and dose modeling, training on the MARSSIM protocols was provided to interested CAP members. MARSSIM (Multi-

Agency Radiation Survey and Site Investigation Manual) is a document developed by the US EPA, US NRC, US DOD, and US DOE to provide detailed guidance for planning, implementing, and evaluating environmental and facility radiological survey conducted to demonstrate compliance with dose or risk based release regulation.

The primary issue addressed at the October 1999 CAP meeting was the LTP release criteria and EPA release requirements (non-radiological). At the following CAP meeting in December 1999, four separate State of Maine departments as well as FOTC stated that the LTP should require cleanup beyond the NRC requirements.

Despite Maine Yankee agreeing to the more restrictive, "enhanced" cleanup criteria, on April 26, 2000, the State of Maine Law LD 2688-SP1084 was signed into law. This law specified an unrestricted release criteria of 10 mrem/y through all pathways and 4 mrem/y through the groundwater pathway. It also specified that any remaining concrete rubble contain no greater than 5,000 dpm/100 cm^2 residual radioactive contamination.

In the summer of 2000, the State of Maine and FOTC petitioned the NRC to intervene on Maine Yankee's LTP. The NRC subsequently appointed an Atomic Safety and Licensing Board (ASLB) to consider the petitions and request for a hearing. Rather than pursue the ASLB hearing, Maine Yankee asked for and received an abeyance on the hearing in order to work with the State and FOTC to resolve their issues.

Over 30 stakeholder meetings were held through the fall of 2000 and the spring of 2001 which led to the development of revised LTP bases. Revision 1 of the LTP, which included major changes, was submitted to the NRC in June of 2001. An additional revision (revision 2) was submitted in August 2001 which included additional comments from the State and FOTC.

At the end of August 2001, a settlement agreement was reached with the State and FOTC and accepted by the ASLB eliminating the need for hearings. Key aspects of the settlement included the following:

1. <u>Maine Yankee and State Of Maine</u>

    - Maine Yankee and the State of Maine will work jointly with the NRC to determine whether the intertidal zone is within or beyond the site boundary, hence within or outside the scope of 10 CFR 50.82.

    - Maine Yankee and the State of Maine will jointly participate in a process to resolve the outstanding technical issues in the LTP. This Technical Issues Resolution Process (TIRP) would use the Data Quality Objective process outlined in MARSSIM.

    - In a subsequent LTP revision, Maine Yankee would clarify the relationship between the free release criteria in the LTP and NRC Circular 81-07.

    - Maine Yankee will notify the State prior to making changes to the LTP in accordance with 10 CFR 50.59 that would result in any increase in the Derived Concentration

Guideline Levels (DCGLs) and to request NRC approval if the DCGL increased by a factor of two or greater.

- Maine Yankee agrees to obtain additional radiochemical analysis of groundwater from the containment sump.
- Maine Yankee will use the radiological results obtained in implementing the LTP as well as the output from the RCRA health risk assessment (see section X) and compile a Cumulative Risk Assessment.
- Maine Yankee will have additional biota and marine samples taken and analyzed. The sampling program will be developed jointly with FOTC.
- Maine Yankee will provide the State with a listing of all parameters used in the LTP and their basis and include it in a subsequent revision to the LTP.

2. Maine Yankee and Friends of the Coast

- Maine Yankee will take and analyze additional samples in and around the forebay and diffuser discharge piping and incorporate the results and evaluations into a subsequent revision of the LTP
- Additional soil and vegetation samples will be taken and analyzed in areas of elevated soil contamination. The locations of the samples to be agreed to by FOTC.
- In general, Maine Yankee commits to using offsite areas as the background reference area if needed for implementing the LTP.
- Maine Yankee agrees to print ads in local newspapers asking former Maine Yankee employees and contractors to recount knowledge of any spills, incidents or other actions dealing with radioactive materials which should be included in the Maine Yankee Historical Site Assessment.
- Maine Yankee agrees to make flowrate measurements at a discharge point into Bailey Cove and to have samples taken of the outfall.
- FOTC shall receive information obtained from the groundwater and marine sampling performed as part of the agreement with the State.

It was noted in the November/December 2001 issue of Radwaste Solutions that

> "The agreement appears to be the first in the United States to include state officials and environmental activists in setting terms for license termination of a commercial nuclear power plant. It also appears to be the first to set cleanup standards that are more stringent than federal requirements."

Substantial additional detail on the Maine Yankee LTP and Historical Site Assessment can be found in EPRI Report # 1003426, Summary of Utility License Termination Documents and Lessons Learned: Summary of License Termination Plans Submitted by Three Nuclear Power Plants, and EPRI Report # 1009410, Capturing Historical Knowledge for Decommissioning of Nuclear Power Plants: Summary of Historical Site Assessments at Eight Decommissioning Plants.

Community Advisory Panel (CAP)

The Maine Yankee Community Advisory Panel (CAP) was established in 1997 to enhance opportunities for public involvement in the decommissioning process of Maine Yankee. The CAP represents the local community. By thoroughly reviewing the decommissioning process, the CAP is in a position to advise Maine Yankee on key issues of concern to the local community.

One of the first actions in development of the CAP was the creation of the Charter. This document provided the overall structure of the CAP, its operating approach and the operating envelope – what was in their purview and what was outside.

During its first year, the CAP received several technical tutorials on subjects such as radiation, the decommissioning process, decommissioning funding, site characterization, trash monitoring, emergency planning, and spent fuel storage. CAP members also visited used nuclear fuel storage sites at nuclear plants in Maryland, Colorado and Michigan. These visits gave CAP members first hand information about how dry storage facilities work.

After its first year of intense learning, the CAP met in September 1998 to revisit their role and establish a work plan for 1999. Since that time, the CAP annually established a work plan each September for the following year. This annual planning session also provided the CAP to evaluate the work plan against their own deliverables to judge and self critique themselves.

The CAP also shares information with other advisory panels. For example, the Maine Yankee CAP has met with citizen panels at Connecticut Yankee, Big Rock Point, and Millstone. CAP members have also participated in national and international conferences regarding decommissioning and have toured the proposed DOE spent fuel repository at Yucca Mountain, Nevada.

The CAP provided an effective vehicle to obtain community and stakeholder input and to provide to Maine Yankee a means to communicate a consistent message to a diverse group. Two early instances in which the CAP provided a particularly effective means of communication included spent fuel pool fan noise and the Wiscasset landfill. The noise from the SFPI cooling fans was addressed earlier.

The incident at the Wiscasset landfill arose when a concern was raised in a CAP meeting that in the 1980's, Maine Yankee had allegedly sent potentially contaminated material to a local landfill. A detailed investigation was conducted by Maine Yankee along with NRC and state regulators. The investigation determined that during a portion of 1986 and 1987, that Maine

Yankee had sent materials which were radiologically released from a "bag monitor" to the landfill. For various reasons the use of the bag monitor was discontinued by Maine Yankee in 1987. The investigation also included water sampling and land surveys at the now closed landfill site. Similar surveys and sampling were also performed by the NRC and state agencies. The survey and sampling results showed only background levels of radiation and contamination. The investigation progress, as well as results were conveyed in subsequent CAP meetings, including discussion of the health impacts from an independent nationally known health physicist. The prompt action by Maine Yankee as well as the transparency in which the investigation was conducted worked to Maine Yankee's favor by building trust with the regulators and stakeholders.

One thing that was essential to the CAP members was that they wanted real issues to address and to provide input on, and that Maine Yankee would view their input with weight. It became evident to the local media that these meetings would be newsworthy, so at least for the first year, media coverage of the meetings was typical. Maine Yankee staff worked very hard to keep the CAP from being surprised by anything relating to the project in the media – the CAP expected to hear it from Maine Yankee first.

A key value to CAP, and to the company and to the community was that on a very regular basis, senior plant management made presentations before the public and were expected to answer the questions in a manner understandable to lay members of the public. This was a challenge for some site personnel to be able to communicate in this manner. The CAP also served by making MY carefully prepare for presentations and to help ensure a clear, consistent and understandable message got to the public, for examples with the LTP, fuel storage, and explosive demolition.

Maine Yankee did not provide training to personnel prior to presenting material at CAP. Some people took to the task readily, and others improved with experience. Public Affairs Department personnel would help people prepare material and would do dry runs on the material before CAP, including probable public questions. Over time, CAP built up trust with regular presenters. Also, before each CAP meeting Maine Yankee would provide dinner and the site presenters would participate. This social interaction also helped build a rapport between the CAP members and the presenters.

The attendance at CAP meetings was never terribly high (20-30) and periodically, CAP would question the low attendance. The only item really noted was that since media was there, the public could follow the issues in the local newspapers. The only times when public participation was high was when there were issues that directly affected them (SFPI fan noise being the biggest item).

Explosive demolition is another good example of when the CAP was of value. The first time explosive demolition was discussed internally to Maine Yankee, it seemed an unlikely prospect for success from the stakeholder viewpoint. Once it appeared to be sound from a technical and economic standpoint it was presented to CAP. Detailed discussion and questions occurred over a number of CAP meetings, so that when the explosive demolition occurred, it was well understood and of little public concern. The same detailed discussions, planning and communication was used successfully for all the explosive demolition applications.

If a company is considering a CAP or its equivalent, it must understand and accept the level of effort needed to keep it going. When the Maine Yankee CAP was started, the "care and feeding of CAP" was essentially a full time position for one person. A substantial effort was made in the first two years in order to build the trust and credibility needed for success. In addition to the staff support, Maine Yankee budgeted for the travel and education opportunities provided to the CAP members as well as the dinners provided prior to each CAP meeting. Nominally, this was approximately $20,000 per year, but was viewed by Maine Yankee as providing real value for the funds and effort expended.

Perhaps a single comment from one of the interviewees summarizes the view of Maine Yankee toward the CAP.

> "I am absolutely convinced that the CAP was one of the real keys why the decommissioning was successful, because it was an opportunity for a diverse group from the community, who had some really spirited discussions among themselves to come together in understanding complex issues for the benefit of the community and to Maine Yankee"

7
ENGINEERING AND USE OF TECHNOLOGY

Lessons Learned/Recommendations

- Segmentation – For internals segmentation, assure the RFPs address detailed controls and limits for air and water contamination.
- Segmentation – Continuous monitoring of waste debris accumulating in the high integrity containers requires multiple survey points to ensure shipping dose rates of the casks are not being exceeded. Additional remote monitoring detectors were installed on the high integrity container liners during the project.
- Segmentation – The use of a remotely operated capping tool to install lids on the high integrity container liners would help reduce radiation exposure.
- Segmentation – Design improvements are needed to enhance the vacuuming and debris removal operational efficiency.
- Segmentation – Modular and quick disconnect features are needed for all submerged systems
- Segmentation – A complete flush and verification of the primary loop cleanliness after the loop decontamination was needed.
- Explosive Demolition – Explosives are a viable alternative to mechanical demolition. For Maine Yankee, explosives were used as it was estimated to reduce the demolition time by a factor of 3 – 5. You must however balance the improved production rate against the increased costs for explosives use.
- Explosive Demolition – It is essential to maintain strict security oversight of the transfer and accounting of all explosives onsite.
- Explosive Demolition – It is prudent to include an explosives handler in the initial post-blast inspection entry team.
- Explosive Demolition - When the containment concrete interior was removed, it cut out about 99% of the remaining activity – this allowed much less risk with the use of explosives.

Overview

The decommissioning of Maine Yankee involved a wide range of engineering skills and use of technology to optimize the overall project results. Two technology applications are briefly addressed here. The first being the project to segment the reactor vessel internals and the second being the use of explosives for building demolition work including the turbine building, containment polar crane, and containment shell.

Reactor Vessel Internals Segmentation

The segmentation of the reactor vessel internals was performed by abrasive water jet and mechanical cutting by Framatome ANP. No thermal cutting techniques were used. The initial cutting activities began in November 2000. The initial estimate of weight was 363,000 pounds with 70% shipped with the reactor vessel, 20% shipped in casks and 10% (GTCC) stored in the ISFSI. The activity was estimated at 1.964 million Curies (7.267E16 Bq) of which 2% was shipped with the reactor vessel, 15% shipped in casks and 83% (GTCC) stored with the ISFSI. The entire project was estimated to require 57 person-rem (0.57 person-Sv) to complete. The project ultimately required only 29 person-rem (0.29 person-Sv) to complete.

Full "proof testing" was performed for the segmentation system at Framatome. This activity took longer than anticipated and ultimately resulted in the project starting on site about eight months late. The planned total onsite work duration was correct, so the result was the project ended about eight months later than planned.

Maine Yankee used lessons from Rowe, and kept a consistent focus on maintaining water clarity. The segmentation approach was to cut the internals into larger sections which didn't have to put into individual fuel cask cells. A special cask container was fabricated for fragments and larger pieces. This substantially reduced the number of required cuts, hence reduced debris and swarf. A detailed CAD/CAM based plan was developed to plan cuts, detailed tool movements, and placement of pieces into cask. This allowed for optimization of cask loading and required the fewest cuts and piece movements. Cut away views of the reactor pressure vessel and internals prior to any segmentation is shown in Figure 7-1. The planned cuts on the thermal shield and core support barrel are shown in Figure 7-2. A view of the partially segmented internals is provided in Figure 7-3.

The reactor pressure vessel (RPV) internals segmentation was performed in the flooded refueling cavity. Cavity penetrations were sealed to confine the cutting debris to the reactor cavity. Reactor cavity housekeeping and contamination controls were strictly maintained to prevent buildup of high radiation sources. In order to minimize cross contamination, the cutting was performed first on the least activated components and progressed to cutting the most highly activated materials.

