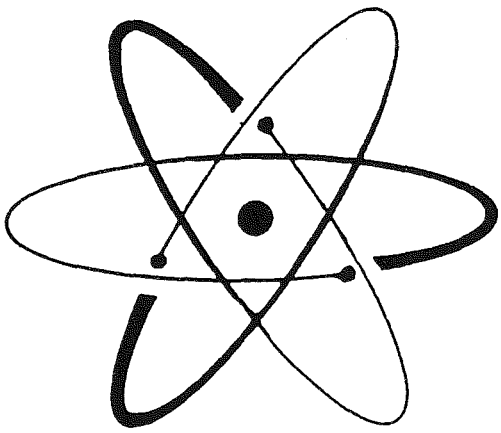
STATE OF MAINE

NUCLEAR SAFETY REPORT

submitted to the

114th MAINE LEGISLATURE

1990



State Nuclear Safety Advisor
Executive Department
Maine State Planning Office

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STATE OF MAINE
EXECUTIVE DEPARTMENT
STATE PLANNING OFFICE

JOHN R. McKERNAN, JR.
GOVERNOR

RICHARD H. SILKMAN
DIRECTOR

June 19, 1990

Members of the 114th Legislature,

I am pleased to submit to you the 1990 annual report of the State Nuclear Safety Advisor.

This report discusses the 1989 operation of the Maine Yankee Atomic Power Station with respect to the plant's performance, inspections by the Nuclear Regulatory Commission, and monitoring activities of the State Nuclear Safety Inspector. This year's report adds a Special Topics section which discusses recent revisions in radiation exposure risks and issues related to nuclear plant life extension. The report also reviews on-site storage of spent fuel at Maine Yankee and emergency planning activities for the Seabrook and Point LePreau nuclear stations are briefly reviewed.

As issues in nuclear safety are certainly to be of continued interest, I am sure the work of the State Nuclear Safety Advisor will contribute to informed decision-making.

Sincerely,

Richard H. Silkman
Director

RHS/jmb

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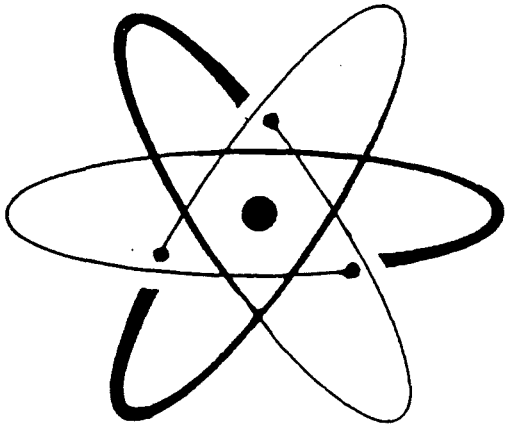

State Nuclear Safety Advisor
Executive Department
Maine State Planning Office

EXECUTIVE SUMMARY

INTRODUCTION

This report complies with the reporting requirements (25 MRSA, sec. 10) directing the State Nuclear Safety Advisor (NSA) to submit an annual report on activities and issues pertaining to the safe operation of nuclear facilities, and the safe transportation and storage of nuclear waste in the State of Maine.

Maine Yankee, the only nuclear power plant located in Maine, is discussed with respect to its operational record, performance and safety. The Seabrook and Point LePreau nuclear stations are discussed with regard to emergency planning activities which impact portions of Maine. A section entitled "Special Topics" is included to provide information and perspective on events or activities which may be of interest and value in public decision making and discussions. Two special topics presented are (1) the recent revision of radiation risk estimates, and (2) the extension of nuclear power operating licenses in the U.S. to recapture years lost while the plant was under construction. The issue of spent fuel storage at Maine Yankee is discussed in the "Upcoming Issues" section, and projected work tasks for 1990-1991 are outlined in the last section of the report.

MAINE YANKEE NUCLEAR STATION

Operational History and Performance Indicators

Maine Yankee's operation compares favorably in terms of operational performance indicators relative to those of other similar plants in the U.S. nuclear power industry. Performance indicators reflect upon the condition and management of the plant with respect to maintenance activities, equipment failure, and regulatory compliance and management which, with limitations, are related to plant safety. The major performance indicators for Maine Yankee clearly show that operation has been improving steadily since the early eighties, and performs better than most similar plants in the U.S. In addition, the net electrical production from Maine Yankee has been reliable and consistent since operation began and reached a plant record in 1989.

On-Site Nuclear Safety

The authority to regulate activities at Maine Yankee and to assure the protection of public health, safety and the environment rests primarily with the Nuclear Regulatory Commission. To assure that a nuclear power plant is operated safely and in compliance with NRC regulations, the NRC performs numerous announced and unannounced inspections on an ongoing basis.

Recently, the NRC completed a comprehensive assessment of Maine Yankee's operation, called a Systematic Assessment of Licensee Performance (SALP). The purpose of the SALP is to determine areas of plant operations where the NRC should direct their resources and attention. In this most recent SALP, all areas of Maine Yankee's operation received good marks, while two areas, Plant Operations and Maintenance/Surveillance received high marks. Although no low grades were given to Maine Yankee during the most recent SALP period, the NRC did note deficiencies, (areas where improvement is needed), in the areas of Radiological Controls, Security and Emergency Planning. The NRC concluded the SALP review by describing Maine Yankee's operation as one of "safe and conservative overall performance."

In 1989, 13 violations were issued by the NRC to Maine Yankee. Twelve of the violations issued were of minor severity involving no fines. However, one violation resulted in a fine of $75,000, due to deficiencies in security. Maine Yankee has paid the fine and implemented corrective action to address the NRC's concern, and strengthen other aspects of its security program.

Maine Yankee is required by the NRC to file Licensee Event Reports (LER's) acknowledging various circumstances that are considered significant, but not immediate safety concerns. In 1989, Maine Yankee issued six LER's. Two were due to component failures, three were due to design or manufacturing flaws, and one was the result of personnel error. Since 1987, the annual number of LER's filed by Maine Yankee has been declining.

As U.S. reactor experience and technology advances, the NRC becomes aware of new safety issues which nuclear plants are subsequently asked to remedy. Currently, Maine Yankee has four unresolved safety issues of this type being addressed.

The Three Mile Island accident in 1979 led to the NRC issuing many safety requirements to be addressed by nuclear power licensees. Maine Yankee has completed the implementation of all Three Mile Island-related safety issues, and was the first plant in the nation to do so.

As mandated by 1987 legislation, the State established the Office of the State Nuclear Safety Inspector at the Maine Yankee Nuclear Station. The State Nuclear Safety Inspector (NSI) began monitoring activities at the plant in February 1989. The duties of the NSI include monitoring storage and transportation of low-level radioactive waste, observing NRC inspections, and overseeing the State's newly acquired and installed remote radiation monitoring system around Maine Yankee.

Noteworthy activities monitored by the NSI during the last year include :

Reactor Power Upgrade: Maine Yankee received approval from the NRC to increase reactor power from 2630 to 2700 Megawatts thermal. However, due to turbine and generator design limitations, Maine Yankee was only able to achieve a reactor power level of 2650 Megawatts thermal. During the April 1990 refueling outage, Maine Yankee will install a new high pressure turbine which

will allow the plant to be operated at the higher power level. The increased efficiency of the high pressure unit translates into approximately 20 Megawatts net increased electrical output.

Radiological Controls at Maine Yankee: The NSI has been monitoring Maine Yankee's efforts in implementing a Radiological Controls Improvement Plan. The program has been successful, not only in reducing dose to personnel, but also in creating a healthy awareness within the plant.

Annual Emergency Exercise at Maine Yankee: On November 15, Maine Yankee conducted its annual emergency plant exercise. The NSI participated in this drill and was satisfied with Maine Yankee's performance.

Off-Site Nuclear Safety

On a routine basis, Maine Yankee, (as well as all nuclear power plants), release controlled and regulated quantities of gaseous and liquid radioactive effluent into the environment. All releases from Maine Yankee in 1989, (and since the beginning of operation in 1972), have been well below Federal Limits. In 1989 gaseous releases were the lowest on record for the plant, though liquid releases were slightly elevated from previous years. Estimated doses to members of the public living in the vicinity of the plant from the releases of gaseous and liquid radioactive effluent are very small and pose no undue risk to the public and environs. The State operates three programs to monitor radioactive effluent from Maine Yankee. They are (1) the Environmental Radiation Network Program, (2) the Volunteer Monitoring Program, and (3) the Environmental Radiation Surveillance Program. Data from these programs, as well as environmental data acquired by the NRC and Maine Yankee, indicate that there is no evidence of abnormal releases or radioactive contamination which could pose an undue risk to the public or environment.

