THE EFFECT OF WASTE MANAGEMENT POLICY DECISIONS ON THE OPERATION OF THE PILGRIM NUCLEAR POWER STATION

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ABSTRACT

In response to the loss of the radwaste system equipment components and processing capabilities and the enactment of the Low-Level Radioactive Waste Policy Act, Boston Edison created a Radwaste Betterment Program, with the goals of radwaste system improvement, review of volume reduction techniques and systems, reduction of radiation exposures, reduction of waste generation rates, and development of onsite radwaste storage capabilities. A pragmatic review of external policies, considerations within Boston Edison and the existing industry capabilities resulted in a unique solution for meeting the goals of the Radwaste Betterment Program and the disposal guidelines of the recent Amendments Act. Implementation will be through the project management concept. This concept is viewed by Boston Edison as the most effective method to deal with the now complex issues of Low-Level Radioactive Waste Management.

INTRODUCTION

The Pilgrim Nuclear Power Station (Pilgrim) is a 670 MWe single unit Boiling Water Reactor, located on the shore of Cape Cod Bay in the Town of Plymouth, Massachusetts. Pilgrim Station commenced operation in December, 1972. Public scrutiny has always been high due to its location in Plymouth and the proximity to Boston, Massachusetts, 38 miles.

The first and second years of PNPS operation were rewarded with high capacity factors and praise for efficiency by the nuclear industry and regulatory agencies. Fuel problems were experienced from 1974 to 1976, and the impact on the Pilgrim system from the contaminants and radiation levels in the process streams, rapidly changed the excellent reputation to one of radiological concerns and fair performance.

The operational efficiency of Pilgrim has been improving since the late seventies and the enactment of the Low-Level Waste Policy Act in 1980 was viewed by Boston Edison as a positive move towards the improvement in public perceptions of the nuclear industry. To deal with the issues of Low-Level Radioactive Waste (Radwaste) Management Boston Edison established a Radwaste Betterment Program at Pilgrim. The goals of the Radwaste Betterment Program were to improve radwaste system operations, reduce radiation exposures, reduce waste generation rates, review volume reduction techniques and systems, and develop onsite radwaste storage capabilities. The impact of the Low-Level Radioactive Waste Policy Amendments Act with guidelines for burial allocation limits, surcharges, disposal site development milestones, and potential need for onsite radwaste storage has been incorporated with other external policies and internal considerations. While many other nuclear facilities face a complicated decision-making process, a unique solution resulted from a pragmatic review of existing capabilities. The project management concept was determined by Boston Edison to be the most effective method for implementation and managing the economic and administrative tasks. The project responsibility will be coordination of radwaste processing, packaging, storage and disposal while implementing the solutions to meet the requirements of all external policies and internal considerations.

A discussion of the following topics will be presented in the paper.

- The Pilgrim Radwaste System, Radwaste Generation Rates, and Potential Radwaste Storage Requirements.
- The External Policies and Internal Considerations Affecting the Decisions for Radwaste Management at Pilgrim.
- The Radwaste Management Solutions for Pilgrim.

RADWASTE SYSTEM/GENERATION RATES/STORAGE REQUIREMENTS

The original design of the Radwaste Processing System is illustrated in Fig. 1.

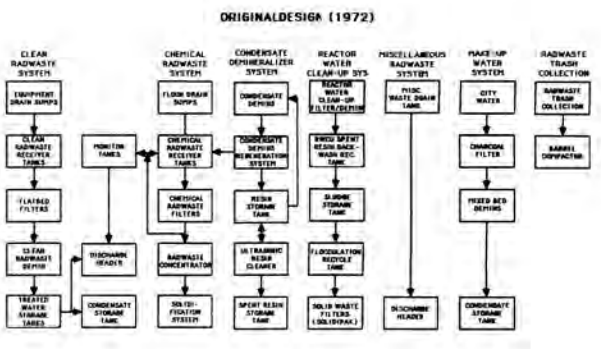

Fig. 1. Original Radwaste System at Pilgrim.

The classic liquid radwaste processing design included separate process streams for low conductivity/high radioactivity, or the Clean Radwaste System, high conductivity/low radioactivity, or Chemical Radwaste System, and high detergent/low radioactivity, or the Miscellaneous Radwaste System. Some interesting features of the Pilgrim Radwaste System were that Diatomaceous Earth was, and still is, used as filter medium for the Flatbed Filters, the Chemical Radwaste Filters were cartridge type, the Solid Waste Filters provided sludge dewatering as well as a shipping container, and that much of the system utilized remote manual versus automatic operation for batch processes.