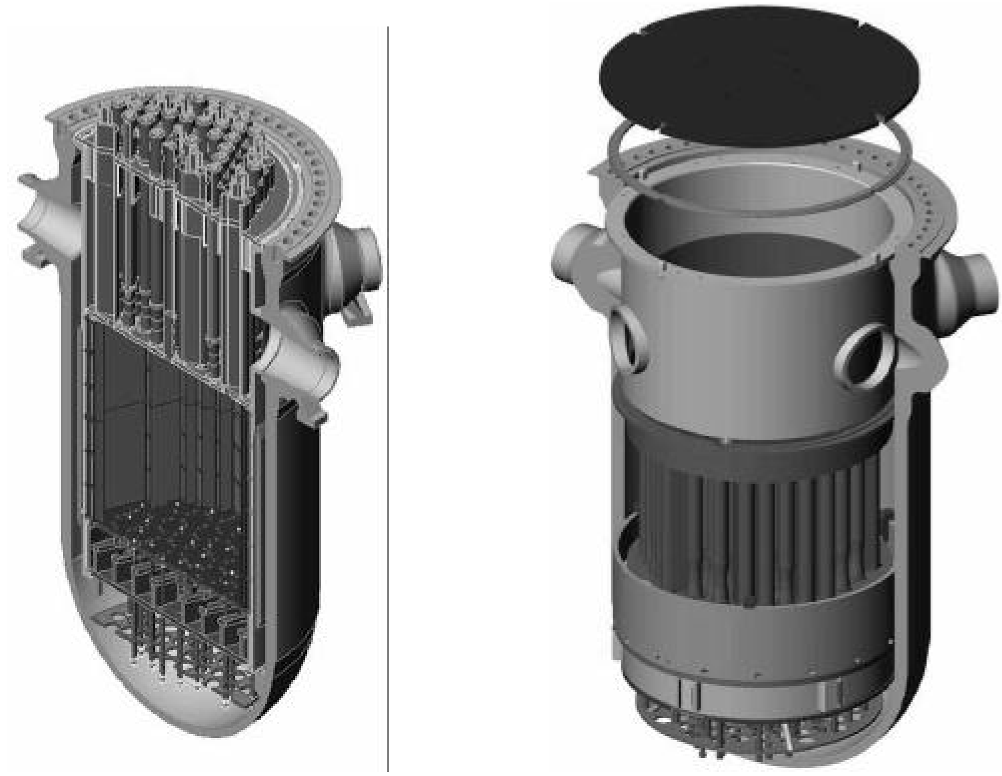


Figure 7-1 Maine Yankee RPV and Internals Prior to Segmentation

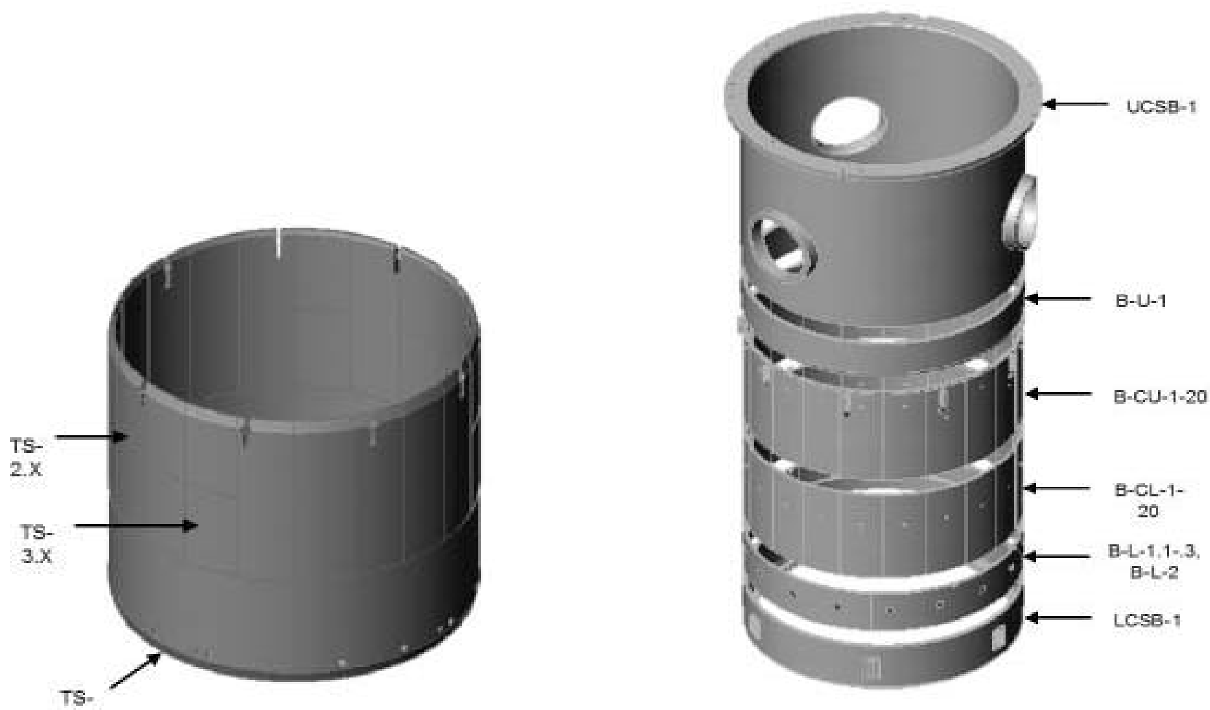


Figure 7-2 Maine Yankee Projected Cuts on Thermal Shield and Core Support Barrel

Figure 7-3 Maine Yankee Vessel Internals Segmentation

The water jet cutting was performed with a four axis telerobotic manipulator that was remotely operated. Custom designed and fabricated rigging equipment was used to assist in the lifting and positioning of the internals. A number of other innovations were developed during the segmentation process, including vision enhancement during cutting, capture of cutting waste and a new licensed waste container for the high level abrasive swarf. Maine Yankee in particular found the control and precision of the telerobotic manipulator (the “mast”) to be quite good. It allowed for very precise x/y/z location control for cuts. The ultimate results were only four casks of GTCC were generated. Approximately 2/3 of the cut internals were able to be put back into the reactor pressure vessel for subsequent disposal using the custom rigging equipment as shown in Figure 7-4.

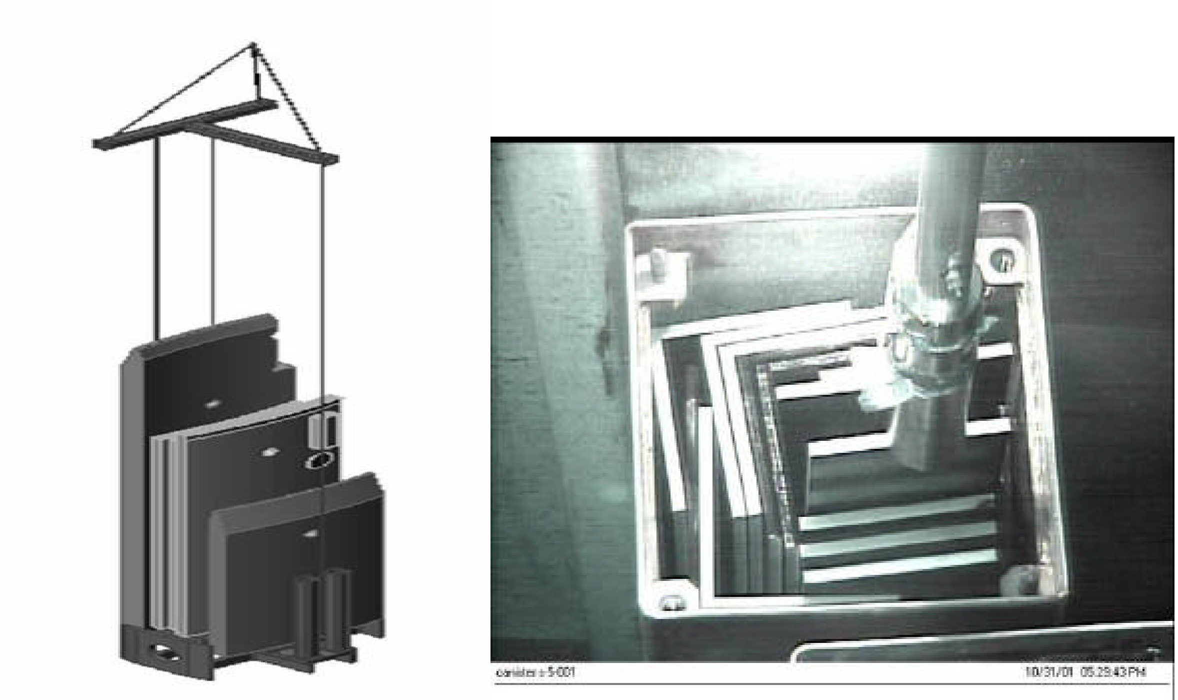


Figure 7-4 Maine Yankee Lifting Rig with Segmented Pieces and Placement Back Into Vessel

The most difficult challenge in the internals segmentation process was the removal of the colloidal suspension created from the fragmentation of the garnet used in the abrasive water jet cutting. Initial testing demonstrated that a simple filtration system quickly clogged. A specially designed and patented filtration system was fabricated for the actual water jet cutting operations. This Solid Waste Collection System (SWCS) was used with a separate Cavity Water Treatment System (CWTS) in order to control debris cleanup and water clarity. Another challenge was an initial crud burst from the residual reactor coolant system decontamination wastes due to incomplete flushing of the system after decontamination.

Maine Yankee used larger than fuel assembly sized containers for their GTCC waste in order to reduce the number of segmentation cuts that were required. These waste containers held two canisters approximately 6 feet in diameter and 8 feet tall. Two canisters containing GTCC waste were stacked on top of each other in one waste container. A total of four waste containers with GTCC wastes and 60 containers with spent fuel were moved into dry cask storage and placed on the ISFSI storage pad. The reactor pressure vessel containing the lower activity internals segments was removed from the containment in August 2002 and prepared for shipment via barge to the Barnwell disposal site. Due to low water levels in the Savannah River, the reactor pressure vessel did not leave Maine Yankee until May 2003 (Figure 7-5).

Figure 7-5 Maine Yankee RPV Ready for Transport to Barnwell

The Maine Yankee reactor vessel internals segmentation along with the segmentation of other reactor vessel internals is discussed in detail in EPRI Report # 1003029, Decommissioning: Reactor Pressure Vessel Segmentation. A portion of the material above was obtained from this EPRI report.

Use of Explosives

As noted in this and earlier sections, Maine Yankee encountered some project delays due to the overall effort to remove all fuel from the spent fuel pool and the fuel building. This action was required to be complete prior to final fuel building demolition. One way in which Maine Yankee worked to recover some of the project schedule was the use of controlled explosives for a portion of the building demolition. In particular, for building demolition efforts in which the standard mechanical demolition equipment (e.g., ram hoe) could not reach high enough from ground level to affect the upper elevations/roof of plant structures.

When the use of explosives was initially evaluated, the following design requirements were established.

- Damage to nearby structures, systems and components including those involving safe storage of spent fuel must be avoided. These potentially affected structures, systems and components included the Fuel Handling Building, Spent Fuel Pool Transfer Tube, Spent Fuel Storage Racks and Spent Fuel Assemblies. Other non-safety related structures, systems and components which could be affected include building ventilation and relays in the 345 kV switchyard which were sensitive to vibration;
- Offsite dose limits for gaseous effluents (including particulates) must be met;
- All applicable rules and regulations for use of explosives must be met;
- The analysis must demonstrate that the task can be performed safely;
- Overpressure due to the explosion in the vicinity of the ISFSI must not exceed the design value of 22 pounds per square inch, otherwise existing design criteria such as wind loading pressures and peak particle velocity, as well as ground motion were used to assess the consequences on the ISFSI for the use of explosives;
- Peak ground velocity limits for the spent fuel in the ISFSI was established at 1 inch/sec; and,
- The town of Wiscasset ordinance governing the use of explosives deferred to state law. Although not required, the state fire marshall's office was notified of the activity.

In addition to safety analyses required per 10 CFR 50.59, additional radiological analyses were performed. The analysis indicated that no significant exposure to the public would result from the demolition of buildings with low levels of contamination. As long as the average beta/gamma contamination levels are below 5,000 dpm /100 cm^2 (~ 83 Bq /100 cm^2) for loose surface contamination and 500,000 dpm/100 cm^2 (~ 8,300 Bq /100 cm^2) fixed contamination, the critical organ dose to any member of the public using methods in the Maine Yankee Offsite Dose Calculation Manual would be under 0.066 mrem (0.66 µSv) for the entire project. Alpha contamination limits of 20 dpm/100 cm^2 (~ 0.33 Bq /100 cm^2) for loose surface contamination and 100 dpm/100 cm^2 (~ 1.68 Bq /100 cm^2) fixed contamination results in a critical organ dose of 8.6E-3 mrem (8.6 nSv) for the entire demolition project.

In order to validate the calculations and models, Maine Yankee and their explosive demolition contractor performed low yield explosive tests in containment and the spray buildings. Following the initial blast in the sontainment building, walkdowns were performed to assess the impact (if any) on plant structures, systems and components. Maine Yankee reported that no damage was observed to the fuel, fuel pool, fuel pool cooling equipment, or structural walls. In addition, no leakage was detected at the spent fuel pool leakage detection system and no change in the fuel pool water level was observed. In addition no significant airborne radioactivity was generated during the blasting.

Following the blasting in the spray building on April 25, 2003, a Safety Representative and Health Physics technician discovered that several charges failed to detonate in the spray building. One of Maine Yankee's corrective actions was to ensure that during any future blasting, an explosives handler would be included in the initial post-blast inspection entry team.

Turbine Building Demolition

The turbine building was approximately 135 feet x 335 feet x 110 feet high, approximately 45,000 square feet and contained approximately 5.4 million cubic feet of free volume. Prior actions included removal of major commodities, galbestos siding and other possible contaminants. The structure had satisfactorily completed the final status survey and was ready for demolition. Controlled explosives were selected as the preferred method to soften the turbine pedestal before standard mechanical demolition, and to implode the turbine building roof trusses onto the building upper floors.

The turbine building pedestal provided support for the turbine-generator set and weighed approximately twenty-million pounds. The debris from the pedestal was expected to fill approximately 100 gondola rail cars, which would subsequently be shipped offsite over a ten week period.

The remainder of the building was demolished by a combination of standard mechanical means and explosive demolition. The southern eight bays (approximately 240 feet of length) were explosively dropped by the use of shaped charges which were strategically placed on the building's supporting frame. The northern section of the building was mechanically dismantled later due to its proximity to equipment important to safety. The use of controlled explosives was determined to be a safer approach for workers as it reduces worker time in the building and reduces worker exposure to dust. Overall the process produces less noise and dust as the total time to complete demolition was reduced from approximately two months using standard equipment to approximately two weeks.

A substantial safety analysis was performed to use the controlled explosives approach. In particular, the impacts had to be evaluated for the public (~ 0.5 miles from the blast point), workers, spent fuel pool (260 feet from the blast point), reactor cavity (200 feet from the blast point), 345 kV switchyard (660 feet from the blast point), ISFSI (1000 feet from the blast point) and control room (77 feet from the blast point).

Maine Yankee worked with the construction demolition contractor and the explosives company to design the blasts so that ground vibration would be limited to 50% of that allowed under the site design basis (1 inch/second).

In order to accomplish the demolition, vertical holes approximately 39 feet deep were drilled into the turbine building pedestal at three to four foot spacings for the explosives to be placed into (Figure 7-6). The roof trusses were severed with explosives which dropped the roof onto the turbine deck. The roof was 65 feet above the turbine deck and 100 feet above the ground. Dropping the roof allowed standard ground based mechanical demolition to occur (Figure 7-7)

Figure 7-6 Maine Yankee Turbine Pedistal - Explosives Placement and After Detonation

Figure 7-7 Turbine Building Demolition After Use of Explosives

Polar Crane Demolition

Maine Yankee's containment interior demolition project involved the use of explosives to bring down their 330-ton polar crane from the upper levels of the containment building. Special precautions had to be taken to ensure the detonation and subsequent dropping of the polar crane did not affect the integrity of the fuel pool and associated equipment, that ground vibrations would not affect other plant structures and the Central Maine Power Co. 345 kV Switch Yard, that explosives were properly controlled and transferred while on-site, and proper precautions were taken to control and monitor potential offsite releases of contaminated dust.

In preparation for the crane drop, Maine Yankee:

- Positioned concrete rubble and sacrificial concrete inside containment to reduce ground vibrations;
- Installed seismic monitors or geophones to monitor ground vibrations inside containment, at the ISFSI slab, at the 345 kV Switch Yard, in the Control Room, and at Westport Island;
- Installed three air blast curtains made of chain link fencing and fibrous fabric at the former equipment hatch access to reduce potential effluents;
- Wetted down concrete surfaces inside of containment for dust suppression;
- Removed or de-energized electrical components and fixtures in containment;
- Installed multiple air monitors inside containment, in the former equipment hatch, and outside of containment to monitor potential effluents;
- Maintained strict security oversight of the transfer and accounting of all explosives;
- Modified the fuel transfer tube to prevent damage during containment demolition by removing the portion on the tube extending into the refueling cavity and welded steel plates to cover and seal the fuel transfer tube;
- Conducted multiple plant briefings to effectively coordinate the work and ensure personnel safety; and,
- Conducted communications with the public and stake holders via press releases and telephone contacts.

Typical guidelines established by construction insurers for use of explosives specify a maximum ground velocity of 2 inches per second. For conservatism, Maine Yankee's engineering plans were intended to limit the peak ground velocity limit to 1 inch per second. The maximum measured ground movement as measured by a seismic monitor on the 20 foot elevation of containment was 0.1 inches per second.

On December 19, 2002, Maine Yankee safely brought down their 330-ton containment building polar crane. Maine Yankee's explosives contractor used approximately 37 pounds of shaped explosive charges (RDX) to cut the polar crane into three separate pieces, allowing it to fall approximately 50 feet onto concrete rubble and sacrificial concrete (Figure 7-8). No damage to the fuel, fuel pool, fuel pool cooling equipment, or structural walls was observed. In addition, no leakage was detected by the spent fuel pool leakage detection system and no change in the fuel pool water level was observed. A follow-up inspection inside containment showed that the polar crane dropped onto the concrete rubble bed and sacrificial concrete as planned. Most horizontal surfaces were covered with about a 1/16 inch layer of concrete dust. Some damage, which was not unexpected, occurred to lighting and conduit as a result of the blast.