In 1989 Maine Yankee sent 24 outgoing shipments of low-level radioactive waste (LLRW) to out-of-state disposal facilities. There were no transportation incidents reported. Access to the out-of-state disposal facilities may end for Maine Yankee and other LLRW generators in Maine as of the end of 1992. If so, Maine Yankee will be able to safely store any waste generated in their on-site LLRW storage building which is licensed by the NRC for a period of five years. Though the NRC has never issued a LLRW storage license for a period greater than five years, the NRC will consider an application for an extension. Therefore, Maine Yankee has the capability to safely manage its LLRW at least until 1998, and possibly several years thereafter.

Emergency planning activities continue to be exercised between the State and Maine Yankee. However, the biennial exercise, which is observed by the Federal Emergency Management Agency (FEMA), was rescheduled from November 1989 to July 1990. The postponement was initiated by FEMA due to demands on the agency associated with the major earthquake in California and hurricane damage in South Carolina.

A notable improvement in emergency planning in 1989 is in the Public Emergency Alert System (PEAS). The purpose of the PEAS is to notify persons within the ten-mile emergency planning zone of a test or real emergency at Maine Yankee. Originally, the system relied on eight sirens and approximately 108 "Paul Revere Routes" for notification of residents. The PEAS has been revised to reduce reliance on "Paul Revere Routes" -- accomplished by increasing siren coverage to thirty-seven, and distributing some 500 tone alert radios.

SEABROOK NUCLEAR STATION

The Seabrook nuclear station has obtained a full power license and is in the process of beginning normal operations. It is not expected that the normal operation of Seabrook will have an adverse impact to public health and safety or the environment. The State is operating an environmental radiation monitoring program in the Kittery, Maine area to verify that normal operational releases of radioactive effluent do not adversely impact the public or environment. Since Seabrook is more than 10 miles from the Maine border, it is highly unlikely that any radioactivity would be detected.

A radiological emergency at Seabrook will impact the State of Maine to the extent that York County is within the ingestion pathway zone, which is the area surrounding the power plant within a 50 mile radius, where the primary concern is radioactive releases into the food chain. The State of Maine has an Ingestion Pathway Plan approved by the Federal Emergency Management Agency. It is designed to mitigate the effects of radioactive releases on the food chain in the event of radiological emergency. This plan was successfully exercised in June 1988 with the Seabrook Station and the State of New Hampshire. The next emergency exercise with Seabrook is planned for December 1990.

POINT LEPREAU NUCLEAR STATION

The Point LePreau Power Station is located in New Brunswick, Canada about 27 miles from Eastport, Maine. A portion of Washington County lies within the 50 mile radius of the plant which is designated as an ingestion pathway emergency planning zone. State emergency planning activities have been primarily directed towards assuring that communication capabilities are adequate to alert and inform the Maine Emergency Management Agency (MEMA), the Maine State Police, and officials in Washington County. MEMA has successfully exercised its emergency plans with Emergency Measures Operations in New Brunswick, Canada in 1989.

SPECIAL TOPICS

IMPACT OF RADIATION RISKS REVISIONS

Recently, two significant reports examining the health risks from ionizing radiation exposures have been released--the 1988 report of the United Nations Scientific Committee on the Effects of Atomic Radiation and a 1990 report entitled the Biological Effects of Ionizing Radiation (BEIR V) by the National Research Council. Both reports have revised upwards risk estimates from radiation exposure, primarily as a result of reexamining radiation exposures linked to cancer occurrence in the Japanese survivors of the atomic bombings of Hiroshima and Nagasaki. Although the studies continue to indicate considerable uncertainty when estimating risks at very low doses, the evidence is sufficient in prompting governments worldwide to reexamine radiation dose limits to the general public and radiation workers. Preliminary indications are that the greatest impact from reduced dose limits will be to radiation workers, particularly those working in the nuclear power industry who receive the largest annual average radiation doses. Already the United Kingdom has issued interim guidance statements recommending a reduction of the annual exposure limit for radiation workers, to approximately one-third the previous limit. The U.S. government is presently conducting investigations to evaluate if U.S. radiation protection regulations should be revised to reflect the new radiation risk estimates.

It is likely that radiation dose limits will be reduced, but the extent of the reduction is difficult to predict. A study performed by the Electric Power Research Institute (EPRI) found that while the U.S. nuclear industry has been successful in reducing dosage by half in recent years, the dose received by workers in this country is still high enough that there will be a significant economic impact on many U.S. utilities. The increased cost will be primarily the result of radiological activities to reduce dose for maintenance activities. However, the report states that the impact could be lessened by nuclear utilities planning and implementing steps to further reduce radiation exposure.

The impact upon Maine Yankee from possible reduced dose limits will be dependent on the degree of dose reduction and Maine Yankee's new commitment to radiological protection. Since 1985, Maine Yankee's low performance in radiation protection has led to higher than average personnel radiation doses as compared to the U.S. nuclear industry. A reorganization of Maine Yankee's radiological program has led to significant improvements in 1989, and a healthy awareness of the need to reduce dose at the plant. Should Maine Yankee's efforts to reduce dose prove successful, this would cushion the operational and financial impacts of statutory reduced dose limits.

CONSTRUCTION PERIOD RECAPTURE

The NRC has ruled that the duration of an operating license for a nuclear power station can be amended to reflect a 40-year period beginning at the issuance date of the operating license rather than the issuance of the construction permit. Since Maine Yankee received its construction permit in 1968 and its operating license in 1972, Maine Yankee could recapture four years of operation, therefore extending its current operating license expiration date from 2008 to 2012.

It is important to note that this is not a form of license renewal, but an amendment to the licensee's current operating license. Applications for such amendment are primarily reviewed with respect to plant aging concerns, to assure that a plant can operate safely for the additional years requested. The NRC has already granted 24 requests from nuclear power licensees to recapture the years spent in construction; another 22 applications are being processed. No request for an operating license extension based on recapturing construction years has been denied by the NRC.

To date, Maine Yankee has not applied to the NRC to recapture the four years spent in construction, nor have they publicly stated any intention to seek a license extension. However, it is probable that an application from Maine Yankee would be approved, since (1) the plant is recognized by the NRC as being well maintained and operated, and (2) embrittlement and other aging factors do not at this time appear to be of concern with respect to the plant's continued operations.

In years to come, energy and environmental demands may lead to Maine Yankee seeking additional years of operation based on recapturing years in construction. If so, a primary concern for the State should be the management of the additional high and low-level radioactive waste generated in those years. However, four years of additional waste represents a small fraction of the total which would be generated under Maine Yankee's current operating license, and a solution for waste management will be needed many years prior to the expiration of Maine Yankee's current operating license.

UPCOMING ISSUE - - *SPENT FUEL STORAGE AT MAINE YANKEE*

Maine Yankee produces a highly radioactive waste in the process of making electricity. This waste, commonly referred to as "spent fuel", is exhausted nuclear fuel which is removed from a reactor during refueling operations. Since the beginning of Maine Yankee's operation in 1972, the spent fuel removed from the reactor has been stored on-site in a spent fuel pool. By 1996, the pool is expected to be full, having only sufficient capacity to accommodate the removal of all fuel from the reactor, if necessary.

Removal of the spent fuel from the Maine Yankee site by the Department of Energy (DOE) is unlikely to occur in time to alleviate the need to increase spent fuel storage capacity at Maine Yankee. The Department of Energy's schedule to begin operating a high level waste repository has been moved up from 2003 to 2010, due to technical and legal reasons. Although the DOE is requesting Congress to approve the development of an interim storage facility to accept spent fuel by 1998, the proposed capacity will be limited and the 1998 availability date is possibly optimistic. If Maine Yankee is to continue its operations in the late 1990's and beyond, an expansion of on-site storage capacity for spent fuel will be necessary.

Several times in the past, Maine Yankee has successfully increased the capacity of its spent fuel pool by reracking the fuel assemblies. The latest, July 1989 effort to increase the capacity of the pool used a process called spent fuel pin consolidation. The process is complex and resulted in technical and manpower difficulties, prompting management to put the program on indefinite hold, pending an investigation of spent fuel storage options to be completed in 1992.

Maine Yankee will require increased spent fuel storage capacity, and possibly sufficient capacity to accommodate the plant until its present operating licence expires in 2008. There are many issues and concerns to be addressed from the States perspective, and, therefore, it is advisable that Maine Yankee work closely with State officials in its research and assessment of the various options available to store spent fuel. Hopefully, early collaboration will address concerns on a timely basis, and lead to a solution which is acceptable to both parties.

1. INTRODUCTION

This report complies with the reporting requirement (25 MRSA, sec. 10) directing the State Nuclear Safety Advisor to submit an annual report on activities and issues pertaining to the safe operation of nuclear facilities, and the safe transportation and storage of nuclear waste.