As illustrated in Fig. 2, between 1972 and 1982 components of the Radwaste System were taken out of service as a result of high radiation levels related to fuel problems, equipment failure and unacceptable maintenance requirements. The loss of the Chemical Waste System now limits liquid processing to the Flatbed Filters and Radwaste Demineralizer. The limited processing capability has significantly increased the generation of solid radwaste packaged in High Integrity Containers (HIC's or Liners). For example, operation of the Flatbed Filters produce 17 pounds of filter medium to 1 pound of contaminant. The ability to decant Cleanup Filter Sludge was lost when the Floc Recycle Tank and Solid Waste Filters were taken out of service. Sludge is now transferred with large amounts of water to dewatering type HIC's.

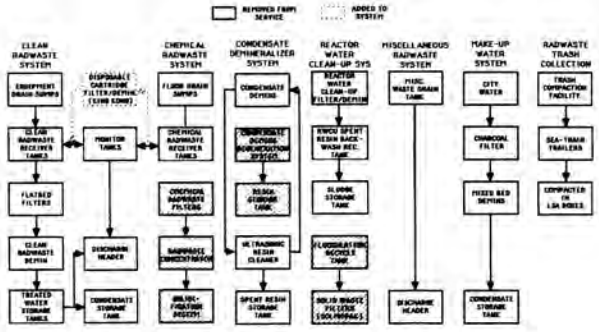

Fig. 2. Current Radwaste System at Pilgrim.

Dry Activated Waste (DAW) consisting of trash, contaminated clothing, tools and construction materials is collected throughout Pilgrim and now transferred to a Trash Compaction Facility (TCF). The TCF was constructed in 1984 through the Radwaste Betterment Program. The TCF was designed to collect DAW (Trash), provide sorting capabilities, provide compaction capabilities, and a staging area while awaiting transportation. The TCF has not been fully utilized. DAW is currently compacted in LSA Boxes or placed in Sea-Train Trailers and subsequently shipped for disposal. In addition, other temporary staging areas are available for packaged radwaste awaiting shipment.

The volume of radwaste shipped from Pilgrim for the years 1973 through 1985 is delineated on Fig. 3. Based on this figure the average yearly generation rate is 40,000 cubic feet for DAW and 10,275 cubic feet for dewatered solid radwaste in Liners. The radwaste placed in Liners for disposal is comprised of 15% dewatered spent powdered resin, 25% dewatered expended bead resin, and 60% dried Diatomaceous Earth.

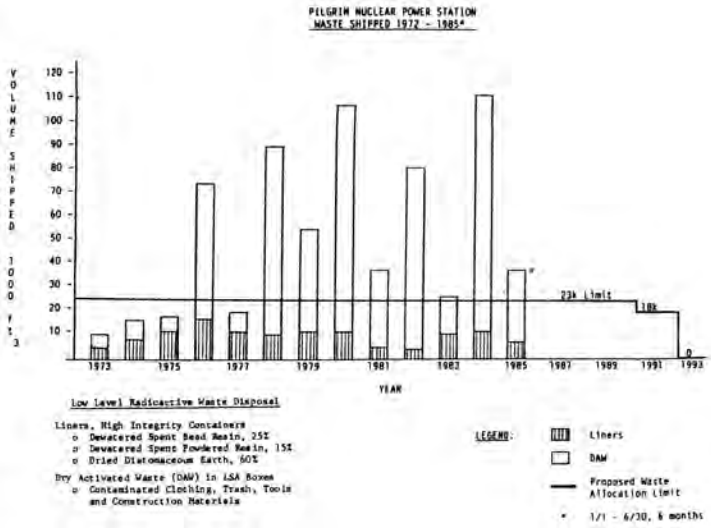

Fig. 3. Radwaste Volume Shipped from Pilgrim 1972 Through 1985.

The allocation limits for Pilgrim from the guidelines of the Low-Level Radioactive Waste Amendments Act will be 23,412 cubic feet per year for years 1986 through 1989, 18,396 cubic feet per year for years 1990 through 1992, and zero in 1993. The TCF at Pilgrim has the capability for temporary staging of approximately 12,000 cubic feet of DAW. Staging of DAW trash was the period of time only while expeditious arrangements were made for transportation and disposal. Additional temporary staging is available onsite for a limited amount of DAW and Liners, in designated onsite outside areas.

Based on the historical radwaste generation rate at Pilgrim and the 23,412 cubic feet yearly burial allocation limit, approximately 27,000 cubic feet of DAW will remain onsite at the end of 1986. This assumes that all Liners are shipped offsite (approximately 10,275 cubic feet). Without changes in the current mode of operation the required onsite storage space will increase by 27,000 cubic feet on an average per year until 1989, then by 32,000 cubic feet per year through 1992. The resulting DAW volume requiring storage at Pilgrim in 1993, will be approximately 204,000 cubic feet. At that time the State of Massachusetts may be required, in accordance with the Amendments Act, to take legal possession of the radwaste.