The air blast also damaged temporary wooden doors used at the containment access and the outer containment blast curtain located at the former equipment hatch was blown down. The crane drop also spread concrete dust and low level contamination (i.e., 1,000 dpm/100 cm^2 beta-gamma) into major hallways in the 20 foot elevation of the primary auxiliary building (PAB). Initial air sampling results performed inside the PAB, at the former equipment hatch, and outside the equipment hatch were all less than 0.3 DAC.

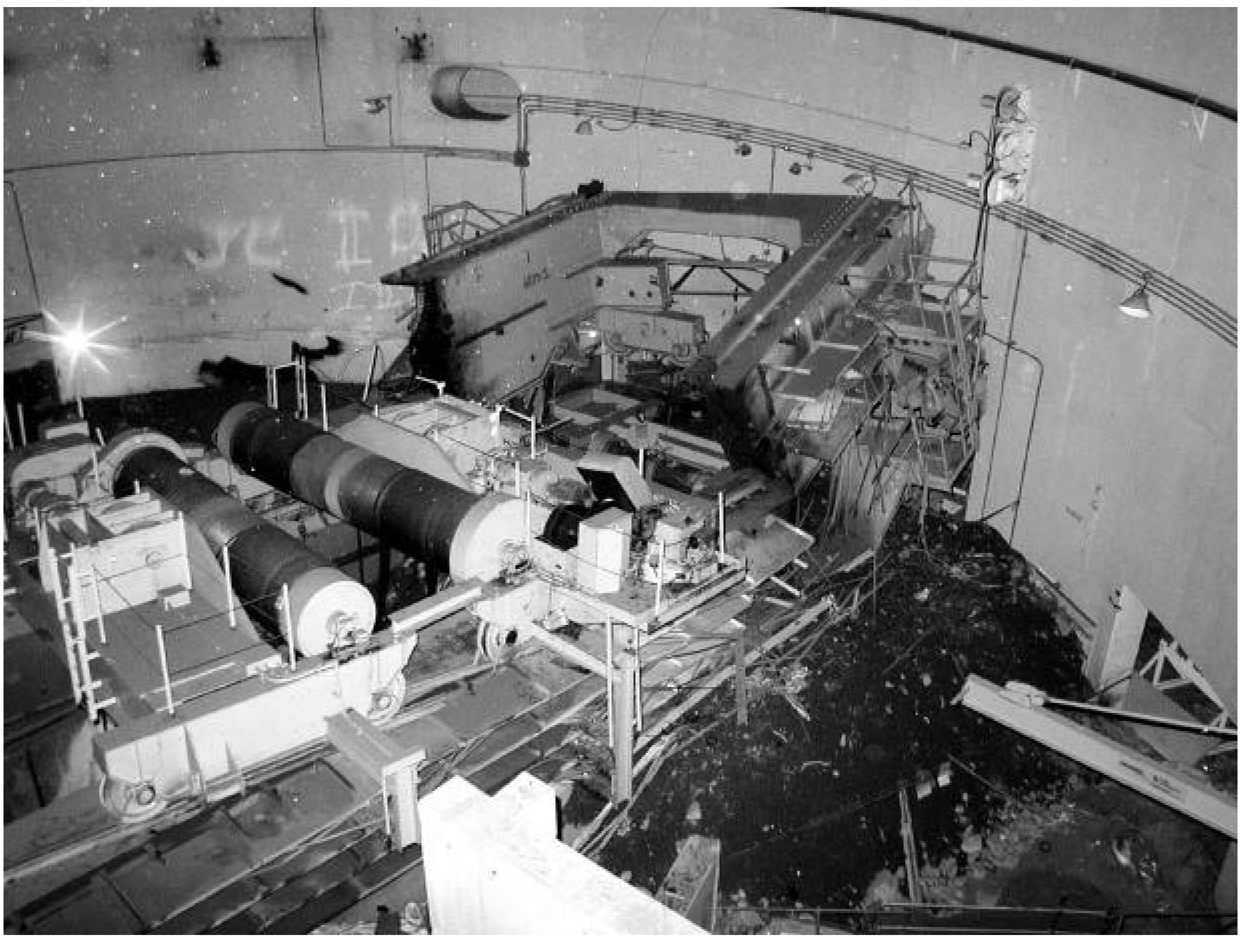


Figure 7-8 Maine Yankee Polar Crane After Explosive Segmentation

Containment Demolition

The containment was a 150 feet high cylinder 144 feet in diameter with 4 feet 6 inch walls at the base and a dome 2 feet 6 inches thick. It contained a steel liner between 3/8 and ½ inch thick. Similar to the turbine building demolition, the focus was on safety for workers, public and nearby structures (primarily the spent fuel pool). Project planning began in January 2002 with demolition complete in September 2004.

Due to the robust nature of the 150 foot tall concrete and steel reinforced containment building, it was necessary to weaken it substantially before final demolition was possible. Nine 75-foot tall rectangular openings were cut through the exterior shell and steel liner using hoe rams and cutting torches. This resulted in the removal of two-thirds of the shell concrete and steel or about thirteen-million pounds of material. Additionally, all of the 2.25 inch diameter vertical reinforcing bars – approximately 1,360 of them – were cut (Figures 7-9 and 7-10). The columns were then drilled laterally for the 1,100 pounds of explosives used for final demolition. Prior to demolition the columns were wrapped in chain link fence and fabric to minimize flying debris.

Analysis identified that even with the large rectangular openings, the containment would still be capable of resisting wind loads up to 40 miles per hour. Administrative controls were then implemented to prohibit personnel access in and around the structure if wind speeds exceeded 40 mph.

Blast loads considered included the explosive demolition of the arches and the development of a high pressure air pocket under the containment dome as it collapsed after the arch demolition. The demolition sequence was therefore designed to progress circumferentially to allow the dome to tilt and land on edge. The dome and remaining portion of the containment were estimated to weigh 10,450 tons.

On September 17, 2004 the containment building was safely demolished with explosives, making it the first former nuclear power plant containment building to be demolished in this manner. This demolition resulted in approximately twenty-million pounds of rubble.

Figure 7-9 Maine Yankee Containment Demolition Preparation

Figure 7-10 Maine Yankee Containment Ready for Demolition

8
SITE CLOSURE ISSUES

Lessons Learned/Recommendations

- Site Release – For the overall project schedule, think about final status survey (FSS) as being the end point and structure the decommissioning work to support this end point.
- Site Release – Nuclide Fractions which exist per compliance with 10 CFR 61 are not necessarily nuclide fractions used for final status surveys
- Site Release – Maine Yankee developed a joint operational radiation protection/final status survey group. Maine Yankee had a core group of FSS technicians, but many technicians were cross trained. This added flexibility for work scheduling and task loading.
- Site Release - Much time was spent on decontaminating concrete rather than simply removal and disposal as waste ("rip and ship"). The project took too much time chasing cracks. It was decided for the containment interior to just have wholesale removal of concrete. This led to shipping approximately nine-million pounds of concrete, but allowed far less characterization and iterative decontamination. This also made FSS easier to perform.
- Site Release – The RCRA and state compliance was a bigger issue than anticipated. Some RCRA work will continue after NRC license termination.
- Site Release – Improvement in soil segregation and monitoring would be useful.
- Site Release – Maine Yankee didn't have ideas on soil remediation approaches early enough.
- Site Release – Do more quality control work on FSS data coming in from the field. Maine Yankee had many transcription errors.
- Site Release – Put a standard database in place early – it helps keep data consistent (e.g, 16 cm^2 vs. 15.5cm^2 probe area, types as simple example). Maine Yankee uses spreadsheet for data analysis.
- Site Release – Work with early characterization so that their data would better support FSS in addition to DOC required characterization.
- Site Release – Maine Yankee tried to have joint sampling for FSS/RCRA requirements but couldn't really accomplish this due to regulatory requirement differences.
- Site Release – Make sure you put all instruments through their paces before field use (e.g., temperature ranges, geometries, efficiencies, physical use parameters) – know all of these before you begin FSS measurements.

License Termination Plan Issues

The Maine Yankee License Termination Plan evaluated the potential doses for the following materials.

- Contaminated basement surfaces;
- Embedded piping;
- Activated concrete/rebar;
- Groundwater;
- Surface water;
- Surface soil;
- Buried piping/conduit;
- Deep soils; and,
- Forebay sediment.

The dose from each material was evaluated and summed to determine the total dose to the average member of the critical group. After considering radionuclide transfer from these nine contaminated materials, five environmental media were determined to potentially deliver dose to the resident farmer. These are groundwater, surface soil, deep soil, surface water and basement fill. The forebay sediment does not readily transfer to the five environmental media and was evaluated separately. The resident farmer was selected as the critical group for dose assessments. The dose assessment basis for each media is addressed below.

Dose Assessment Models - Concrete

All contamination on concrete surfaces is assumed to be released and mixed with the water that has infiltrated the basements. Contamination is assumed to be within top 0.1 cm of concrete. The highest concentration is obtained with the highest surface area to volume ratio. The highest ratio was found to be 1.7 m^2/m^3 in the spray building basement. This ratio was therefore used to determine volumetric contamination for all contaminated basement structures. Maine Yankee analysis showed an average concrete density of 2.2 g/cm^3

Contaminated basement surfaces result in exposures via the drinking water, irrigation, and direct exposure pathways. The drinking water dose is obtained by multiplying the basement water concentration (pCi/l) times the annual water intake (478 l/y per NRC guidance) times the applicable dose conversion factor from the Federal Guidance Report No. 11 (FGR-11 – Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion, Ref. 21). The irrigation dose was obtained by multiplying the basement water concentration (pCi/l) times the irrigation rate (0.274 $l/m^2/d$) over the affected area resulting in the applicable soil concentration. The soil concentration (pCi/g) is then converted to a dose using the NUREG 1727, Table C2.2 values. The direct dose was obtained using a standard industry shielding code assuming a three-foot cover, 10,000 m^2

affected area and a 5.8 m depth (representing the deepest basement). The resultant exposure rate is multiplied by the outdoor occupancy factor of 0.1101 from DandD version 1.0 (an NRC approved dose pathway analysis computer code used in decommissioning).

Activated concrete and rebar were also evaluated for basement concrete. Each showed a different nuclide mixture and characterization showed that the rebar contained approximately 1.9 times higher total activity concentration than did the concrete surrounding the rebar. Calculated doses however showed that the total contribution from the rebar was less than half that from the concrete. The decision was therefore made to assume that the entire volume was composed of the concrete and ignore the rebar contribution – providing for a conservative dose calculation.

The approach used for embedded piping was similar to that used in contaminated basement concrete. A determination was made of the potential radionuclide inventory in any remaining embedded piping, and the calculation assumes this entire inventory was released into the worst-case basement volume.

The calculations for surface soil use the NRC screening values from NUREG 1727, Table C2.3. A separate calculation is developed for deep soil, as the screening values only apply to the top 15 cm of soil. The resident farmer is exposed from deep soil through the direct exposure pathway and groundwater. As any excavation could move deep soil to the surface, the deep soil Derived Concentration Guideline Level (DCGL) was limited to no exceed the surface soil DCGL. The direct exposure contribution assumed a 15 cm cover (surface soil) and a volumetric source of 48,500 m^3. This value represents essentially the entire volume of soil within the restricted area down to bedrock. The direct exposure contribution was developed with an industry shielding code using default DandD values for indoor occupancy (0.6571y), outdoor occupancy (0.1101 y) and external radiation shielding factor (0.5512).

The maximum groundwater contributions were calculated using RESRAD (a DOE developed dose pathway analysis computer code) based on unit concentrations of each nuclide.

Dose Assessment Models - Groundwater

A separate calculation was developed for existing groundwater. Potential additional groundwater contributions from other contaminated materials are included in the applicable dose calculation. The groundwater dose was calculated from the highest individual groundwater sample result from site monitoring wells. The only nuclide identified in site groundwater is H-3 with a maximum concentration of 6812 pCi/l. The dose was calculated using the 478 l/y intake and the FGR-11 dose conversion factors.

Dose Assessment Models – Surface Water

The only sources of site surface water are the fire pond and the reflecting pond. No plant derived nuclides were identified in the fire pond, so only the reflecting pond was evaluated in the dose assessment. H-3 was identified in the reflecting pond at a maximum value of 960 pCi/l. Although this likely is a background level, the doses were likewise calculated for this input. In addition to direct water intake, a potential pathway is fish ingestion. The dose was calculated by combining the water intake result (obtained as in the groundwater calculation above), and using the DandD fish consumption rate and a water to fish contamination transfer rate of 1.

Dose Assessment Models – Piping and Conduit

This calculation evaluates remaining subsurface piping and conduit – not embedded in concrete. This material is expected to contain little or no residual contamination. The piping is assumed to be evenly contaminated and that the entire inventory enters a soil volume equal to the internal volume of the pipe that assumes that the entire pipe has disintegrated. The resulting contaminated soil produces a potential dose that is calculated as in the deep soil approach discussed above, except that a three foot cover is assumed rather than 15 cm. The resultant DCGLs will be limited to not exceed the surface soil DCGLs.

Dose Assessment Models – Forebay Sediment

Initial characterization noted positive results for Co-60 from 0.04 – 11.2 pCi/g and for Cs-137 from less than the minimum detectable activity to 0.53 pCi/g. The minimal sediment that exists is found between rocks on the canal dikes and at low tide. The small sediment volume is reasonable considering the high water flow through the canal during plant operations. Additional characterization noted the following:

- Co-60 – 31.7 pCi/g;
- Fe-55 – 13.6 pCi/g;
- Ni-63 – 8.9 pCi/g;
- Cs-137 – 1.2 pCi/g; and,
- Sb-125 – 0.4 pCi/g.

The dose assessment assumes an inch layer of sediment at the base of 2 foot diameter rocks with an individual standing on or walking over the rocks. The pathways to consider are direct exposure and ingestion. Inhalation was deemed not reasonable as the sediment is either submerged or wet at all times. Resultant doses were approximately 8 times lower than the soil exposure contributions.

Containment Concrete Issue

Characterization and remediation in the lower levels of the containment indicated that there remained several inches of activated concrete behind the liner in the In-Core-Instrumentation (ICI) pit. The approved License Termination Plan specified that the activated concrete would be removed to meet the DCGL levels. The reactor pressure vessel was enclosed and shielded by a combination of the primary shield wall and the ICI sump (Figures 8-1 and 8-2). The remediation of this activated concrete was viewed as a significant industrial safety risk and would incur additional personnel radiation exposures inconsistent with the ALARA principle.

A revised plan was developed to remove all concrete to the liner and to leave the liner in place with 6 – 8 inches of activated concrete behind the liner for approximately 20 feet below the neutron shield tank. Calculations showed that only 7% of the activated concrete was below the liner. In order to accomplish this plan, a revision to the License Termination Plan was required. The change revised the concrete basement fill model to allow the additional activated concrete (raising the DCGL for basement concrete) and a reduction in the surface and deep soil DCGL such that the total projected exposures to the resident farmer would not exceed 10 mrem/y through all pathways and 4 mrem/y through the groundwater pathway.