The State Nuclear Safety Advisor was established within the context of broader legislation creating a State Nuclear Safety Inspection and Monitoring Program for commercial nuclear facilities in the State of Maine. Signed by Governor John. R. McKernan, Jr. on June 29, 1987, the statute expanded monitoring activities of nuclear power plants operating in Maine. The legislation called for on-site activities at nuclear power plants operating in Maine to be monitored by a resident State Nuclear Safety Inspector, while policy issues and overall operational assessment of a nuclear station would be the responsibility of the State Nuclear Safety Advisor. The purpose of expanded monitoring of nuclear power facilities in Maine is not to duplicate or replace any activities by the Nuclear Regulatory Commission (NRC), but to provide the state with information and assurance that activities undertaken by a nuclear power utility and the NRC are consistent with the protection of public health and safety, and in compliance with the environmental protection policies of the State.

By far, the majority of the State Nuclear Safety Advisor's activities are in monitoring and assessing operations at the Maine Yankee Atomic Power Station. The Seabrook nuclear station in New Hampshire and the Point LePreau nuclear station in New Brunswick, Canada are both in close proximity to Maine's border, and are also monitored with regards to any potential impact to the State.

The purpose of the State Nuclear Safety Report is to provide information, assessments, and recommendations on safety issues which affect or may affect Maine. Maine Yankee is discussed in considerable detail with respect to its operational record, performance and nuclear safety. The Seabrook and Point LePreau nuclear stations are discussed with regard to emergency planning activities which impact portions of Maine. A section entitled "Special Topics" is included to provide information and perspective on events or activities which may be of interest and value in public decision making and discussion. Two special topics presented are (1) the recent revision of radiation risk estimates, and (2) the extension of nuclear power operating licenses in the U.S. to recapture years lost while the plant was under construction. The issue of spent fuel storage at Maine Yankee is discussed in the "Upcoming Issues" section, and projected work tasks for 1990-1991 are outlined in the last section of this report.

2. MAINE YANKEE ATOMIC POWER STATION

2.1 OPERATIONAL HISTORY AND PERFORMANCE INDICATORS

Maine Yankee, Maine's only nuclear power plant, is located at Bailey Point in the Town of Wiscassett. The plant began generating electricity in December, 1972. The electric generating plant utilizes a pressurized water reactor (PWR) designed by Combustion Engineering with a claimed electrical output of 840,000 kilowatts. Of the total electricity produced at Maine Yankee, approximately half is sold to utilities in Maine and the remainder goes to out-of-state utilities. Of the total electrical consumption in Maine, Maine Yankee is the most significant sole source, supplying about 25% of Maine's electricity needs. Figure 1 depicts the annual Maine Yankee electrical contribution to total electrical sales by Maine utilities since 1973. As is evident from the graph, Maine's electrical needs are increasing with time, and therefore Maine Yankee's relative contribution will decrease in future years. Maine Yankee's performance has remained fairly reliable since the plant began operation.

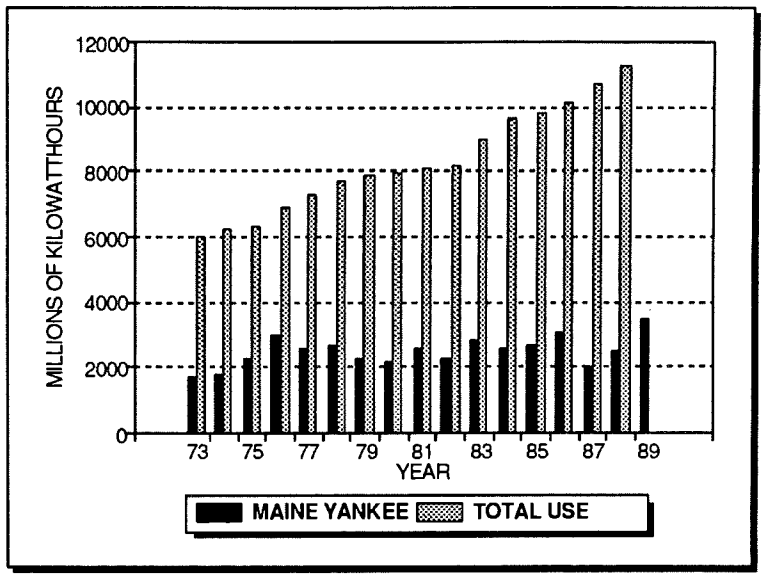

Figure 1 *Annual electrical contribution from Maine Yankee compared to the total annual electrical consumption in Maine.*

Maine Yankee compares favorably in terms of operational performance indicators relative to those of other similar plants in the U.S. nuclear industry. Performance indicators are used to assess many aspects of nuclear power plant operations, and may or may not relate dependably to overall plant safety.[1] That is, the ability of a nuclear power plant to efficiently and reliably generate electricity is dependent upon many factors including plant maintenance practices, regulatory

[1] Efforts to Ensure Nuclear Power Plant Safety Can Be Strengthened, U.S. General Accounting Office, GAO/RCED-87-141, page 25.

compliance and management which, with limitations,[2] are related to plant safety. Several performance indicators are discussed below, to convey the general operational record of Maine Yankee.

In Figure 2, the annual net electrical production for Maine Yankee is displayed. The plant has set many industry records in the past, and is now the leading New England nuclear power plant for total electricity generated during its lifetime. In 1989, Maine Yankee surpassed its own annual electrical production record by generating 6.9 billion kilowatt-hours. This was partially due to 1989 being a non-refueling year, but also to successful implementation of the reactor thermal power increase from 2630 Megawatts to 2700 Megawatts (as approved by the Nuclear Regulatory Commission), and the installation of two new low pressure turbines in 1988. Effective maintenance and plant modernization at Maine Yankee has also served to consistently improve operational efficiency and reliability.

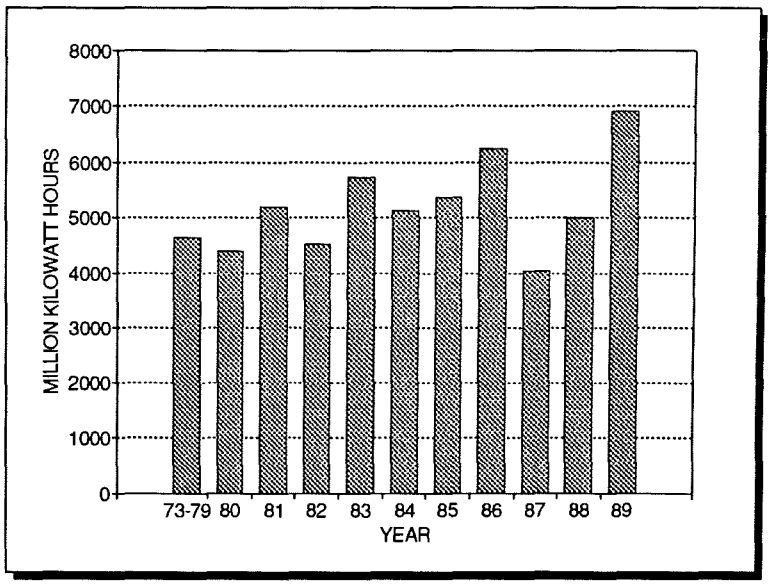

Figure 2 *Annual net electrical production for Maine Yankee.*

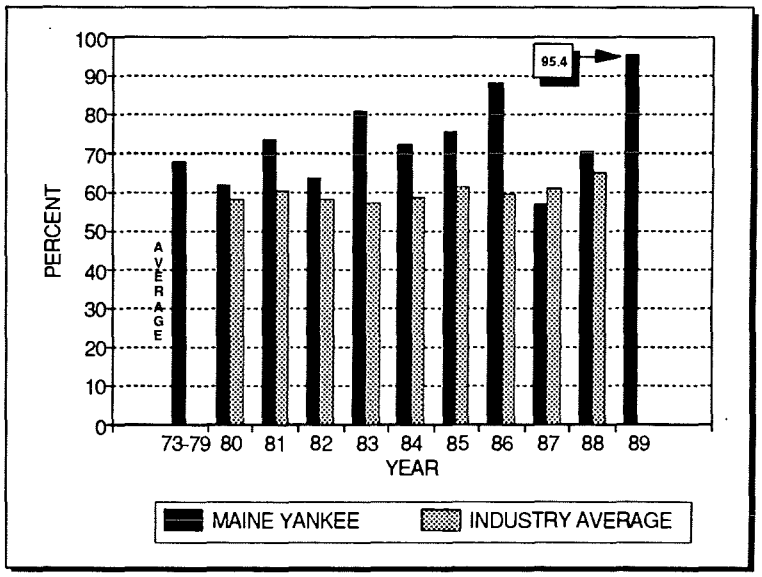

Figure 3 *Annual Maine Yankee capacity factor (MDC net) compared to U.S. pressurized water reactor industry.*