EXTERNAL POLICIES AND INTERNAL CONSIDERATIONS

Policies external to and considerations within the Boston Edison Company have dictated a unique approach for the processing and disposal of radioactive waste at Pilgrim. The external radwaste policies include those that are now common to all commercial nuclear facilities as established by the requirements and guidelines of the existing burial sites, the sited States, and the federal government. The State of Massachusetts and local government have also enacted policies which impact the processing and disposal of radwaste. These additional requirements and/or restrictions in conjunction with the uncertainty of political policies complicate the ability to plan for continued smooth and cost effective operation. The considerations within Boston Edison which impact the operation of the Pilgrim Radwaste System include utilizing the 10 CFR 50.59 safety evaluation process for modifications, a commitment to radwaste volume reduction and control of Capital Expenditures. Also considered are the effects of water usage versus station discharge, performed within all federal and state

regulatory requirements.

The most significant external policy which impacts radwaste management is the Amendments Act to Low-Level Radioactive Waste Policy Act. The burial allocation limits, surcharges, and milestones with penalties, are now well known by all utilities. The State of Massachusetts established a Special Legislative Commission on Low-Level Radioactive Waste in 1982, to discuss the development of a regional burial site and deal with the issues of the Waste Policy Act with the Northeast Compact. The concerns of Boston Edison for the continued smooth and economical operation of Pilgrim is the State missing the milestones for burial site development and the subsequent penalties impacting radwaste shipments. Furthermore, the interaction with other States or Compacts, with existing burial sites, regarding burial requirements or disposal of special radwaste items (e.g., contaminated oil) pose additional potential impacts on radwaste operations.

An additional external influence is placed on radwaste operations by the Department of Public Utilities (DPU). Since the DPU is responsible to the rate payers of the State for ensuring electricity is generated safely and cost effectively, any modification at Pilgrim requires a positive cost benefit analysis and assurance of practicality. Through the DPU public perception has an indirect impact on the Radwaste System at Pilgrim.

The internal considerations by Boston Edison which impact Radwaste Management decisions at Pilgrim are identified below.

o 10 CFR 50.59 Safety Evaluation

The 10 CFR 50.59 Safety Evaluation process will be used to the maximum extent practical for modifications to the structures and operations at Pilgrim.

o Commitment to Radwaste Volume Reduction

Pilgrim will pursue to the maximum extent practical installation of volume reduction equipment and implementation of radwaste reduction techniques.

o Temporary Onsite Radwaste Staging and Storage Areas

Pilgrim will consolidate for the benefit of inventory control and accountability all temporary onsite radwaste staging and storage areas. Consolidation will assist Pilgrim in meeting the disposal guidelines of the Amendments Act.

o Radwaste Discharge/Water Usage

The issue of release limits and offsite exposure is being addressed by Boston Edison in light of volume reduction and storage capabilities at Pilgrim to meet the disposal guidelines of the Amendments Act. Pilgrim will operate within the Technical Specifications and in accordance with all Regulatory requirements. The issue being addressed is to use the approved Technical Specification liquid release and 10 CFR 20 exposure limits as upper bounds to reduce radwaste volumes generated and maximize onsite storage capabilities. Also being considered is the amount of water necessary to replace liquid releases. Water is a natural resource and should be conserved. Water also has a cost that must be considered in economic analyses.

o Capital Expenditure

Increasing capital expenditures are a concern at every utility. As part of the controls on capital expenditure Boston Edison requires stringent cost analysis to be performed for justification. All Radwaste Management decisions which involve capital expenditure will be required to meet these cost analysis requirements.

The resolution of the internal considerations being addressed by Boston Edison, which impact Radwaste Management decisions must meet the requirements and guidelines of the external policies and ultimately achieve the goal of continued safe operation, generating electricity at the lowest possible cost to the general public.