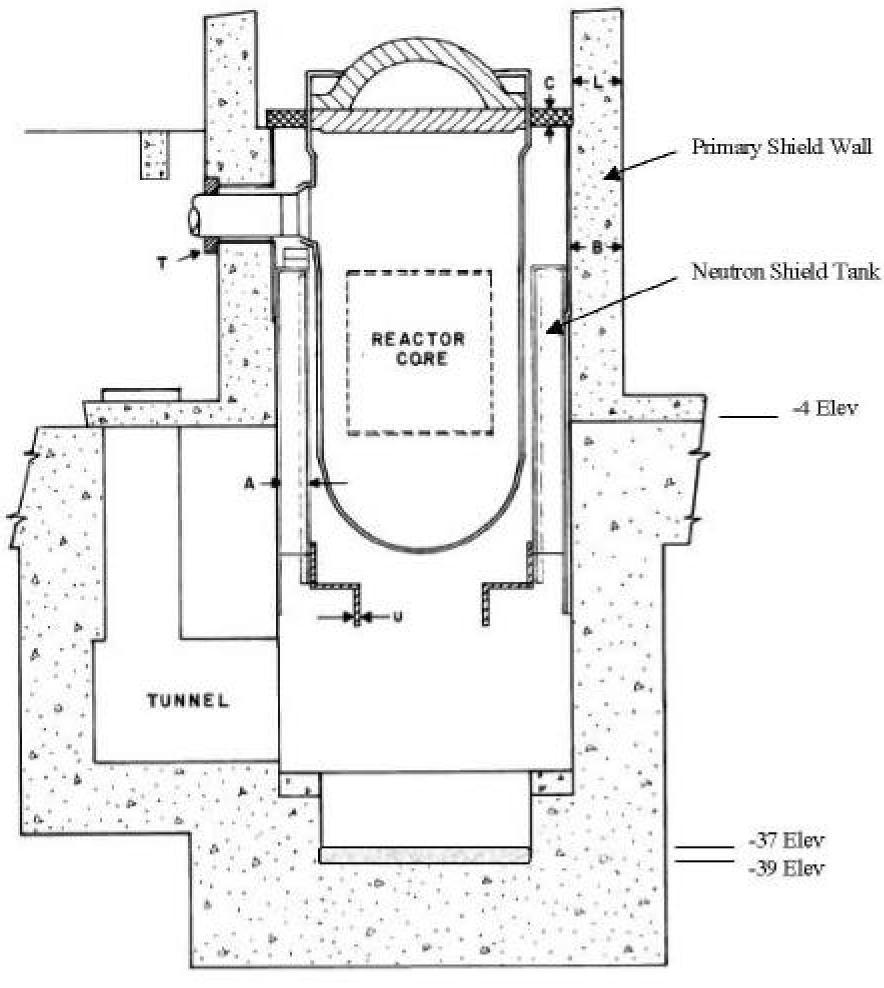


Figure 8-1 Maine Yankee RPV & Shielding

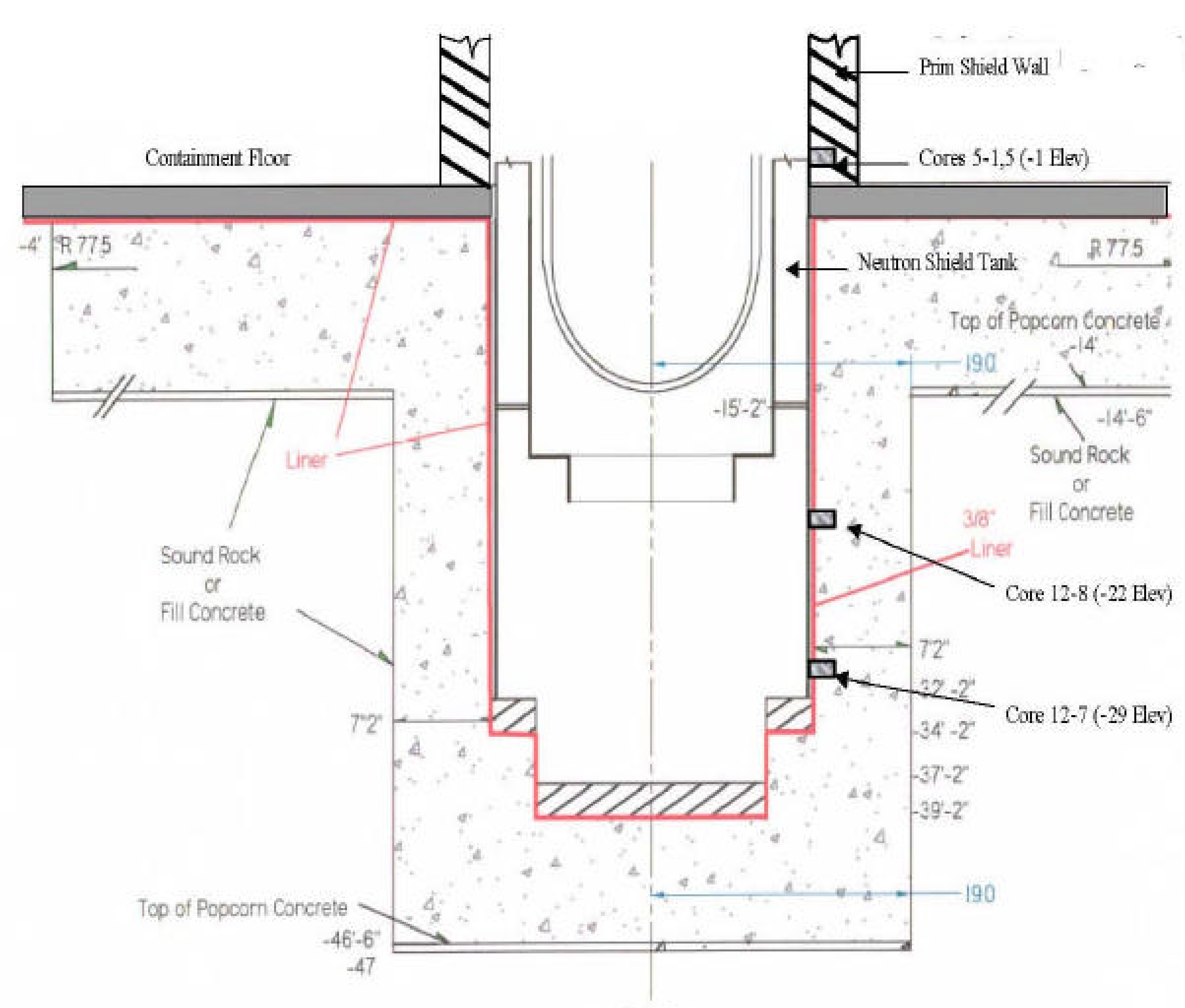


Figure 8-2 Maine Yankee ICI Sump

Forebay and Diffuser Remediation Issues

The Maine Yankee Forebay and Diffuser provided for the intake and discharge of circulating water into the Back River. The forebay prior to remediation is shown in Figure 8-3. The remediation plan called for the forebay to be filled in to a level to allow for the development of a natural highlands marsh (Figure 8-6). The dose model used assumed the dike soil was contaminated to a depth of two feet, and included projected doses from drinking water and irrigation water from the area. Characterization and remediation of the subsurface forebay area was also performed using specialty gamma spectroscopy equipment (Figure 8-4).

Remediation of the forebay required substantial effort. There was a large uncertainty as to the levels and depth of contamination behind the riprap (rocks one to two feet in diameter along the banks of the forebay). A decision was made to perform a boring campaign for approximately one million dollars early on to assess the contaminants and help frame remediation processes

(Figure 8-5). Initial guesses were contaminants up to two feet in depth (based on very minimal sampling). Actual depths based on the borings, were contaminant depths only to about two inches, not two feet. This allowed a large reduction in the remediation conducted on the forebay.

Figure 8-3 Maine Yankee Forebay - Before Remediation

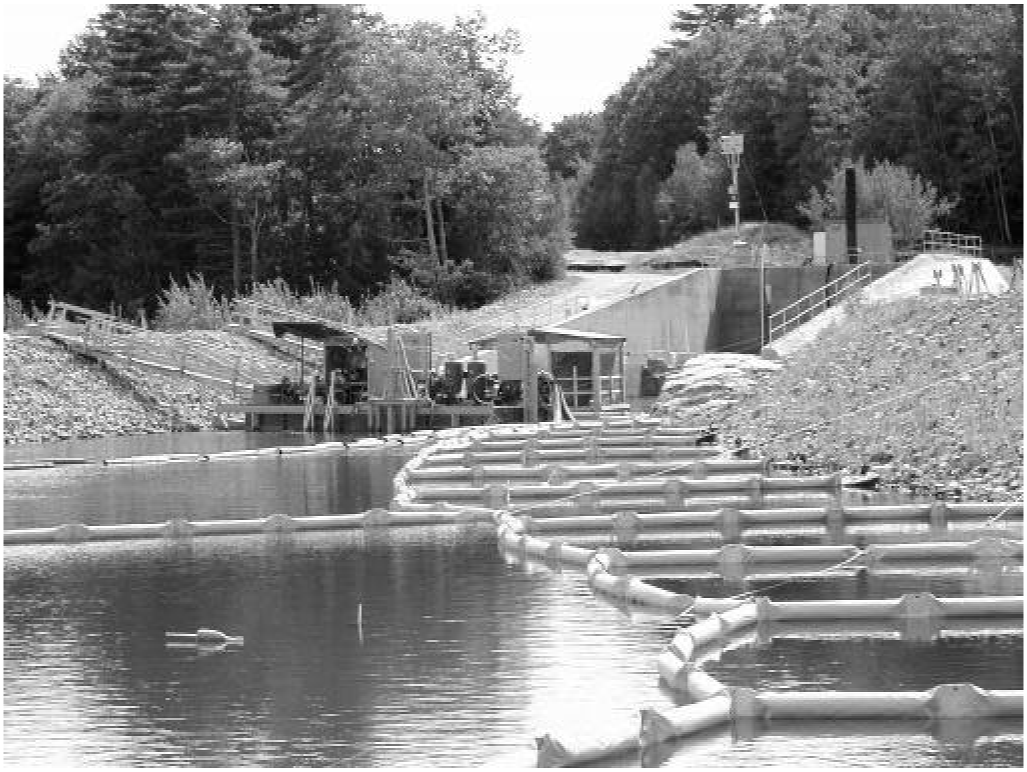


Figure 8-4 Maine Yankee Forebay Characterization and Remediation

Figure 8-5 Maine Yankee Forebay Dike Core Sampling

Figure 8-6 Maine Yankee Forebay After Remediation

Site Boundary Issues

Many different site boundaries may exist at a site depending upon the regulator and the purpose of the regulation. The site boundary is important for many reasons. In decommissioning one objective is to shrink the site to the smallest possible area (either complete elimination of the licensed area or reduced to just the size needed for the ISFSI).

The first site boundary to consider is the boundary as described in the Technical Specifications and/or Updated Final Safety Analysis Report (UFSAR). Research determined that the site boundary at Maine Yankee had changed over time. At one point the site boundary was contained in the Technical Specifications. The site boundary was then removed from the Technical Specifications by license amendment and put into the UFSAR allowing changes to be made without NRC approval under the provisions of 10 CFR 50.59.

The next site boundary to consider is the Exclusion Area Boundary required under the provisions of 10 CFR 100, which in the case of Maine Yankee was changed in early 2004. Altering the location of this boundary becomes less important if the site is able to obtain appropriate exemptions from the site emergency plan early on in the decommissioning process. Reducing the Exclusion Area Boundary may be useful if the reduced boundary allows you to disposition or sell parcels of buffer zone land early on if you no longer have to "own or control the land". Prior to land disposition, you also need to look at boundaries for security and radiological effluents.

Reducing the Emergency Planning Zone (EPZ) becomes a stakeholder interaction. Maine Yankee gave local municipalities the choice of taking over the funding for emergency sirens or Maine Yankee would pay to have them taken down. During years of operations, Maine Yankee provided a various types of equipment to local municipalities for emergency management. Once the EPZ was reduced in size, the offsite response support was no longer required, however Maine Yankee allowed the municipalities to keep the equipment.

New boundaries were also required in the development of the ISFSI. The boundary required per 10 CFR 72 is at least 100 meters. The ISFSI itself covers about 8.5 acres, but an NRC security design basis threat evaluation led to the establishment of a perimeter extending 300 meters from the ISFSI (about 100 acres) as the controlled area.

Final Site Release Issues

The completion of the actions identified in the LTP presented a continuing need for dialog with the various regulators for Maine Yankee. Similar dialog was needed for the closure actions under the State requirements for non-radiological cleanup. A site specific closure plan was developed in accordance with Resource Conservation and Recovery Act (RCRA) requirement including a Quality Assurance Program Plan. These plans were submitted to Maine DEP for approval and were rigidly reviewed and enforced for site closure. One action specified was the development of a Cumulative Risk Assessment which combined the risks from residual radioactive and non-radioactive contaminants. The Cumulative Risk Assessment for the "Backlands" is provided in Attachment F. The Backlands was the colloquial title for the Eaton Farm and North Ferry Road areas.

The determination of final remediation required for the diffuser piping was another exercise in stakeholder interaction. In the State of Maine, anytime major physical actions take place within 100 feet of a waterway, it triggers the need for a National Resources Permit Act (NRPA) process. NRPA requires that all applicable state and federal agencies with interest in the particular environmental action participate in the determination of the most beneficial end state.

To support the process, Maine Yankee performed a wide range of marine sampling and analysis of the diffuser pipe and identified a number of organisms that lived there. When all agencies provided input, the conclusion for overall environmental betterment was not to remove the diffuser pipe. This is another activity that is best served working on early in the decommissioning process as the outcome can affect the overall decommissioning scope and schedule.

One additional issue regarding LTP implementation is noted. The LTP and the NUREG 1757 state what is required for a final survey record, and Maine Yankee developed the final survey records to meet these two documents. The NRC reviewer(s) would request additional information regarding decommissioning and remediation information, HSA data, and release records. This information was not required by either the Maine Yankee LTP or the NUREG.

Addressing this difference in perceived document requirements took some time to resolve and is still ongoing.

Land Transfer Issues

In the 1999 - 2000 timeframe Maine Yankee began looking at what to do with the site property. The first decision required affected the Eaton Farm area. This was approximately 200 wooded acres that the company used for picnics and as a buffer zone. In the FERC agreement Maine Yankee agreed to the property being donated to a non-profit organization to maintain public access, for conservation, and for environmental education.

Three organizations responded to Maine Yankee's RFP for use of the land. After review of the merits of the bids proposed, Maine Yankee agreed to transfer the Eaton Farm area to the Chewonki Foundation. As of the date of this report, the transfer had not yet concluded.

Another parcel of land transferred was the area identified as North Ferry Road. This 430 acre parcel was the first to be released from the NRC license in July 2002. This parcel was sold on August 5, 2004 to a non-profit development created by the Town of Wiscasset. This entity in turn sold the property to a development company that specializes in redevelopment of "challenging properties". The RCRA release for the area required more effort than the NRC release, primarily due to the existence on the property of a legacy dump. This dump was not from Maine Yankee actions, rather from local individuals.

Maine Yankee retains approximately 100-150 acres which primarily constitutes the Bailey Point peninsula. This area includes the former site industrial area and the current ISFSI.

All potential real estate recipients wanted Maine Yankee to indemnify the property recipients against all nuclear hazards and other contaminants. Maine Yankee worked to educate the potential buyers with the provisions of the 10 CFR 20 license termination requirements. Relative to chemical contaminants, the buyer obtained a "no action" letter by the state saying the state has found the area clean from chemical contaminants.

A substantial amount of data was required to be produced for the potential real estate recipients. Examples of information included LTP surveys, RCRA surveys, routine effluent reports (radiological and chemical) from the plants operating period, overall regulatory performance, etc. Much of the information gathered to address the perception of potential contamination in addition to the survey data to demonstrate the measured residual risk. As a site reduces its required records, and sends some records for long term offsite storage, it is important to recognize the records that may be required for property transfer due diligence and keep these records available for ready access.

Property Taxes

During operations, Maine Yankee was paying approximately $12 million a year to Wiscasset. This represented approximately 93% of the property taxes collected by the municipality.

Historically, the site entered into multi-year agreements as to the tax liability. Following the plant shutdown, the town agreed to a reduction in taxes initially to ~ $6.1 million. Subsequent two year agreements were reached wherein by 2002 the annual tax liability was approximately $1 million.