Figure 3 displays the annual capacity factor (CF) for Maine Yankee compared to the U.S. nuclear industry annual average. The capacity factor is the measure which describes the percent of the maximum possible electricity generated by a nuclear power plant. As an example, a nuclear plant generating all the electricity it could by design in one year,

[2] Performance indicators must be evaluated in conjunction with plant inspections when assessing nuclear safety.

would have a CF of 100 percent. As indicated on Figure 3, Maine Yankee's annual capacity factor has been almost consistently above the U.S. industry average. In 1989, Maine Yankee's annual CF reached a plant record of 95.4. Because the annual capacity factor is dependent upon whether refueling activities occurred in a particular year, a three-year average of capacity factors is more indicative of the overall trend in this performance area. Figure 4 shows Maine Yankee's three year average CF compared with the U.S. nuclear industry annual average. It is clear that Maine Yankee's performance in this area has improved since the early eighties, and is better than average for the industry. To date, Maine Yankee has an annual lifetime CF of 70 percent as compared to the U.S. industry annual lifetime CF of 60 percent.

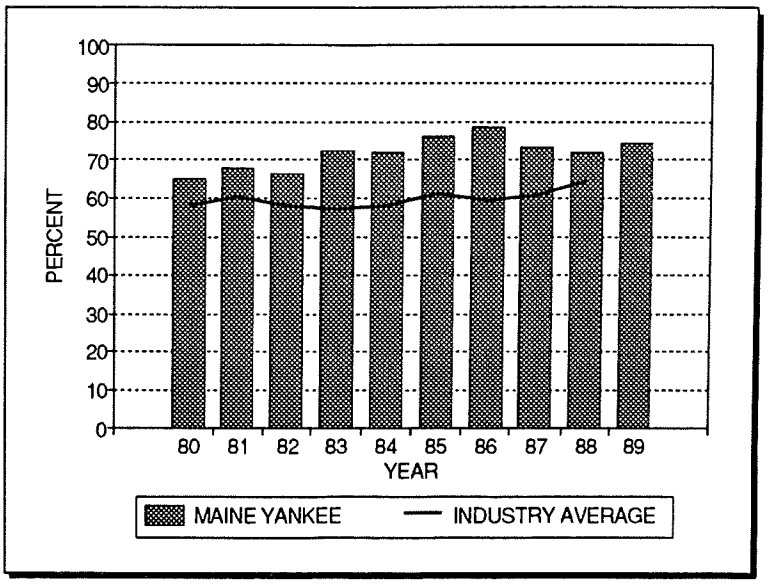

Figure 4 *Maine Yankee and U.S. pressurized water reactor industry three year averaged capacity factor (MDC net).*

The unit availability factor (UAF) for Maine Yankee is shown in Figure 5. This performance indicator is a measure of the time a nuclear plant was in operation. Maine Yankee was unable to achieve a unit availability factor of 100% due to lost time from several equipment failures last year, (as described in Appendix I). However, Maine Yankee did achieve a UAF of 92.8 percent, which is the best performance to date for the plant.

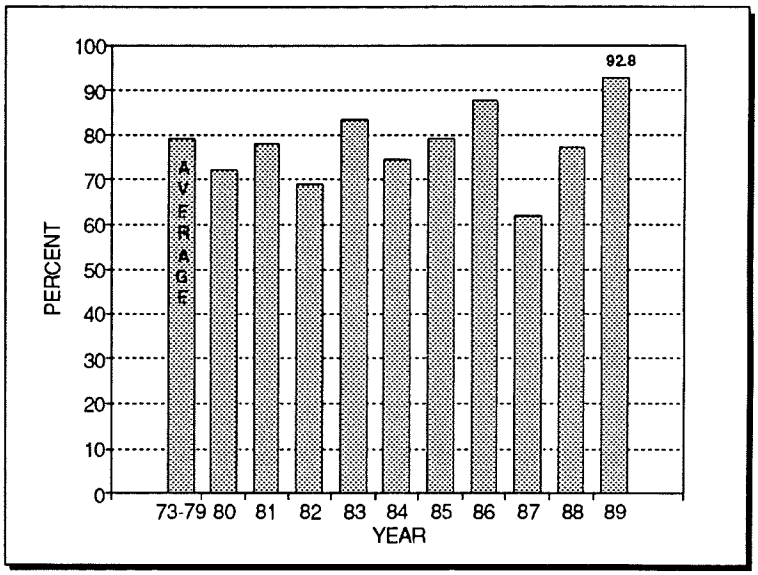

Figure 5 *Annual unit availability factor for Maine Yankee.*

A measure of the unplanned shutdown rate of a nuclear station is given by the annual forced outage rate (FOR) performance indicator. Figure 6 shows the annual FOR for Maine Yankee as compared to the U.S. industry. Overall, Maine

Yankee has done better in this area than the U.S. industry as a whole. A low rating in the FOR is an indication that the plant is well-maintained and conservatively operated. There were several instances in 1989 when Maine Yankee took the conservative approach and manually shutdown the reactor rather than risk further degradation of a component which might result in an automatic reactor trip. (See Appendix I for a description of planned and unplanned shutdowns at Maine Yankee for 1989).

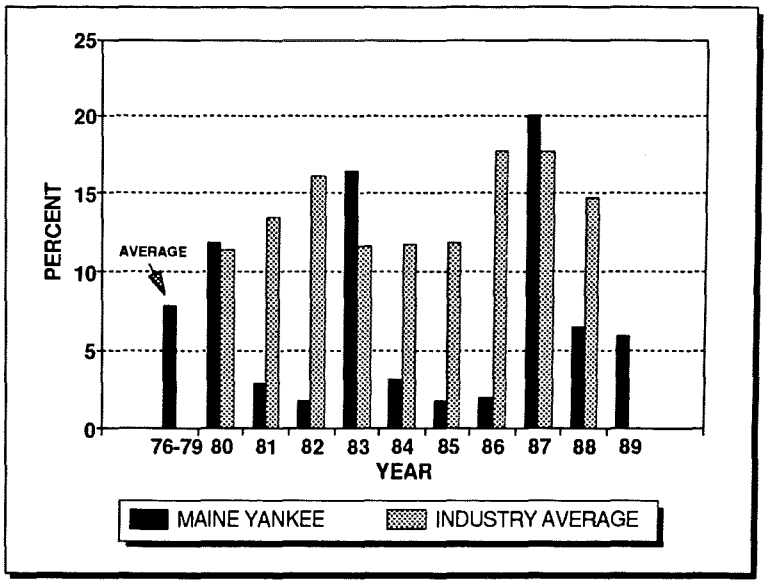

Figure 6 *Maine Yankee annual forced outage rate compared to U.S. pressurized water reactor industry.*

In all, the major performance indicators suggest that not only has Maine Yankee operated efficiently in 1989, but also that it operated better than average, with indications of incremental improvement since 1980.

2.2 ON-SITE NUCLEAR SAFETY

The following on-site safety review discusses activities within the Maine Yankee plant boundary which have an impact on overall plant operations.

2.2.1 NRC REPORTS AND INSPECTIONS

2.2.1.1 NRC SALP REPORT

The authority to regulate activities at Maine Yankee primarily rests with the Nuclear Regulatory Commission (NRC).[3] The NRC conducts plant inspections and technical reviews on an ongoing basis at Maine Yankee to assure the plant is operating in compliance with Federal regulations. In addition to the routine NRC inspections of the Maine Yankee plant, (of which there were 22 in 1989), at 18-month intervals a comprehensive assessment of Maine Yankee's operation is performed called a Systematic Assessment of Licensee Performance (SALP). The purpose of the SALP review is to provide (1) a rational basis for allocating NRC resources and (2) meaningful guidance to licensee management on promoting quality and safety of plant activities.