RADWASTE MANAGEMENT SOLUTIONS FOR PILGRIM

To meet the increasing complexity of radwaste processing, packaging, storage and disposal Boston Edison created the Radwaste Betterment Program. The integration of the external policies and internal considerations with the existing and proven industry capabilities resulted in a unique solution for Radwaste Management at Pilgrim. Extensive evaluation has determined that through implementation of the specific items below zero cubic feet of Radwaste will remain onsite at Pilgrim through 1989. Furthermore, through refinement of operations following implementation, it is possible that zero cubic feet of Radwaste would be left onsite through 1992.

o Reduction of DAW from Onsite Sources

Through aggressive housekeeping practices, training, and sorting a 25% reduction can be realized in the DAW generated onsite.

o Full Utilization of the TCF

Utilization of the TCF to the maximum extent of the design provides Pilgrim with the most appropriate location for collecting DAW Trash, inventory control, segregation, pre-compaction processing, compaction, packaging and temporary storage prior to disposal. Staging of packaged DAW is permitted while transportation and disposal arrangements are expedited.

o Onsite Mobile Supercompaction Services

Use of onsite mobile supercompaction services permits the possibility of reducing the onsite storage requirements for DAW to zero. The final results will be based on compaction efficiency, ratio of compactible to non-compactible DAW and reduction of DAW from onsite sources.

o Solid Waste Volume Reduction Modifications

Through the implementation of modifications to improve equipment and operation of the Radwaste Processing System it has been determined that a 50% reduction can be realized in the amount of dewatered solid radwaste shipped and disposed in liners. The modifications include returning the Chemical Waste System to operation, improving the processing of Cleanup Filter sludge, resin drying, and reducing the processing requirements of the Flatbed Filters.

o Onsite Mobile Incineration Service

Pilgrim will pursue onsite mobile incineration services performed within all requirements and guidelines of federal and state regulatory agencies. Incineration will provide the large volume reduction capabilities which will be required to meet the reduced burial allocation limits beyond 1989, and reduce radwaste disposal costs.

- Onsite Storage Containers

  As insurance to maintain operability in the event of an unanticipated situation of large radwaste generation, transportation problems, or denial of disposal site access (e.g., missing a milestone of the Amendments Act), concrete onsite storage containers will be used at Pilgrim. The Pilgrim site will have an engineered laydown area, sufficiently controlled to alleviate all radiological and security concerns. The storage containers will be used on an as-required basis for both liners and packaged DAW. A 10 CFR 50.59 Safety Evaluation will be performed for the operation.

The Amendments Act and the increasing complexity of integrating all aspects of Radwaste Management has prompted Boston Edison to utilize the Project Management Concept. Implementation of the specific solutions through this concept will ensure effective management, cost control, and an operation within all the requirements and guidelines. Improved operating efficiency of the overall radwaste system and control of radwaste inventory will have the added benefits of reduced radiation exposures, significant decrease in operations and maintenance costs and fulfillment of management commitments.

The responsibilities of Radwaste Project Management encompass activities from processing through disposal. These activities are illustrated on Fig. 4 and include:

- Radwaste Processing Operations.
- Radwaste System Improvement Modifications.
- Incorporation of Volume Reduction Equipment.
- Radwaste Inventory Control.
- Radwaste Packaging.
- Radwaste Staging/Storage.
- Transportation.
- Disposal.
- Meeting Regulatory Requirements for Processing, Packaging, Transportation and Disposal.

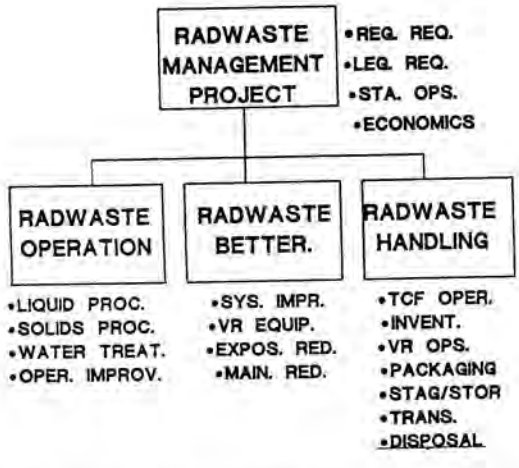

Fig. 4. Radwaste Management Project Responsibilities.

The immediate goals of Radwaste Project Management through implementation of the specific solutions for Pilgrim will be to meet the guidelines of the Low-Level Radioactive Waste Amendments Act. Effective radwaste management and cost control will require the additional goals of anticipating station operating conditions, selecting the appropriate processing, optimizing volume reduction, utilizing the appropriate packaging, ensuring radwaste storage availability and expeditious disposal. An interesting comparison can be made, as shown on Figures 4 and 5, of the evolution of Radwaste Management from 1974 to 1986 as a result of an increasingly complex environment.

Fig. 5. The Responsibilities of the Radwaste Supervisor, 1974.

CONCLUSION

In conclusion, the external policies and internal considerations at Pilgrim form a unique situation for Radwaste Management. The integration of processing, packaging, storage, economics, regulatory and legislative requirements and public perceptions create a challenging environment. This challenge will be met successfully at Pilgrim through a Project Approach.

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