Additional discussions and negotiations occurred with the town but did not result in further agreement. The local property assessment board, reassessed the property as having a value of approximately $263 million. This assessment was not on the basis of the value of the land itself, but a value based on the fact that the remaining property contained the ISFSI which was the only location in the state that Maine Yankee could store its spent fuel. As such, it was deemed to have very high value.

Maine Yankee's position is that Maine state law indicates property values are determined based on what someone would be willing to pay for the property and on that basis, the ISFSI is certainly not worth $263 million. Maine Yankee formally contested the assessment and current plans provide for a property tax appeal to be heard by the Maine State Tax Board of Property Tax Appeals in February 2005.

9
CURRENT STATUS

At the time this report was written, the only remaining structures at the Maine Yankee site were the ISFSI, two warehouses, an administration building and a few office trailers. The buildings unrelated to the ISFSI would be removed in the near term. The remaining rubble from the containment shell demolition was being shipped offsite. The primary remaining actions are the conclusion of final site survey and project closeout activities. The current plan has all physical work complete by March 2005 with an anticipated license termination by mid 2005.

In addition to the ISFSI operations, actions to complete the RCRA closure for non-radiological contaminants will continue as will the supplemental groundwater monitoring to satisfy an agreement with the State of Maine.

The current estimate of project costs from 1997 to 2005 total approximately $495 million as follows:

Table 9-1
Summary of Project Costs 1997 – 2005

Cost Element	Cost ($ Million)
Major Contracts – Low level waste, demolition, Radiation protection, DOC	298
Maine Yankee labor and staff augmentation	153
Support Contracts (Security, Engineering, Accounting)	49
Fees and Property Taxes	23
Materials and Supplies	11
Insurances	7
Purchased Power	6
Other	11

Settlements from contract disputes	(63)

The project should conclude with a total radiation dose of approximately 525 person-rem (5.25 person-Sv) which is less than 50% of the exposure limit in the decommissioning Generic Environmental Impact Statement. The project had completed over two million safe work hours without a lost time accident. Overall, the project has completed approximately 5.4 million hours with a recordable incident rate of approximately 2.3 per 200,000 hours worked.

10
REFERENCES REVIEWED

In the preparation of this report, many publicly available documents regarding the MYAPC decommissioning project were reviewed. Additional documents were provided by MYAPC. The following list identifies the major sources of information used in the preparation of this report.

1. Central Maine Power (CMP) Economic Study, July 30, 1997, www.maineyankee.com

2. Proceedings from American Nuclear Society Winter Meeting – November, 2002

3. FERC Settlement Agreement – Docket Number ER98-570-000, December 31, 1998 www.maineyankee.com

4. ASLB Settlement Agreement – ASLBP No. 00-780-03-OLA, August 31, 2001

5. Primary meeting minutes from Maine Yankee Community Advisory Panel from August 1997 through June 2004 (Maine Yankee)

6. Maine Yankee Community Advisory Panel Self Assessment Report (Appendix D – Maine Yankee)

7. Maine Yankee newsletter for all on-site personnel, The Look Inside, from September 25, 1997 through September 29, 2004 (Maine Yankee)

8. US NRC Inspection Reports for Maine Yankee from August 1998 through January 20043 (IR 98-04 – 03-03) (www.nrc.gov)

9. The following EPRI Reports (EPRI)
   - EPRI/NEI Decommissioning Workshop 12/97 (TR-110006)
   - EPRI/NEI Decommissioning Workshop 12/98 (TR-111025)
   - EPRI Site Characterization Workshop 12/99 (TR-112876)
   - EPRI Decommissioning Engineering Workshop 10/00 (1001238)
   - EPRI LTP Workshop 10/01 (TR-112871)
   - EPRI/NEI Decommissioning Workshop 4/03 (1008924)
   - EPRI/NEI LTP/Site Release Workshop 9/03

- Evaluation of RCS Decontamination at Maine Yankee and Connecticut Yankee (TR-112092)
- Experience and Testing of Application of DfD Process (TR-112877)
- Decontamination of Reactor Systems and Containment Components (1003026)
- EPRI Reactor Vessel Segmentation Lessons Learned (1003029)
- Spent Fuel Pool Cooling and Cleanup Systems Experience at Decommissioning Plants (1003424)
- Summary of Utility License Termination Documents and Lessons Learned: Summary of License Termination Plans Submitted by Three Nuclear Power Plants (1003426)
- Capturing Historical Knowledge for Decommissioning of Nuclear Power Plants: Summary of Historical Site Assessments at Eight Decommissioning Plants (1009410)

10. Newsletters from the Decontamination, Decommissioning and Reutilization Division of the American Nuclear Society from October 2000 through October 2004

11. The Decommissioning Handbook, ASME, 2004

12. NRC SECY 00-0041 Use of Rubblized Concrete Dismantlement to Address 10 CFR Part 20, Subpart E, Radiological Criteria for License Termination

13. MYAPC PSDAR Public Meeting Transcript – November 6, 1997

14. MYAPC PSDAR – August 27, 1997

15. MYAPC Irradiated Fuel Management Plan – July 19, 1999

16. Cumulative Risk Assessment for Backlands Portion of the Maine Yankee Site – August 2004

A
LISTING OF DECOMMISSIONING TOPICS

The following lists the decommissioning topics to evaluate, ranked in order as to their perceived significance during an EPRI decommissioning workshop held at Connecticut Yankee in September 2004.

First Priority Items

- Regulatory interfaces and challenges
- Project approach (DOC, self perform, etc.) and basis for selection
- Inputs for key decision points (shutdown decision, fuel storage approach)
- Stakeholder interfaces and challenges
- Overall project success drivers
- Technical Challenges

Second Priority Items

- Portion(s) of project contracted and basis for work assignment
- Detailed project cost estimate(s) financial management
- Waste generation by key task (volumes and activity levels)

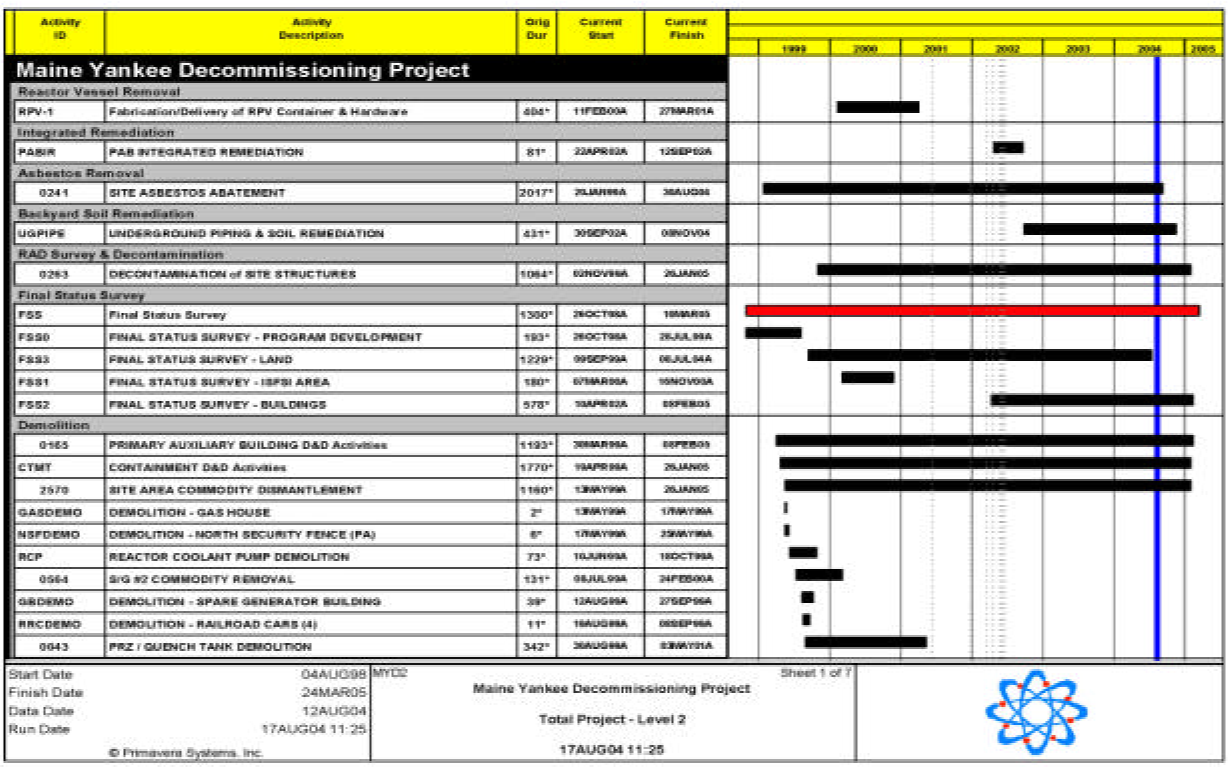
Third Priority Items

- Detailed project planning schedule (level 3)
- Discussion of project delays and basis
- Key contracting lessons
- Worker radiation exposures by key task
- Key administrative challenges

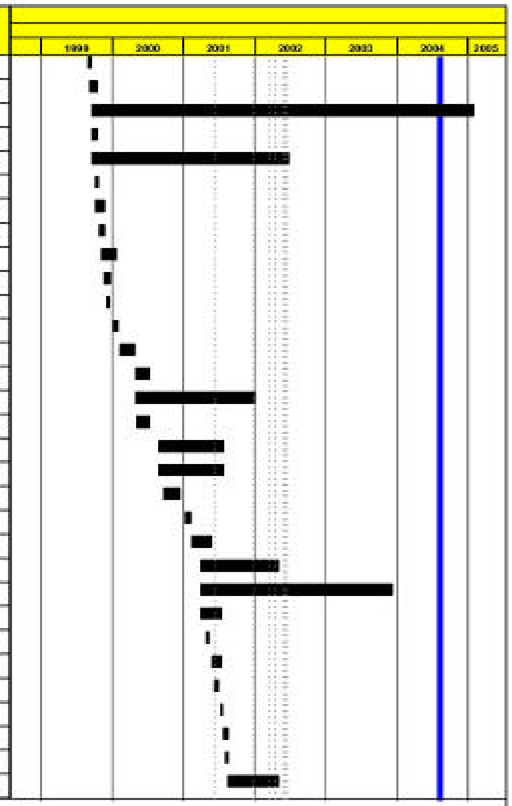
B SUMMARY PROJECT SCHEDULE

The figures in this section represent the project high level schedule from 1999 through 2005 as developed in August 2004.

Figure B-1 Maine Yankee Summary Decommissioning Schedule 1999 - 2005

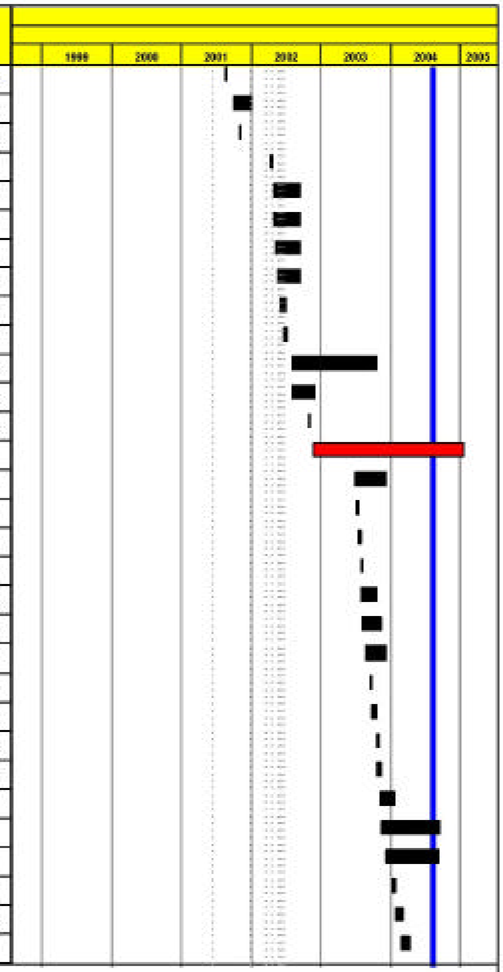


Activity ID	Activity Description	Orig Dur	Current Start	Current Finish
CSTFDEMO	DEMOLITION - COND STORAGE TANK FOUNDATION	3*	30AUG99A	01SEP99A
FOBDEMO	DEMOLITION - FUEL OIL BUNKER	23*	09SEP99A	08OCT99A
0274	DEMOLITION - SITE SUPPORT BUILDINGS	1091*	15SEP99A	20JAN05
GTDEMO	DEMOLITION - GUARD TOWERS (3)	12*	20SEP99A	07OCT99A
TB-COM	COMMODITIES - TURBINE BUILDING	557*	20SEP99A	18JUN02A
ILRTDEMO	DEMOLITION - RCA WEST (ILRT)	6*	05OCT99A	13OCT99A
X24DEMO	DEMOLITION - STATION TRANSFORMERS X-24/26/28	21*	08OCT99A	10NOV99A
DWSTDEMO	DEMOLITION - DEMIN WATER STORAGE TANK (DWST)	10*	27OCT99A	11NOV99A
L2RCSPC	LOOP 2 RCS PIPE CUTS	38*	08NOV99A	11JAN00A
TTDEMO	DEMOLITION - TEST TANKS	12*	22NOV99A	13DEC99A
WH5DEMO	DEMOLITION - WAREHOUSE #5	3*	01DEC99A	06DEC99A
CB33COM	COMMODITIES - CTMT ELEC PENETRATION ROOMS	8*	10JAN00A	20JAN00A
RWSTDEMO	DEMOLITION - REFUELING WATER STORAGE TANK (RWST)	65*	09FEB00A	13APR00A
CW-COM	COMMODITIES - CIRC WATER PUMPHOUSE	33*	27APR00A	28JUN00A
CW0006	CIRC WATER PUMP HOUSE D&D Activities	333*	27APR00A	24DEC01A
SCATD	DEMOLITION - SPRAY CHEM ADDITION TANK (SCAT)	29*	04MAY00A	28JUN00A
TG0102	DEMOLITION - MAIN TURBINE/GENERATOR	181*	28AUG00A	18JUL01A
TURBDEM	Demo Main Turbine & Generator	181*	28AUG00A	18JUL01A
CONDDEMO	DEMOLITION - MAIN CONDENSER	43*	20SEP00A	05DEC00A
EFWCOM	COMMODITIES - EFW PUMPROOM	12*	10JAN01A	30JAN01A
SBCOM	COMMODITIES - SERVICE BUILDING	56*	12FEB01A	17MAY01A
TB-STR	DEMOLITION - TURBINE BUILDING (Phase I)	213*	04APR01A	23APR02A
TB0006	DEMOLITION-TURBINE BUILDING (PH I & II)	542*	04APR01A	04DEC03A
TBSS	DEMOLITION - TURBINE BUILDING SOUTH SIDE	51*	04APR01A	03JUL01A
WH5SDEMO	DEMOLITION - WAREHOUSE #5 FOUNDATION	4*	23APR01A	09MAY01A
X1SDEMO	DEMOLITION - TRANSFORMER X-1S / X-16	20*	29MAY01A	02JUL01A
SPCOM	COMMODITIES - SPRAY BUILDING	7*	11JUN01A	20JUN01A
MET	DEMOLITION - MET TOWER & BUILDING	3*	10JUL01A	12JUL01A
345KV	DEMOLITION - 345KV ELECTRICAL TOWERS	12*	24JUL01A	13AUG01A
CSDEMO	DEMOLITION - COLLECTION SITE	4*	06AUG01A	09AUG01A
SBD1	DEMOLITION - SERVICE BLDG (PHASE 1)	141*	15AUG01A	29APR02A