The most recent NRC SALP review for Maine Yankee was released on February 20, 1990, assessing the performance for the period August 1, 1988 to October 31, 1989. The functional areas assessed and ratings are indicated Table 1; and a pie chart depicting the NRC inspection hours for each area is shown in Figure 7. Each area reviewed is given a rating of one, two or three -- a one indicating the utility's management is safety oriented and a three indicating that although the utility meets regulatory standards, its overall performance is marginal and

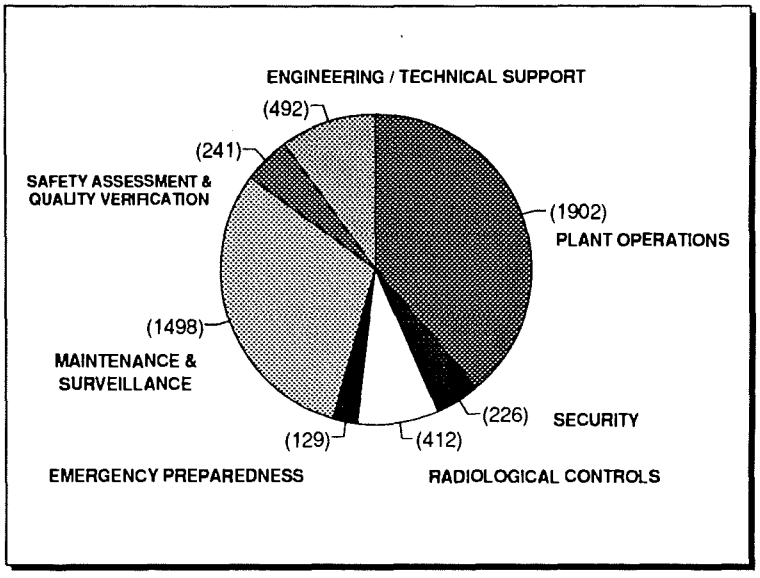

Figure 7 *NRC inspection hours of Maine Yankee for SALP period August 1, 1988 to October 31, 1989.*

[3] Atomic Energy Act of 1954 as amended (42 U.S.C. 2011) requires the Nuclear Regulatory Commission to ensure that nuclear power plant activities are conducted in a manner that protects public health and safety.

warrants attention. In addition, at the close of the SALP review the ratings are assessed as improving or declining.

As shown in Table 1, Maine Yankee's most recent SALP review, as compared to the previous period, has improved by a unit in the area of Radiological Controls and decreased by a unit in the category of Emergency Preparedness, with the other areas remaining unchanged. All areas of Maine Yankee's operation received good marks, with Plant Operations and Maintenance/Surveillance receiving the highest marks. For this period, no area was rated as "category 3", which would indicate a need for considerable attention and improvement.

Table 1

MAINE YANKEE

SALP PERFORMANCE TABULATION

Functional Area	Rating Last Period*	Trend Last Period	Rating This Period**	Trend
A. Plant Operations	1	--	1	--
B. Radiological Controls	3	improving	2	--
C. Maintenance/Surveillance	1	--	1	--
D. Emergency Preparedness	1	--	2	improving
E. Security	2	--	2	--
F. Engineering/Technical Support	2	--	2	--
G. Safety Assessment/Quality Verification	2	--	2	--

* February 1, 1987 to July 31, 1988
** August 1, 1988 to October 31, 1989

Performance Categories

1. *High plant and personnel performance substantially exceeds NRC requirements.*

2. *Good performance, above NRC requirements.*

3. *Performance does not significantly exceed NRC requirements.*

Of the seven areas which were reviewed by the SALP Board, Emergency Planning, Security, and Radiological Controls are particularly noteworthy and discussed below.

Emergency Planning

Emergency planning received a lower rating than the previous year. However by the end of the SALP review period, the situation was seen as improving by the NRC. The lower rating was due to staffing problems which resulted in areas of emergency planning not being effectively implemented, and some emergency staff not being properly trained. However, positive aspects of Maine Yankee's emergency preparedness activities were the addition of sirens and tone alert radios to extend the coverage of the alert and notification system, and a supportive and cooperative relationship with State and local emergency response efforts.

Security

During the previous SALP, the area of Security at Maine Yankee was downgraded from Category 1 to Category 2. In doing so, the NRC was fairly critical of Maine Yankee, and noted that management was insensitive to the need for an unambiguous security plan and implementing procedures. Moreover, the NRC noted that "There was an apparent lack of clear understanding of and commitment to the NRC's security objectives, as well as an overall complacent attitude." In response to NRC's concerns, Maine Yankee developed and implemented a security improvement plan.

During this most recent SALP period, Security was rated unchanged at Category 2. The NRC remarked that the first third of the assessment period, Maine Yankee's security showed deterioration. Some of the deficiencies noted by the NRC were revisions in Maine Yankee's security plan which were compliance oriented, excessive mandatory overtime for security workers which resulted in a decrease of morale, a disrespectful attitude toward Maine Yankee security force members by plant employees, and weak training of security personnel in NRC requirements. In addition, NRC security inspections during this last SALP period identified several violations, one resulting in a civil penalty in February 1989. The numerous deficiencies escalated NRC attention and enforcement of Maine Yankee's security program. NRC reported that Maine Yankee responded to NRC concern's with significant management attention resulting in a sizable expenditure of capital and staff resources to improve the program. The NRC recommended that Maine Yankee continue to identify and correct weaknesses in its security program. During the refueling outage in April 1990, the NRC will be inspecting Maine Yankee's security performance.

Radiological Controls

Radiological Controls at Maine Yankee improved from the previous SALP review. This area was previously rated as Category 3, improving, and was upgraded to Category 2. The deficiencies noted by the NRC in the last SALP were in the management and supervisory oversight of the occupational radiation protection program, in the adequacy and implementation of program procedures, and in self-identification and corrective action for radiological concerns. NRC's concern over minimum performance in this area is that adequate measures were not being taken to reduce radiation exposure. The result of Maine Yankee's inadequate performance in this area is reflected in the total personnel radiation exposure which has been above the industry average since 1985. (See Figure 19 in section 5.1 of this report).

Since receiving the low rating in the area of radiological controls from the previous SALP review, Maine Yankee initiated corrective actions to address NRC's concerns. In particular, Maine Yankee implemented a Radiation Protection Improvement Plan which is broad reaching and addresses issues of radiation protection from the management level to the training of the individual employee. The NRC recognized considerable improvement in Maine Yankee's radiological control program since the last SALP review, and upgraded their performance to Category 2. The NRC remarked that Maine Yankee's progress in improving radiation protection was "commendable", but noted that improvement is still required. The NRC will be inspecting Maine Yankee prior to and during the plant's scheduled refueling outage in April 1990 to measure the effectiveness of the Radiological Protection Improvement Plan.

Within the radiological controls SALP review, the NRC also commented on Maine Yankee's performance in the areas of Radiological Effluent Monitoring and the Radiological Environmental Monitoring Program (REMP) as being effectively implemented. In the area of transportation and solid radioactive waste, the NRC found Maine Yankee's functions were adequately performed, but noted deficiencies in the radwaste manifests, reflecting upon weaknesses in management's oversight in this area. Maine Yankee has taken measures to address this deficiency.

It should be noted that the SALP review is not only focused on locating deficiencies, but also evaluates and recognizes the many aspects of the operation which have a positive impact on nuclear safety. Some of these mentioned in the SALP report are:

-- The Morning Managers' meetings which were evaluated as *"particularly effective and promoted a high level of safety-consciousness."*

-- With regards to the SALP review of plant operations, the report stated, *"the licensee demonstrated a strong orientation toward safe operation, with good management involvement and oversight. The Operations Department exhibited professionalism and technical and operational competence."*

-- With regards to the SALP review on maintenance and surveillance, the report stated, *"In summary, maintenance and surveillance activities were well coordinated and controlled, resulting in minimal adverse impact on operations. Management was dedicated to a strong management program. Although some weaknesses were identified, a major strength of the organization was a stable, dedicated staff with competent supervision, a low turnover rate, and a well established program which generally resulted in high quality work."*

The NRC SALP Board concluded the review of Maine Yankee by describing it as one of *"safe and conservative overall performance."*

2.2.1.2 NRC Violations

For 1989, the NRC issued 13 violations to Maine Yankee. Violations are issued when a licensee is not in compliance with NRC regulations and/or guidelines. Since the NRC's regulatory requirements have varying degrees of safety significance, NRC categorizes utility violations by five levels of severity to show their relative importance within seven areas--reactor operations, facility construction, safeguards, health physics, transportation, emergency preparedness, and miscellaneous matters. NRC assigns severity level I to violations that are the most significant, such as those involving high potential safety risk, and a severity V to violations that are the least significant and having little safety significance. Only violations of severity I, II or III may result in a civil penalty (fine) to the utility.

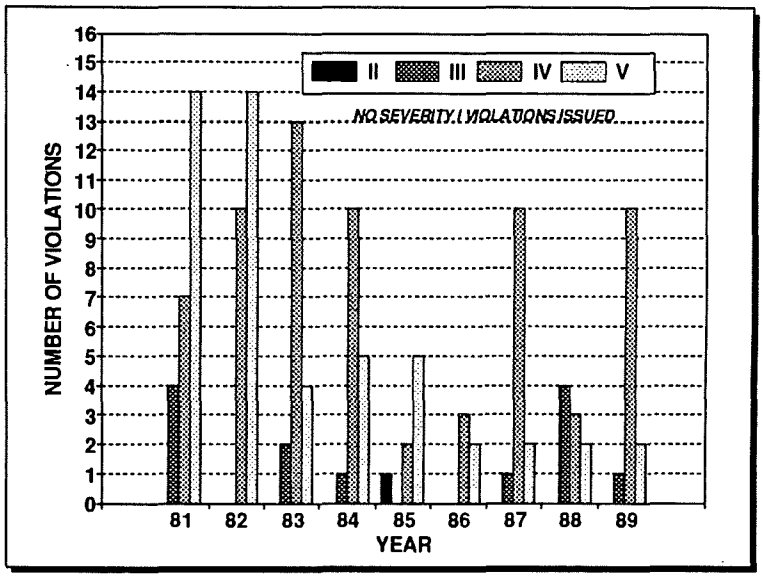

Figure 8 *History of Maine Yankee NRC violations by severity level.*

Figure 8 displays violations issued by the NRC to Maine Yankee by severity level for the years 1981 to 1989. There were 13 violations issued to Maine Yankee in 1989, ten of severity IV, two of severity V, and one of severity III. The severity III violation resulted in a fine of $75,000, due to deficiencies in security at Maine Yankee. Details on this violation are not available to the public, since it is classified by the NRC as safeguards information. According to the NRC, Maine Yankee has implemented corrective actions to address this violation and others.

2.2.1.3 Licensee Event Reports

Maine Yankee is required to file a report to the NRC within 30 days of events occurring which are specified in NRC regulations 10 CFR 50.73. These reports, called Licensee Event Reports (LER's), are considered significant, but not immediate safety issues by the NRC. In general, an LER is required when an engineered plant safety feature is actuated, including scrams (reactor shutdowns). One is required for any of the following: all losses of safety function at a system level, all significant systems interactions, all plant Technical Specification violations, and all significant internal and external threats to plant safety.

LER's give an indication of the stability of a plant's operating performance within its technical specifications, compliance to regulations, and overall safe operation. Thus, an LER may indicate a mechanical malfunction or deviation from procedures, or an event which could potentially impact safety. Maine Yankee filed six LER's with the NRC for 1989. Of the six LER's, two were due to component failures, three were due to design or manufacturing flaws, and one was the result of personnel error. A description of the LER's can be found in Appendix II.

Figure 9 is a graph depicting the frequency of LER's generated at Maine Yankee for the years 1984 through 1989. Data prior to 1984 is not shown since a change in NRC regulations concerning LER reporting requirements occurred. As is evident from the graph, in the years 1987-1989 the numbers of LER's generated were significantly reduced. This reflects reduced equipment malfunctions and personnel errors, and good engineering analysis, giving further indication of a conservative and safe operation at the Maine Yankee Station.

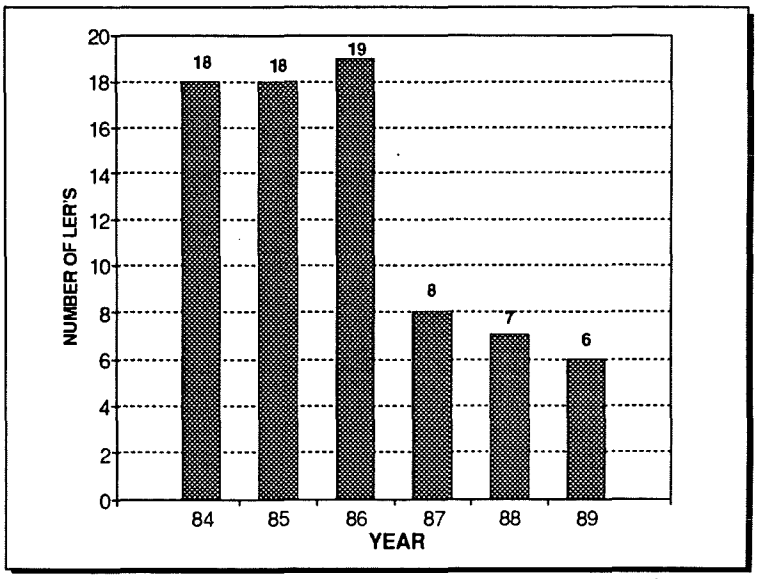

Figure 9 *Annual history of Maine Yankee Licensee Event Reports filed with the NRC.*

2.2.1.4 UNRESOLVED SAFETY ISSUES

As U.S. reactor experience and reactor technology advance, the NRC is made aware of safety issues which it subsequently asks nuclear plant licensees to resolve. Currently Maine Yankee has four Unresolved Safety Issues (USI) to complete. They are as described below:

1. Anticipated Transients Without Scram (ATWS) per 10 CFR 50.62

   An ATWS is an expected operational transient (such as loss of feedwater, loss of condenser vacuum, or loss of off-site power), which is accompanied by a failure of the reactor trip system (RTS) to shut down the reactor. The ATWS Rule requires specific improvements in the design and operation of commercial nuclear power facilities to reduce the likelihood of a failure to shut down the reactor following anticipated transients and to mitigate the consequences of an ATWS event.

   Maine Yankee's expected date of resolution for this issue is January 31, 1992.

2. Station Blackout

   Station Blackout refers to the loss of all alternating current (a.c.) electric power (from both normal off-site and emergency on-site sources) to the nuclear power plant. In the event all backup power sources are not available to operate the emergency systems for the reactor, the ability to cool the reactor core would be dependent on the availability of systems that do not require a.c. power sources and on the ability to restore a.c. power in a timely manner. The station blackout rule requires that all nuclear plants be capable of coping with a station blackout for some specified period of time beyond which, experience has shown, there is a high probability of off-site powers being restored.

   Maine Yankee has met the requirements of the rule, and received preliminary NRC approval in June 1989.

3. Seismic Qualification of Equipment in Operating Plants

   As technology has progressed, the design criteria and methods employed for the seismic qualification of mechanical and electrical equipment in nuclear power plants have changed significantly. Therefore, the seismic qualification of equipment in operating plants requires reassessment to assure that a plant can be brought to safe shutdown condition following a seismic event.

   The NRC states there is an ongoing re-evaluation of potential industry open issues on this matter and a completion date has not been determined. In

the past, Maine Yankee has demonstrated adequate seismic design conditions to the NRC's satisfaction.

4. Safety Implications of Control Systems in Light Water Reactor Nuclear Power Plants

This safety issue involves the prevention of overfilling the steam generators by incorporating high level trip mechanisms on the steam generators and feedwater valves. Maine Yankee has already installed the necessary equipment and incorporated mechanisms to address this issue, and it sent a letter of response to the NRC in March 1990.

The NRC is presently reviewing Maine Yankee's response to this safety issue.

2.2.2 REPORT FROM THE STATE NUCLEAR SAFETY INSPECTOR

2.2.2.1 Mandate of the State Nuclear Safety Inspector

Legislation signed by Governor McKernan on January 29, 1987 established the State Nuclear Safety Inspector Program for the on-site monitoring, regulatory review, and oversight of the operations of commercial nuclear power facilities within the State that hold an operating license issued by the United States Nuclear Regulatory Commission. To accomplish the on-site activities necessary to assure the safe operation of a nuclear facility, the legislation established a State Nuclear Safety Inspector (NSI) position within the Department of Human Services.

The Office of the State Nuclear Safety Inspector was established at the Maine Yankee plant with the hiring of the NSI on February 6, 1989. The NSI undertook the responsibility of monitoring Maine Yankee, e.g., monitoring storage and transportation of low-level radioactive waste, observing NRC inspections, and overseeing the State's newly acquired and installed remote radiation monitoring system installed in proximity to Maine Yankee.

Outlined below are the more significant activities at Maine Yankee which were monitored and subsequently reported in the NSI's 1990 Annual Report.

2.2.2.2 NSI Review of Major Plant Activities

Reactor Power Upgrade: Maine Yankee received approval in July 1989 from the NRC to increase the reactor power from 2630 Megawatts thermal to 2700 Megawatts thermal. The purpose of the power upgrade was to increase the

electrical output of the plant by approximately 20 Megawatts, which is equivalent to a small hydroelectric station. The NRC, in its evaluation of the power upgrade, concluded there was no significant reduction in safety in operating the Maine Yankee reactor at the new power level of 2700 Megawatts thermal. Also, other plants similar to the Maine Yankee design have received power upgrades with no significant safety implications. Maine Yankee informed the State of all the details related to this change in their operation.