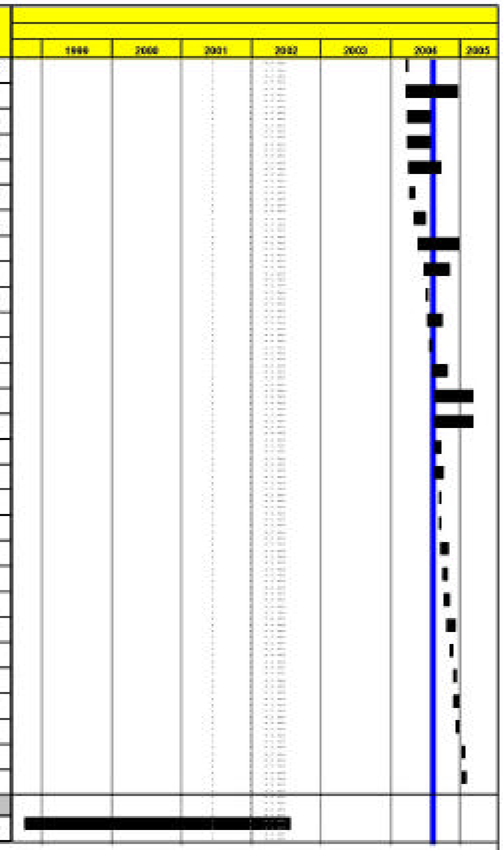
Sheet 2 of 7

Activity ID	Activity Description	Orig Dur	Current Start	Current Finish
WWPHDEMO	DEMOLITION - WELL WATER PUMPHOUSE	2*	15AUG01A	16AUG01A
CW-STR	DEMOLITION - CIRC WATER PUMPHOUSE	48*	01OCT01A	21DEC01A
STP	DEMOLITION - SEWAGE TREATMENT PLANT	4*	29OCT01A	01NOV01A
GAS	DEMOLITION - GAS HOUSE FOUNDATION	3*	11APR02A	16APR02A
0126	DEMOLITION - REACTOR MCC ROOM	70*	02MAY02A	05SEP02A
RMCC-COM	COMMODITIES - REACTOR MCC ROOM	70*	03MAY02A	05SEP02A
0132	DEMOLITION - STEAM & VALVE HOUSE	67*	08MAY02A	05SEP02A
PHD	DEMOLITION - PERSONNEL HATCH BLDG	60*	21MAY02A	05SEP02A
BLOCK1	DEMOLITION - VEHICLE THREAT BARRIERS	15*	03JUN02A	25JUN02A
INFO	DEMOLITION - INFORMATION CENTER	8*	19JUN02A	02JUL02A
SBD2	DEMOLITION - SERVICE BLDG (PHASE 2)	244*	31JUL02A	11OCT03A
FP	DEMOLITION - FIRE PUMP HOUSE & POND	63*	02AUG02A	20NOV02A
TTFDEMO	DEMOLITION - TEST TANK FOUNDATIONS	3*	28OCT02A	30OCT02A
CTMTD1	DEMOLITION - CONTAINMENT	512*	22NOV02A	19JAN05
TRANS	DEMOLITION - MAIN XFMR FOUNDATIONS	89*	01JUL03A	04DEC03A
SBFDEMO	DEMOLITION - SOFTBALL FIELD	4*	07JUL03A	10JUL03A
BPS	DEMOLITION - BAILEY POINT STORAGE AREA	3*	17JUL03A	22JUL03A
SANDEMO	DEMOLITION - SANITARY LINES	1*	30JUL03A	30JUL03A
WART	DEMOLITION - WART BUILDING	40*	31JUL03A	10OCT03A
ADMIN	DEMOLITION - ADMINISTRATION BUILDING	51*	06AUG03A	04NOV03A
TB-STR2	DEMOLITION - TURBINE BUILDING (Phase II)	56*	27AUG03A	04DEC03A
BAILEY	DEMOLITION - BAILEY HOUSE	3*	16SEP03A	18SEP03A
EFDEMO	DEMOLITION - EATON FARM STRUCTURES	11*	23SEP03A	10OCT03A
HV7	DEMOLITION - HV-7 & 9 BUILDING	4*	20OCT03A	23OCT03A
SPDEMO	DEMOLITION - SPRAY BUILDING	14*	20OCT03A	06NOV03A
PHS	DEMOLITION - PER HATCH BLDG SLAB / BACKFILL	37*	10NOV03A	15JAN04A
115KV	DEMOLITION - 115KV ELECTRICAL TOWERS	168*	12NOV03A	03SEP04
BWST	DEMOLITION - BWST & BERM AREA	151*	03DEC03A	31AUG04
PVS	DEMOLITION - PRIMARY VENT STACK	7*	13JAN04A	21JAN04A
FOXBIRD	DEMOLITION - FOXBIRD ISLAND BUILDING	20*	26JAN04A	25FEB04A
RACKS	SPENT FUEL POOL STORAGE RACK REMOVAL	31*	03MAR04A	06APR04A



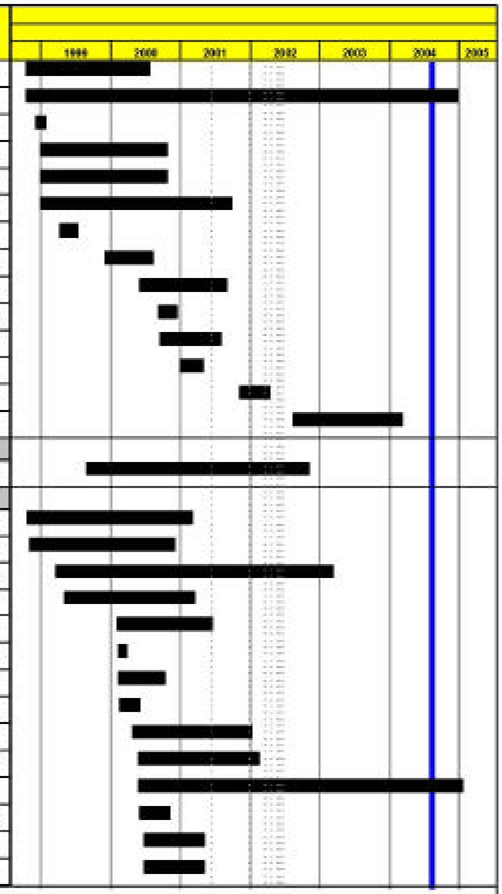
Sheet 3 of 7

Activity ID	Activity Description	Orig Dur	Current Start	Current Finish
PAGODA	DEMOLITION - SFPI GENERATOR & PAGODA	3*	22MAR04A	24MAR04A
RMCCBF	DEMOLITION - RMCC SUBGRADE & BACKFILL	149*	24MAR04A	14DEC04
PAB-DEMO	DEMOLITION - PRI AUXILIARY BUILDING	87*	29MAR04A	22JUL04A
EFWDEMO	DEMOLITION - EFW PUMPROOM	83*	01APR04A	21JUL04A
LSA	DEMOLITION - LSA STORAGE BUILDING	94*	05APR04A	16SEP04
DWSTF	DEMOLITION - DWST FOUNDATION	8*	15APR04A	26APR04A
CR3HAM	DEMOLITION - FUEL BUILDING CRANE CR-3	30*	05MAY04A	29JUN04A
RPDEMO	DEMOLITION - SITE ROADS & PARKING LOTS	117*	25MAY04A	20DEC04
FENCE	DEMOLITION - SECURITY FENCE	71*	28JUN04A	29OCT04
RWSTFN	DEMOLITION - RWST/SCAT FOUNDATION	1*	08JUL04A	09JUL04A
RCA	DEMOLITION - RCA STORAGE BUILDING	41*	14JUL04A	23SEP04
TPDEMO	DEMOLITION - TEST PIT	1*	28JUL04A	28JUL04A
X14	DEMOLITION - TRANSFORMER X-14/16 AREA	35*	12AUG04	13OCT04
0280	Final Site Grading	110	23AUG04	03MAR05
0280-HAM	FINAL SITE GRADING & LANDSCAPING	110*	23AUG04	03MAR05
PWSTDEMO	DEMOLITION - PRI WATER STORAGE TANK	14*	23AUG04	15SEP04
0250	DEMOLITION - SFP BUILDING	19*	24AUG04	27SEP04
GT1	DEMOLITION - GUARD TOWERS FOUNDATIONS	1*	15SEP04	15SEP04
TPSDEMO	DEMOLITION - TEMP POWER SHACK	1*	16SEP04	16SEP04
FHDEMO	DEMOLITION - FIRE HYDRANTS/HOSE STATIONS	19*	20SEP04	20OCT04
LSDEMO	DEMOLITION - LIFT STATION	8*	05OCT04	18OCT04
WH23DEMO	DEMOLITION - WAREHOUSE #2/3	12*	11OCT04	28OCT04
SFDEMO	DEMOLITION - STAFF BUILDING	22*	20OCT04	29NOV04
PWDEMO	DEMOLITION - POTABLE WATER CONNECTION	4*	10NOV04	16NOV04
LPDEMO	DEMOLITION - UTILITY LIGHT POLES	5*	30NOV04	07DEC04
OUDEMO	DEMOLITION - OUTSIDE UTILITIES	12*	30NOV04	20DEC04
WH4DEMO	DEMOLITION - WAREHOUSE #4 (Annex)	4*	13DEC04	16DEC04
MODDEMO	DEMOLITION - MODULAR OFFICES	4*	11JAN05	17JAN05
RRDEMO	DEMOLITION - RAILROAD TRACKS	10*	11JAN05	26JAN05
ISFSI (Independent Spent Fuel Storage Install.)				
ISFS52	Licensing - Federal (HA)	771*	01OCT99A	15JUL02A



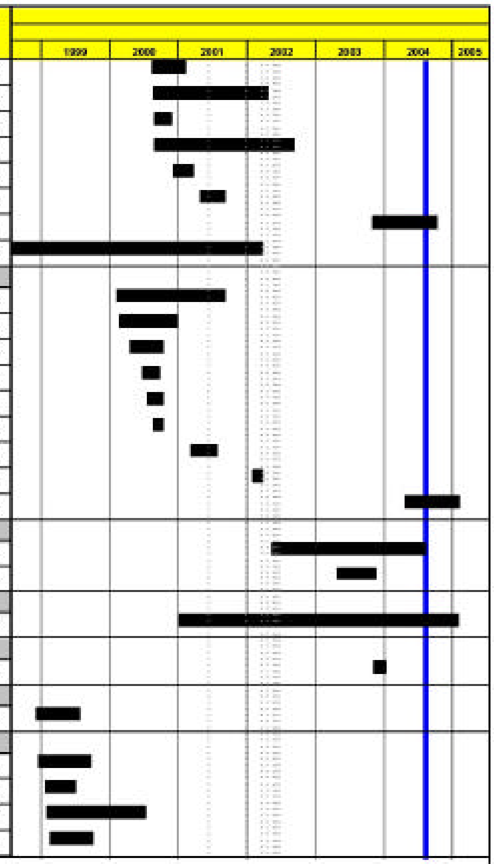
Sheet 4 of 7

Activity ID	Activity Description	Orig Dur	Current Start	Current Finish
ISFS51	Site Selection (HA)	381*	12OCT98A	13JUL00A
ISFS65	Cask Vendor Licensing (Storage & Transport) (HA)	1256*	15OCT98A	16DEC04
1008	Detailed Engineering and Design (HA)	31*	01DEC98A	14JAN99A
1073	Supply fab drawings, Specs & Procedures (HA)	461*	28DEC98A	13OCT00A
1074	MYPS Review - Drawings, Specs, & Procs (HA)	461*	28DEC98A	13OCT00A
ISFS66	Cask Vendor Eng/Design (HA)	656*	28DEC98A	19SEP01A
1104	Finish Inventory Fuel Pool (Std Fuel) Insp (HA)	62*	07APR99A	03JUL99A
1141	ISFSI Construction Phase I (HA)	138*	29NOV99A	01AUG00A
1142	ISFSI Construction Phase II (HA)	313*	31MAY00A	22AUG01A
VCCFAB-HAM	GTCC VCC Construction Units 1 thru 4	75*	05SEP00A	02DEC00A
PHIIC-60	Construct Security/Ops Bld Mods - ISFSI Phase II	389	15SEP00A	23JUL01A
VCCFAB-WIN	WINTER DEMOB & LAY-UP (VCC Construction)	112	01JAN01A	22APR01A
GTCCLOAD	Load & Transfer GTCC Casks to ISFSI	150*	06NOV01A	04APR02A
FUELLOAD	LOAD & TRANSFER 60 FUEL CASKS TO ISFSI	662*	12AUG02A	27FEB04A
ISFSI Licensing				
CVLT-SF	Cask Vendor Licensing Transport (Standard Fuel)	806*	01SEP99A	31OCT02A
Licensing				
CVLS-NS	NAC-UMS Storage (Non-Standard Fuel)	596*	20OCT98A	20FEB01A
CVLS-HAM	Cask Vendor Licensing Storage (Standard Fuel)	525*	02NOV98A	20NOV00A
DD0191	License Termination Plan Approved by NRC (HA)	1003*	22MAR99A	28FEB03A
CN2000	Regulatory Approvals (HA)	470*	30APR99A	05MAR01A
0700-LIC	Dev & Implement Transitional Training Progr (HA)	272*	02FEB00A	06JUN01A
0033-LIC	ISFSI Application (Rev.1) (MDEP & Wiscasset (HA)	21*	07FEB00A	13MAR00A
CVLT-NS	NAC-UMS Transport Amendment I (Non-Standard Fuel	168*	09FEB00A	06OCT00A
SEC-290	Security 72.212 (b)(5) Exemption Request	55*	18FEB00A	24MAY00A
CVLS-NS2	NAC-UMS Storage Amendment II (Non-Standard Fuel)	427*	24APR00A	31DEC01A
ITS-HAM	ISFSI & Dismantlement Tech Specs (HA)	433*	22MAY00A	05FEB02A
ROB-HAM	Release of Backlands (HA)	1179*	22MAY00A	11JAN05
PLAN-100	FUEL IN TRANSIT E-PLAN (HA)	82*	01JUN00A	25OCT00A
SEC-180	ISFSI SECURITY PLANNING PROCEDURE CHANGES (HA)	170*	22JUN00A	26APR01A
SEC-420	ISFSI SECURITY PROCEDURES (HA)	170*	22JUN00A	26APR01A



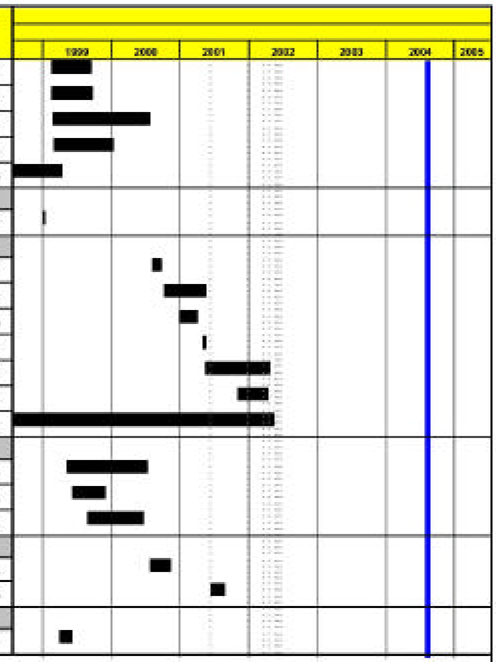
Sheet 5 of 7

Activity ID	Activity Description	Orig Dur	Current Start	Current Finish
0800-OPS	ISFSI Operating Procedures (HA)	93*	14AUG00A	29JAN01A
0600-HAM	Part 72 Specific License for ISFSI (Not Pursued)	335*	22AUG00A	17APR02A
PLAN-210	FUEL IN TRANSIT E-PLAN PROCEDURES (HA)	47*	24AUG00A	15NOV00A
PLAN-400	ISFSI EMERGENCY PLAN (STAND-ALONE)	514*	25AUG00A	04SEP02A
PLAN-280	FUEL IN TRANSIT E-PLAN LESSON PLANS/TRAINING (HA	55*	04DEC00A	12MAR01A
SEC-250	ISFSI SECURITY TRAINING (HA)	71*	24APR01A	29AUG01A
ROS-HAM	Release of Site Lands: Remaining Non-ISFSI Land	234*	03NOV03A	01OCT04
0489-LIC	Plan Special Circumstance Discharges (HA)	4087*		14MAR02A
Environmental Permitting				
0300-HAM	RCRA Closure Plan (External) (HA)	315*	18FEB00A	31AUG01A
0100-HAM	Building Demolition Assessment (HA)	164*	23FEB00A	14DEC00A
0700-CPR	PCB Concrete Paint Removal Plan (HA)	90*	20APR00A	03OCT00A
0700-HAM	Concrete Characterization of CRS/Scarborough (HA	48*	26JUN00A	14SEP00A
CD-HAM	Concrete Disposition (HA)	41*	20JUL00A	02OCT00A
0900-HAM	ISFSI Concrete Characterization (HA)	23*	23AUG00A	03OCT00A
0600-NRPA	NRPA & Corps of Engineers Permit (HA)	76*	07MAR01A	19JUL01A
FPHEP	FIRE PUMP HOUSE ENVIRONMENTAL PERMITTING	24*	04FEB02A	14MAR02A
LIC-HAM	Termination of Licenses & Permits	161*	22APR04A	02FEB05
Forebay Remediation				
FOREBAY	DEMOLITION - FOREBAY & SEAL PIT	449*	16MAY02A	30JUL04A
FBAY-REM	FOREBAY & SEAL PIT REMEDIATION	113*	28APR03A	12NOV03A
Waste Disposal				
HP-2	HP Support Routine Duties Outside of CTMT	1461*	02JAN01A	26JAN05
Neutron Shield Tank Demolition (21)				
NST	NEUTRON SHIELD TANK DEMOLITION (C/P)	43*	05NOV03A	31DEC03A
Decommissioning Readiness				
0798	Plant Prep & Temp Services (HA)	130*	01DEC98A	15JUL99A
7574				
ISFS59	Architectural Engineering and Design	154*	15DEC98A	13SEP99A
ISFS60	Radiological Analysis	88*	20JAN99A	23JUN99A
ISFS62	Engineering & Design - Plant Upgrades	290*	01FEB99A	30JUN00A
ISFS56	Electrical/Controls & Security Eng. & Design	124*	10FEB99A	22SEP99A



Sheet 6 of 7

Activity ID	Activity Description	Orig Dur	Current Start	Current Finish
ISFS54	Geotechnical Engineering and Design	112*	19FEB99A	02SEP99A
ISFS57	Mechanical Engineering and Design	115*	19FEB99A	06SEP99A
ISFS64	Local Permitting	282*	22FEB99A	10JUL00A
ISFS50	Structural Engineering and Design	173*	01MAR99A	30DEC99A
ISFS53	QA Plan and Design Criteria	3393*		29MAR99A
8501				
DD0183	Transition Security	1*	04JAN99A	04JAN99A
RPV Internal Segmentation				
SEG-1	Framatome Equipment Assembly and Testing	35*	09AUG00A	13SEP00A
VESSEL	Rx Vessel Internals Segmentation	175*	09OCT00A	08MAY01A
SEG-4	Thermal Shield / CSB Segmentation	84*	29DEC00A	23MAR01A
SEG-10	GTCC Segmentation	9*	01MAY01A	09MAY01A
SEG-13	Final Cavity Clean and Drain	332*	13MAY01A	15APR02A
SEG-11	Load GTCC and Transfer to ISFSI	147*	06NOV01A	04APR02A
SEG-12	Teardown and Final Packout of Cavity Equipment	7056*		08MAY02A
Large Component Removal				
0791	Steam Generators (HA)	233*	10MAY99A	28JUN00A
0789	Reactor Coolant Pumps & Motors	30*	16JUN99A	15NOV99A
0790	Pressurizer (HA)	160*	30AUG99A	12JUN00A
Reactor Vessel Head Removal				
HEAD-PH1	RPV Head Removal to Outside Laydown Area	98*	26JUL00A	01NOV00A
HEAD-PH2A	RPV Head Cut / Rig / Transport to Envirocare	63*	14JUN01A	16AUG01A
Source Term Reduction				
PABS	PAB SOURCE TERM REDUCTION	33*	30MAR99A	25MAY99A



Sheet 7 of 7

C PROJECT TIMELINE

This appendix provides a detailed timeline of events during the Maine Yankee decommissioning project and includes a high level summary schedule of the entire project as it existed in August 2004.

Table C-1 Maine Yankee Project Timeline

Date	Event
October 21, 1968	Construction permit issued
September 12, 1972	Provisional operating license issued
December 28, 1972	Commercial Operations begin
June 29, 1973	Full power operating license received
December 6, 1996	Last commercial operations. Maine Yankee shut down the plant as a result of design basis implementation concerns associated with cable separation and control logic issues.
December 18, 1996	The NRC issued a confirmatory action letter requiring need for mid-cycle inspections to check for potential further deterioration, and the overall condition of the steam generators. Engineering staff indicated that while the generators should last 3 more fuel cycles, there could be no assurance that they would not need to be replaced after that.
January 29, 1997	NRC placed Maine Yankee on the NRC watchlist.
January 30, 1997	The NRC issued a supplemental confirmatory action letter requiring resolution of additional concerns ("extent of condition") before startup. Maine Yankee to remain shutdown until resolution of those problems requiring shutdown were accepted by the NRC.
February 13, 1997	One year management contract with Entergy signed.
March 7, 1997	Submittal of Restart Plan to the NRC
May 1997	Maine Yankee Board of Directors decide that plant will either be sold or enter decommissioning

July 30, 1997	Maine Yankee Board of Directors complete economic analysis for shutdown
August 6, 1997	Decision to terminate commercial operations
August 7, 1997	NRC notified of permanent cessation of operations and permanent defueled status
August 21, 1997	First meeting of CAP
August 27, 1997	Post Shutdown Decommissioning Activities Report issued
October 30, 1997	Maine Yankee and Wiscasset finalize agreement on property tax for 1998
October 1997	Initial Characterization Surveys (ICS) begins
November 5, 1997	Maine Yankee files rate case with FERC to increase decommissioning collections
November 6, 1997	PSDAR public meeting
November 6, 1997	Maine Yankee continues management contract with Entergy to provide management services during decommissioning
December 10, 1997	Maine Yankee conducts press briefing onsite for reporters and photographers
January 28, 1998	Maine Yankee submits QA program changes to NRC
February 5, 1998	Maine Yankee submits defueled safety analysis report (DSAR) to NRC
March 1998	RCS decontamination occurs. Asbestos remediation begins
April 17, 1998	DOC RFP issued by Maine Yankee
April 29, 1998	Initial Characterization Surveys completed and report finalized
April 1998	Public opinion poll taken for spent fuel storage options
May 29, 1998	DOC bids are due to Maine Yankee
May 1998	SFPI begins operation
June 2, 1998	Maine Yankee files suit against DOE in court of claims for failure to accept and remove spent fuel
June 24, 1998	Initial CAP meeting regarding SFPI fan noise
August 4, 1998	SWEC chosen as DOC
September 23, 1998	CAP all day planning meeting

September 30, 1998	SFPI fan modifications completed
October 15, 1998	Transition to new control room completed
October 30, 1998	All mechanical systems abandoned
December 30, 1998	Plant achieves “cold and dark” status
December 1998	Asbestos abatement project complete
January 19, 1999	FERC case settlement
March 22, 1999	Source term reduction begins
March 1999	Maine Yankee meets with Wiscasset Planning Board regarding ISFSI construction
April 5, 1999	Fuel inspection begins
May 27, 1999	Source term reduction program complete
May 1999	Maine Yankee submits permit application to Maine BEP for ISFSI construction
June 7, 1999	Emergency diesel generators purchased by a midwest utility
June 1999	First Reactor Coolant Pump removed
July 3, 1999	Fuel inspection completed
July 14, 1999	Maine Yankee and Wiscasset reach agreement on property taxes for 1999 and 2000
September 17, 1999	Maine Yankee proposes rubblization approach to remediation to CAP
September 1999	Maine Yankee files suit against Maine DEP on radiological jurisdiction for ISFSI
October 21, 1999	CAP meeting with NRC and EPA to address LTP and site release criteria
October 1999	All three reactor coolant pumps shipped by rail to Barnwell low level waste site. Reactor coolant pump motors shipped to Envirocare of Utah. Site main power transformers shipped offsite by barge to Midwest utility
December 1, 1999	Maine Yankee received three proposals for use of Eaton Farm
December 1999	Final status surveys begin on property south of Ferry Road
January 13, 2000	Revision 0 to License Termination Plan submitted to NRC – includes agreement to meet 10 mrem/y all pathways and 4 mrem/y groundwater release criteria
March 2000	SWEC decommissioning vice president and construction manager leave Maine Yankee to move to other projects. State of Maine legislation introduced that would require state

	oversight of radiological issues and specify a 0.05 mrem/y residual contamination limit
April 6, 2000	Pressurizer removed
April 26, 2000	State of Maine Law LD 2688-SP1084 signed into law mandating an unrestricted release criteria of 10 mrem/yr for all pathways and 4 mrem/yr for the groundwater pathway
May 4, 2000	SWEC contract terminated and Federal Judge rules that Maine BEP does not have radiological jurisdiction for ISFSI
May 15, 2000	NRC LTP public meeting
June 2000	State of Maine and FOTC petition the NRC to intervene in LTP amendment request
July 2000	Maine Yankee receives construction permits for ISFSI
September 2000	ISFSI construction begins
November 2000	Reactor pressure vessel internals segmentation begins
January 2001	Maine Yankee to self perform decommissioning
February 2001	RCRA Closure Plan submitted to State of Maine
July 2001	Revision 1 to LTP submitted – no longer included rubblization – fuel transfer to ISFSI scheduled from 9/01 to 11/02
August 2001	Revision 2 of the LTP submitted to the NRC
August 30, 2001	Agreement reached in ASLB settlement proceedings
January 2002	Transfer of GTCC from SFPI to ISFSI begins
April 2002	RPV to be removed summer 02 – sent to Barnwell. SF transfer to ISFSI scheduled from 5/02 – mid 2003. All GTCC waste in DCS at ISFSI.
July 2002	North Ferry Road parcel released from NRC license
August 24, 2002	Spent fuel begins transfer from SFPI to ISFSI
August 2002	RPV removed from containment - stored onsite until 2003 for shipment to Barnwell. Delay for shipment due to low water levels in the Savannah River precluding barge traffic to Barnwell site.
October 15, 2002	License Termination Plan, Revision 3 submitted
January 2003	NAC contract terminated and MY to self perform fuel movement/transfer to ISFSI
April 22, 2003	NAC and MY reach new contract agreement for NAC to continue to provide DCS hardware

	hardware
April 2003	Test blast occurs to validate explosive demolition models and calculations
May 6, 2003	MY RPV leaves site for Barnwell
November 2003	Maine Yankee received approval on records disposition exemption request
February 27, 2004	All spent fuel now on ISFSI pad
August 5, 2004	North Ferry Road parcel sold to Wiscasset for redevelopment
September 17, 2004	Explosive demolition of containment shell

D PROJECT RADIATION EXPOSURES

When the Maine Yankee PSDAR was issued in August, 1997 the projected radiation exposure for the project was 946 person-rem (9.46 person-Sv). The License Termination Plan, Revision 3, issued in October 2002 noted the projected exposure to be approximately 937.5 person-rem (9.375 person-Sv). Information on the actual exposures received during detailed decommissioning tasks was not readily available for this document, however the following information from the License Termination Plan provides estimated exposures for a number of decommissioning tasks.

Table D-1 Maine Yankee Projected Radiation Exposures for Project

Area/Activity	Title	Exposure
DC.2 PERIOD 2 (DECOMMISSIONING) **DC.2.01 NSSS REMOVAL** DC.2.01.01 Reactor coolant piping DC.2.01.02 Pressurizer relief tank DC.2.01.03 Reactor coolant pumps and motors DC.2.01.04 Pressurizer DC.2.01.05 Steam Generators DC.2.01.06 CRDMs & service structure removal DC.2.01.07 Reactor vessel internals DC.2.01.08 Reactor vessel		93.951 REM

DC.2.03 SYSTEM REMOVAL		
DC.2.03.01 Containment		
DC.2.03.01.01 Cbl-1	CTMT Loop #1	97.114 REM
DC.2.03.01.02 Cbl-2	CTMT Loop #2	65.745 REM
DC.2.03.01.03 Cbl-3	CTMT Loop #3	63.171 REM
DC.2.03.01.04 Cbl-4	SI Tank #2 & Regen Ht Exch E-67	11.592 REM
DC.2.03.01.05 Cbl-5	CTMT -2 Lvl Pressurizer Area	25.411 REM
DC.2.03.01.06 Cbl-6	CTMT -2 Lvl Sump Pump Area	22.608 REM
DC.2.03.01.07 Cbl-7	CTMT Iodine Filter Area	6.485 REM
DC.2.03.01.08 Cbl-8	CTMT -2' Outer Annulus	43.334 REM
DC.2.03.01.09 CB2-1	CTMT 20' Outer Annulus	19.313 REM
DC.2.03.01.10 CB3-1	Reactor Cavity Area	19.615 REM
DC.2.03.01.11 CB3-2	CTMT Cavity Upender Pit	26.683 REM
DC.2.03.01.12 CB3-3	CTMT 46' Penetration Room	6.078 REM
DC.2.03.01.13 CB3-4	CTMT Polar Crane (CR-1)	4.042 REM
DC.2.03.01.14 CCG	CTMT Charging Floor	3.105 REM
DC.2.03.01.15 CEHO	CTMT Equip Hatch Outer (PE-3)	3.871 REM
DC.2.03.01.16 CICI L	CTMT Incore Instrument Sump	6.533 REM
DC.2.03.01.17 CPHO	CTMT Personal Hatch Outer Area	.728 REM
DC.2.03.01.18 CPLE	CTMT Elevator & Room	.173 REM
DC.2.03.02 PRIMARY AUXILIARY BUILDING		
DC.2.03.02.01 P21A	PAB 21' Level Valve Alley	.742 REM
DC.2.03.02.02 P21B	PAB 21' Boric Acid Pump Area	6.387 REM
DC.2.03.02.03 P21C	PAB 21' Charging Pump Cubicle	22.718 REM
DC.2.03.02.04 P21D	PAB 21' Level Degas Cubicle	9.160 REM
DC.2.03.02.05 P21E	PAB 21' Evap Cubicle	39.169 REM
DC.2.03.02.06 P21H	PAB 21' Heat Exchanger Room	16.495 REM
DC.2.03.02.07 P21L	PAB 21' General Area	1.418 REM
DC.2.03.02.08 P21S	PAB 21' Sample Sink Area	2.799 REM
DC.2.03.02.09 P21V	PAB 21' Level HPSI Room	.956 REM
DC.2.03.02.10 PLAD	PAB Lower Lvl Aerated Drain Tank Area	22.184 REM
DC.2.03.02.11 PLBA	PAB Lower Lvl Boric Acid Mix Tank Area	13.790 REM
DC.2.03.02.12 PLCP	PAB Lower Lvl Aux Chrg Pump Cubicle	5.054 REM
DC.2.03.02.13 PLDC	PAB Lower Lvl Degas Cubicle	1.551 REM
DC.2.03.02.14 PLEC	PAB Lower Lvl Evap Cubicle	13.751 REM
DC.2.03.02.15 PLLA	PAB Lower Lvl Letdown Area	38.761 REM
DC.2.03.02.16 PLPA	PAB Lower Lvl Ctmt Penetration Area	28.907 REM
DC.2.03.02.17 PLPD	PAB Lower Lvl Primary Drain Tank Area	11.122 REM
DC.2.03.02.18 PLPT	PAB Lower Lvl Pipe Tunnel	30.815 REM
DC.2.03.02.19 PLPW	PAB Lower Lvl Primary Water Pump Area	.289 REM
DC.2.03.02.20 PU48	PAB Upper Lvl FN-48 Area	.485 REM
DC.2.03.02.21 PUDD	PAB Upper Lvl Decay Drum Cubicle	.512 REM
DC.2.03.02.22 PUEC	PAB Upper Lvl Evap Cubicle	5.921 REM