Maine Yankee implemented the reactor power upgrade plan in July 1989. However, due to design limitations the plant could only achieve 2650 Megawatts thermal. To correct this problem, Maine Yankee will be installing a new high pressure turbine during the April 1990 refueling outage, and a new generator in the fall refueling outage of 1991 (which will increase electrical production by 20-25 Megawatts in addition to the 20 Megawatt increase from the installation of the new high pressure turbine). The NSI will continue to monitor the implementation of the reactor power upgrade.

Spent Fuel Pin Consolidation Project: Maine Yankee, in pursuit of increasing the storage capacity of the spent fuel pool, attempted to consolidate eight spent fuel assemblies into five. However, various difficulties occurred in the process. In consequence, Maine Yankee placed the program on indefinite hold and began efforts to research and assess other options available for spent fuel storage. Maine Yankee has notified the State that a decision on a spent fuel storage plan will be reached in 1992.

The expansion of spent fuel capacity at Maine Yankee is an issue discussed in Section 6.1.

Improving Radiological Control Practices at Maine Yankee: Maine Yankee's performance in minimizing radiation exposure to workers required improvement as indicated by the NRC SALP board. Management responded to NRC's concerns by implementing a Radiological Controls Improvement Plan in August 1989. The plan has resulted in significant improvements, recognized by the NRC. In addition, the NSI has observed a new healthy awareness within the plant to reduce radiation exposures.

Annual Emergency Exercise: On November 15, 1989, Maine Yankee conducted its annual emergency exercise. The NSI participated in this drill and was satisfied with Maine Yankee's performance.

2.3 OFF-SITE SAFETY

This section details and addresses the public and environmental impact from the routine releases of liquid and gaseous radioactive effluent from the Maine Yankee Nuclear Station.

2.3.1 Radioactive Gaseous Releases

Radioactive gaseous releases from Maine Yankee to the environment in 1989 were the lowest on record for the 1980's. In 1989 Maine Yankee had 44 gaseous releases, which totaled about 23.5 Curies.[4,5] About 75% of the total release occurred as the result of two shutdowns (in November and December of 1989) to repair reactor coolant pump seals.

The release of radioactive noble gases accounted for the majority of the radioactivity. Figure 10 shows the record of Maine Yankee noble gas releases since 1980. Maine Yankee's release of 17.5 Curies in 1989 is the lowest since the plant began operation in 1972, and that level is well under the Federal Limit of 100,000 Curies. Figure 11 shows the Maine Yankee record for gaseous Tritium releases since 1980. For 1989, Maine Yankee released 5.95 Curies of gaseous tritium, which is about ten percent of the allowable Federal Limit. Halogen gaseous releases, as shown in Figure 12, were well below the Federal Limit of 30,000 milliCuries, equal to 0.151 milliCuries for 1989. The amount of halogens released from Maine Yankee have been steadily declining since 1986. This is an indication that Maine Yankee has been successful in obtaining quality fuel which is not burdened with leaks. The result of leaking fuel can be seen by the elevated gaseous releases from Maine Yankee in the years 1980 and 1986, as shown in Figure 10 and 12.

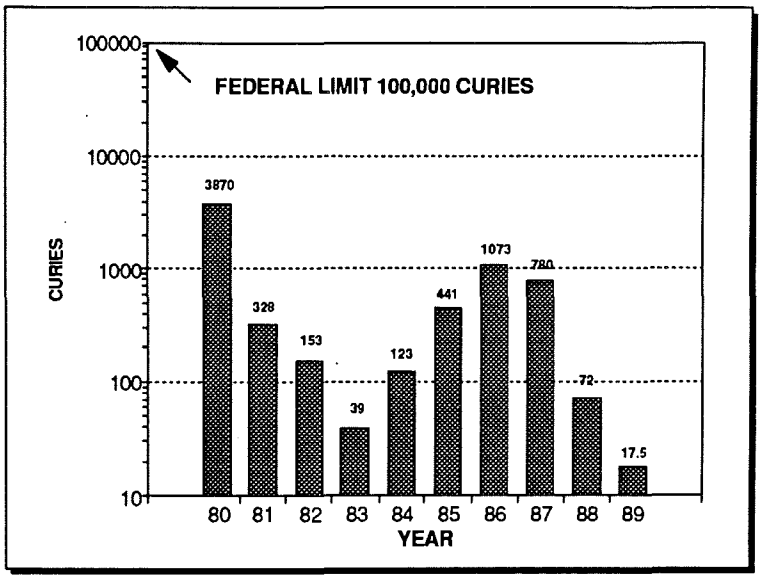

Figure 10 *Annual quantity of noble gaseous releases from Maine Yankee.*

[4] The Curie is a measure of radioactivity equaling 37 billion nuclear disintegrations per second. A typical home smoke detector contains 0.000001 Curies of radioactivity, which equals 37,000 disintegrations per second.

[5] Semi-Annual Effluent Release Reports from Maine Yankee to the Nuclear Regulatory Commission.