DC.2.03.02.23 PUFN	PAB Upper Lvl FN-1A/B Area	.506 REM
DC.2.03.02.24 PUHV	PAB Upper Lvl Heat & Ventilation	.383 REM
DC.2.03.02.25 PUL	PAB Upper Lvl General	1.741 REM
DC.2.03.02.26 PUSA	PAB Upper Lvl Radioactive Storage Area	.316 REM
DC.2.03.02.27 PUTC	PAB Upper Lvl VCT Cubicle	.529 REM
DC.2.03.02.28 PUWG	PAB Upper Lvl Waste Gas Cubicle	.279 REM
DC.2.03.04 SERVICE/FUEL BUILDING		
DC.2.03.04.01 DWST	Demineralizer Water Storage Tank (TK-21)	.103 REM
DC.2.03.04.02 EFPR	Emergency Feed Water Pump Room	.159 REM
DC.2.03.04.04 LSAB	LSA Storage Building	.628 REM
DC.2.03.04.05 NFLA	New Fuel Laydown Area / Fuel Vault	1.622 REM
DC.2.03.04.07 RCAW	RCA Waste Solidification	8.772 REM
DC.2.03.04.08 RMCC	Reactor MCC Room	.046 REM
DC.2.03.04.09 SBDR	Service Building Decon Room	.314 REM
DC.2.03.04.10 SBHP	Service Building HP Checkpoint	.044 REM
DC.2.03.04.11 SBMS	Service Building Machine Shop	.293 REM
DC.2.03.04.13 SBSR	Service Building Seal Room	.111 REM
DC.2.03.04.16 SFP	Spent Fuel Pool	32.159 REM
DC.2.03.04.17 SFPH	Spent Fuel Pool Heat Exchanger Room	9.120 REM
DC.2.03.04.18 SFPV	Spent Fuel Pool Ventilation Room	.287 REM
DC.2.03.04.19 SPRB	Spray Building	78.093 REM
DC.2.03.04.20 SVH	Steam & Valve House	.054 REM
DC.2.03.05 Miscellaneous		
DC.2.03.05.01 BWST	Boron Waste Storage Tanks (TK-13 A&B)	.162 REM
DC.2.03.05.02 CST	Condensate Surge Tank (TK-122)	.003 REM
DC.2.03.05.08 HRB	High Radiation Bunker	.528 REM
DC.2.03.05.09 PWST	Primary Water Storage Tank (TK-16)	.068 REM
DC.2.03.05.10 RWST/SCAT	RWST/SLAT Tanks	1.549 REM
DC.2.03.05.13 West - RCA	RCA Yard Area - West Side	7.136 REM

E PROJECT WASTES

The following data represents a summary of project wastes (radioactive and non-radioactive) from the start of the project (shipments beginning in 1998) through January 2005. Table E-1 below summarizes the waste shipments offsite on a yearly basis for radioactive and non-radioactive wastes by waste category and provides the number of truck and rail shipments required to transport the waste.

Figures E-1and E-2 which follows graphically shows the weight of radioactive and non-radioactive wastes shipped each month from 1998 through January 2005.

Table E-1 Summary of Maine Yankee Waste Shipped 1998 - 2005

SUMMARY TABLE - TOTAL WASTE SHIPPED OFFSITE										
(all weights are in pounds)										
					Totals					
Category	**1998***	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**To-Date**	**Projected**
Non-Radioactive										
Asbestos	199,004	0	15,740	235,100	200	0	0	0	450,044	546,000
Other		1,765	8,405	15,293	5,445	0	0	0	30,908	36,293
Hazardous Waste		4,848	14,079	140,618	10,626	965	3,500	0	174,636	249,512
Oil		7,830	3,927	19,014	5,300	8,664	0	0	44,735	50,307
Paper/ Cardboard		32,294	34,246	35,605	32,200	24,500	20,000	0	178,845	500,000
Trash		188,250	290,050	260,000	212,020	181,000	83,000	4,000	1,218,320	1,326,867
Concrete		0	27,300	19,002,660	35,246,440	16,768,340	15,000,000	3,768,000	89,812,740	104,000,000
Soil		0	3,951,285	137,454	956,000	18,000	1,600,000	0	6,662,739	12,000,000
Demolition Debris	40,940	526,740	1,558,580	906,560	1,705,040	2,932,000	65,000	0	7,734,860	10,000,000
Metal		2,059,720	3,745,814	10,866,357	3,870,040	1,600,200	0	0	22,142,131	23,000,000
Total	239,944	2,821,447	9,649,426	31,618,661	42,043,311	21,533,669	16,771,500	3,772,000	128,449,958	151,708,979
Radioactive										
Concrete	0	0	1,945,790	1,601,610	14,952,424	34,838,550	82,471,195	4,151,900	139,961,469	145,291,000
Soil		0	0	0	117,800	1,919,900	38,868,414	8,628,510	49,534,624	72,395,000
Commodities	0	1,286,771	2,092,783	2,201,350	1,895,400	2,703,690	7,487,899	1,648,200	19,316,093	20,000,000
Distributables	0	455,716	688,385	633,900	317,725	431,375	466,500	0	2,993,601	3,000,000
Large Components	305,560	568,380	2,342,310	152,540	231,508	1,900,000	0	0	5,500,298	5,500,298
Total	305,560	2,310,867	7,069,268	4,589,400	17,514,857	41,793,515	129,294,008	14,428,610	217,306,085	246,186,298
Total	545,504	5,132,314	16,718,694	36,208,061	59,558,168	63,327,184	146,065,508	18,200,610	345,756,043	397,895,277
Total without concrete										148,604,277
Truck Shipments	**1998***	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**To-Date**	
NonRad Truck Shipments	64	168	335	680	355	224	82	4	1,912	
Rad Shipments	21	63	96	102	30	10	7	1	330	
Total	85	231	431	782	385	234	89	5	2,242	
Train Shipments	**1998***	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**		**To-Date**	
NonRad Train Shipments	0	0	0	16	29	10	21	3	79	
Rad Shipments	0	0	5	11	28	40	67	8	159	
Total	0	0	5	27	57	50	88	11	238	
	*1998 data only includes asbestos abatement work									
	Note: Large components include SGs, Pressurizer, RCP pumps & motors, RPV & internals, and 1998 asbestos removal project									

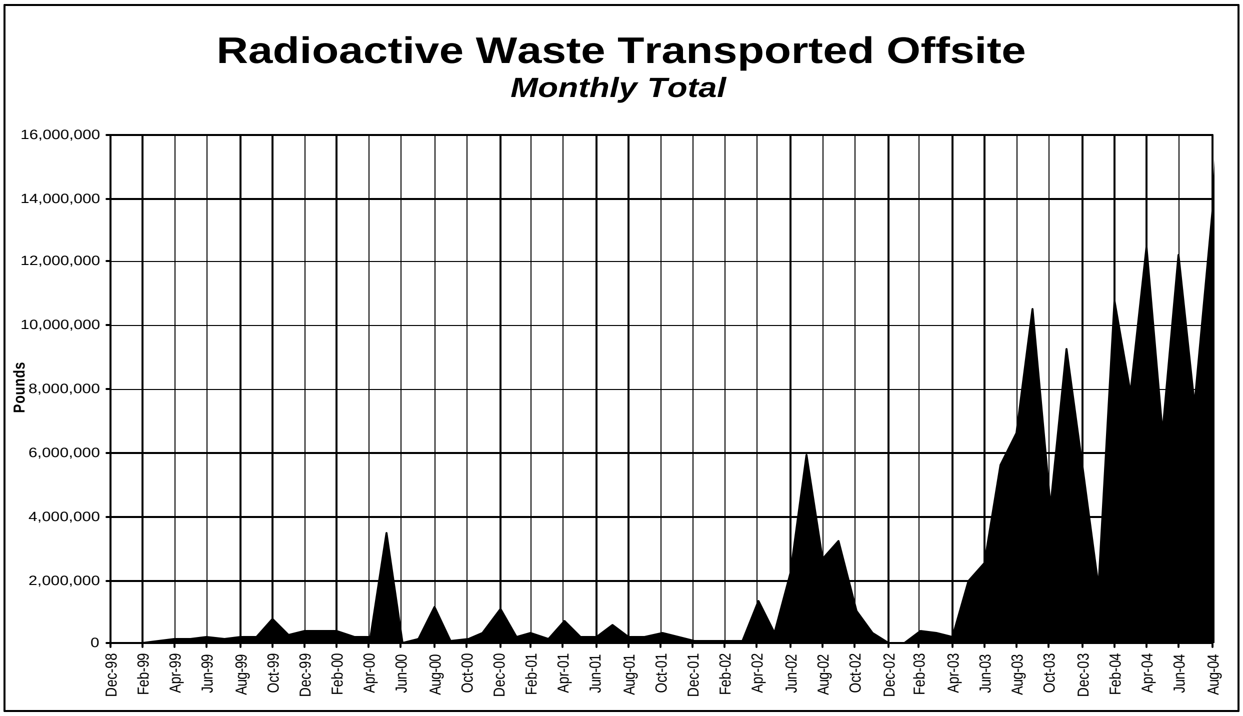


Figure E-1 Maine Yankee Radioactive Waste Shipments - Monthly Totals 1998 - 2004

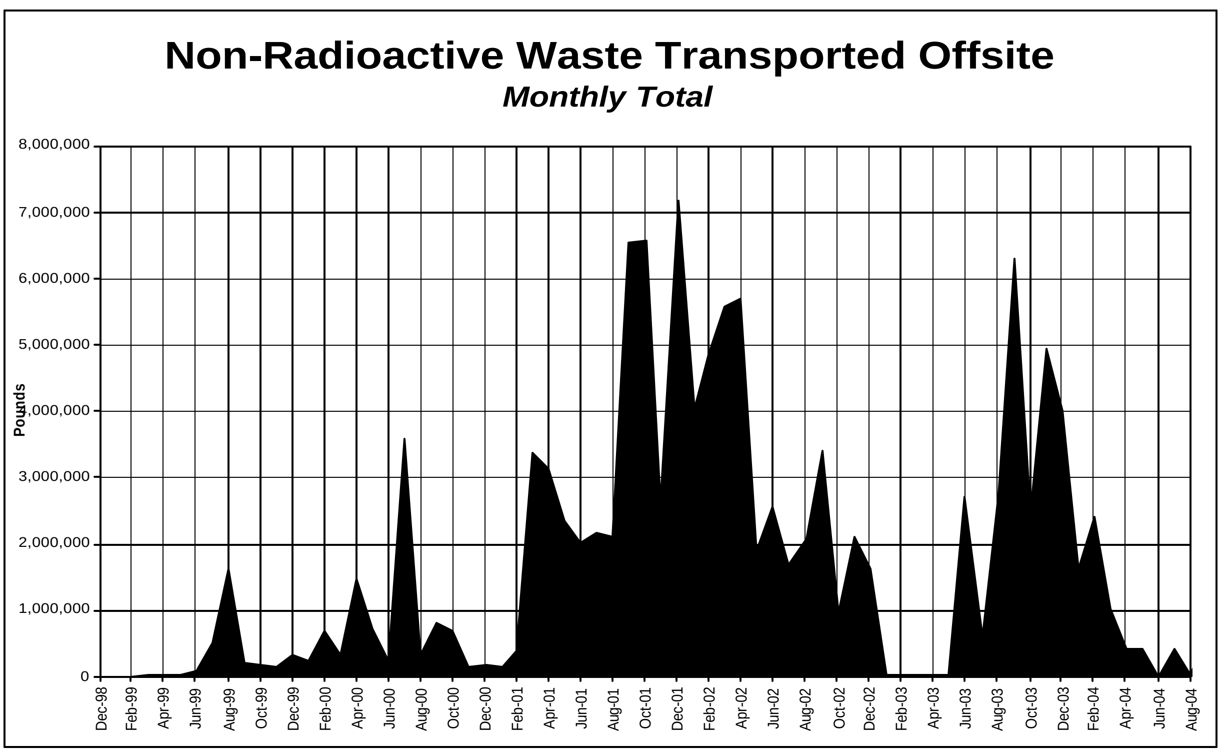


Figure E-2 Maine Yankee Non-radioactive Waste Shipments - Monthly Totals 1998 - 2004

F ADDITIONAL RECOMMENDATIONS FOR OPERATING FACILITIES

The following recommendations are from current Maine Yankee personnel as well as from a speech given by the Maine Yankee Vice President of Decommissioning at a conference in November 2002. They provide Maine Yankee's perspective on recommendations for operating plants based from the decommissioning viewpoint.

Stakeholder Relations

- Invest more energy into building relations with facility opponents
- Invest more energy into engaging in dialogue with the local community (i.e., form an operating community advisory panel
- Cultivate relationships one by one with key stakeholders
- In transitioning into decommissioning, don't underestimate the level of interest and concern among state regulators, the state Governor, and key legislators
- Don't promise or imply that you will necessarily return the site to the way is was before the plant was built
- Consider a CAP type group for operating plants to establish two way communication and build relationships early on

Contamination Control

- Operate a clean plant – prevent leaks and spills, and clean them up quickly when they occur
- Aggressively control contamination and eliminate hot spots
- Maintain stringent and well documented free release control processes
- Minimize the amount of radiation work performed outside the restricted area

Build a Strong Historical Site Assessment (HSA)

- Build your HSA as you operate. Include good records on radiological and non-radiological spills and excavation activities
- Include movement and disposal of soils during plant modifications
- Include a series of site aerial photos and pictures of structures, systems and components over time
- Include spill and event questions in employee out-processing forms

Sampling and Monitoring

- Conduct a ground water monitoring program
- Include hard-to-detect (HTD) analyses when performing nuclide profiles of systems and materials
- Pick a very good laboratory for sample analysis and establish consistent low minimum detectable activities (MDAs) for analytical procedures
- Use EPA guidelines with independent testing for remediation of chemical spills
- Conduct removal and confirmatory sampling in accordance with U.S. NRC, U.S. EPA and state closure and land transfer requirements
- Identify and become familiar with the U.S. EPA and state site closure requirements and real-estate transfer requirements.

Structures and Equipment

- Look at total life cycle including removal and disposal when designing modifications and operating processes
- Integrate utility (water, sewer, telephone, electricity, computers, parking, traffic, shipping, office space and maintenance shops) needs, plans, locations and proposed movement in decommissioning planning
- Thoroughly apply sealant to original construction joints
- Avoid use of underground piping (or place into structured pipe chases)
- Maintain strict controls on solvent and oil use
- Ship waste offsite when generated – avoid legacy wastes
- Construct clear separation between containment and spent fuel pool in fuel transfer tube
- Spent fuel pool crane should be single failure proof
- Eliminate floor drains and buried piping where possible
- Know what is underground

Develop a Good Decommissioning Plan

- Lack of pre-planning can add $50-$100 million to total decommissioning costs
- The earlier the facility end state is established the better
- Transition to a decommissioning mindset as quickly as possible – unneeded or cumbersome operating processes, procedures and oversight can be costly.
- Establish a decommissioning plan including:
    - Assessment of DOC vs. Self-performance
    - Stakeholder involvement program
    - Safety emphasis

  - Schedule importance
  - Well thought out sequence of events
  - Identify business risks including low level waste disposal
- A good plan leads to more confident cost estimating and efficient change to decommissioning even when abrupt changes are needed
- Develop a plan to transition staff from operational to project management structure
- Develop a listing of permits and regulations applicable to decommissioning and plant end state
- Decide what is going to stay following decommissioning (e.g., foundations, discharge piping, infrastructure, etc.)

Other Items

- Avoid being classified as a RCRA large quantity generator
- Maintain a strong document control system including effective retrieval, and prompt disposal of unneeded documents
- Avoid acquiring land with relic dumps
- Make sure the definition of the your site boundaries are clear and known over time
- For facilities with ocean access, define impacts of high and low tide on location of site boundary