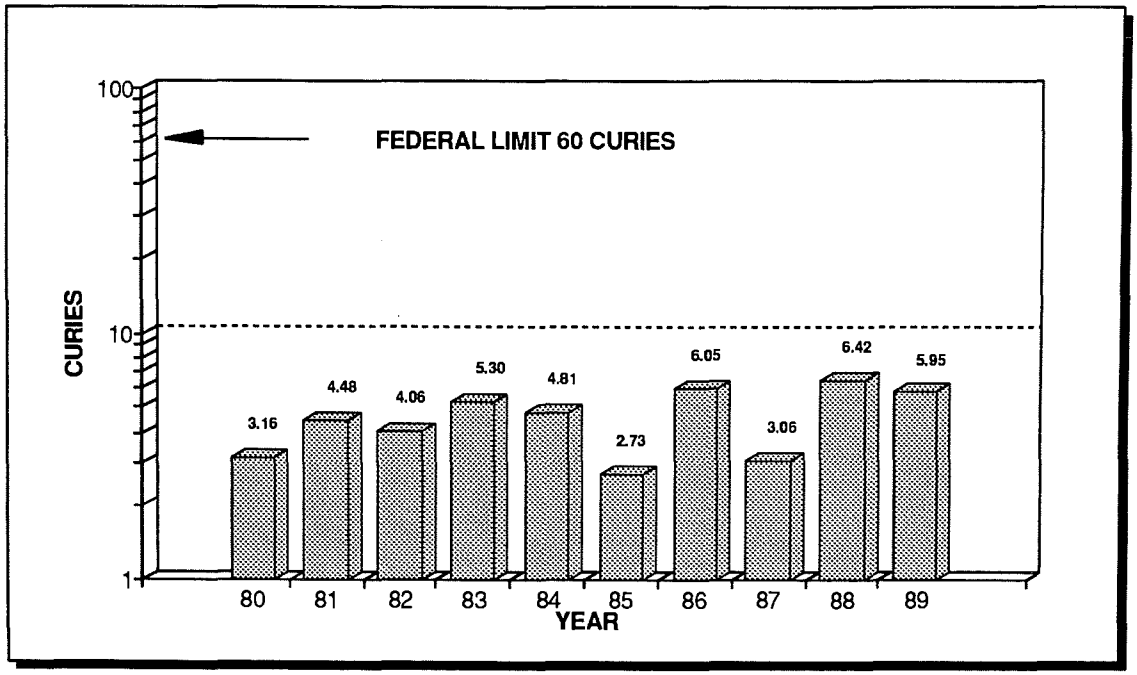

Figure 11 *Annual quantity of gaseous Tritium released from Maine Yankee.*

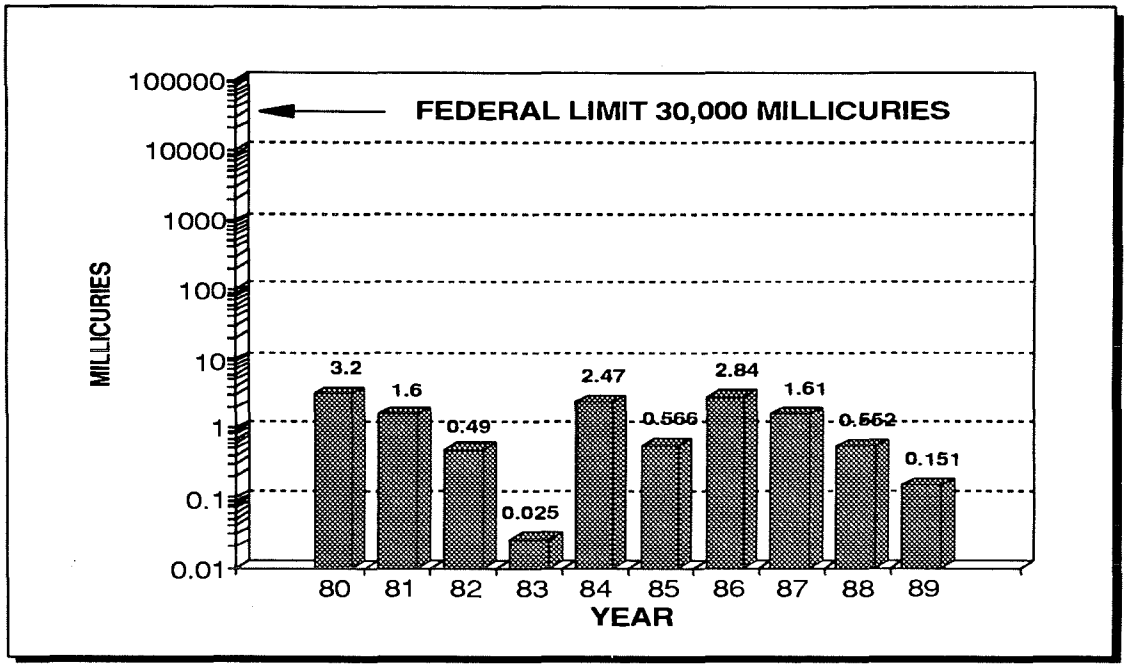

Figure 12 *Annual quantity of gaseous halogens released from Maine Yankee.*

The estimated dose from all the radioactive gaseous releases from Maine Yankee for 1989 to members of the public living near the plant is 0.0058 millirem.[6,7] For comparison purposes, the average person receives an annual dose of 200 millirem from sources of natural radiation. In conclusion, there appears to have been no undue risk to the public health and safety or impact to the environment from the gaseous releases at Maine Yankee in 1989.

2.3.2 Radioactive Liquid Releases

Radioactive liquid releases from Maine Yankee were elevated from previous years. For 1989, Maine Yankee had 132 releases totaling 422.48 Curies, of which approximately 99% was radioactive Tritium.[5] The increase in liquid radioactive effluent released was primarily due to a reactor coolant pump seal failure which occurred on November 6, 1989 and resulted in approximately 3000 gallons of seal water requiring reprocessing prior to being discharged as a routine release.[8] Figure 13 depicts Maine Yankee's record for Tritium liquid effluent releases since 1980. It is shown that Maine Yankee's releases have consistently been well below the Federal Limit of 48,000 Curies. The liquid releases of fission and activation products from Maine Yankee also have been substantially below the Federal Limit of 60 Curies, as shown in Figure 14. Calculated doses to members of the public living in proximity to Maine Yankee from the release of liquid effluent are estimated at 0.0011 millirem[5]. This level poses no undue risk to the public health, safety or the surrounding environs.

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[6] The unit "millirem" is a measure of health risk from the cancerous and/or genetic effects from radiation dose.

[7] Estimated Dose and Meteorological Summary Reports from Maine Yankee to the Nuclear Regulatory Commission.

[8] See Appendix I for a description of Reactor Coolant Pump #1 Failure.

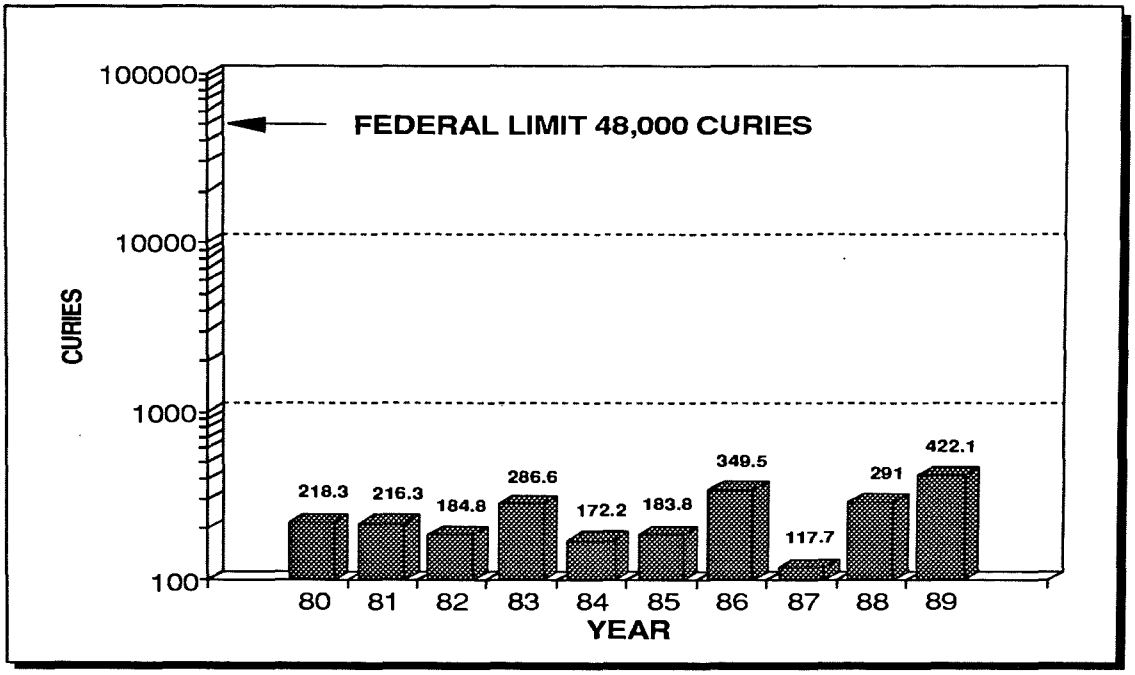


Figure 13 *Total annual Tritium liquid effluent releases from Maine Yankee.*

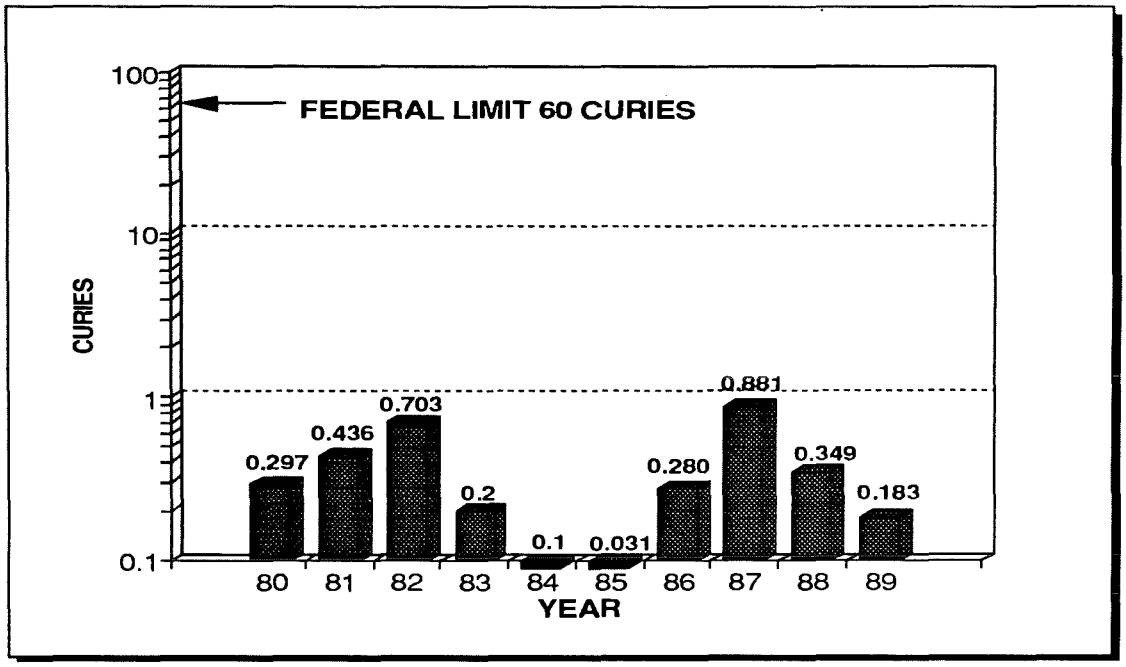


Figure 14 *Annual release of liquid fission and activation products from Maine Yankee.*

2.3.3 Low-Level Radioactive Waste

Maine Yankee had a total of 24 outgoing shipments of low-level radioactive waste (LLRW) in 1989, with a total volume of 13,078.9 cubic feet. Of the total, ten (shipments totaling 10,377.6 cubic feet) were sent for volume reduction prior to disposal. In 1989, Maine Yankee generated 4928.7 cubic feet of LLRW, of which 4324 cubic feet was dry active waste (DAW), with the remaining 604.7 cubic feet being processed liquid waste (such as resins, filters, and evaporator bottoms). The total volume of LLRW buried in out-of-state facilities in 1989 was 6977.6 cubic feet, with an activity of 267.25 curies.

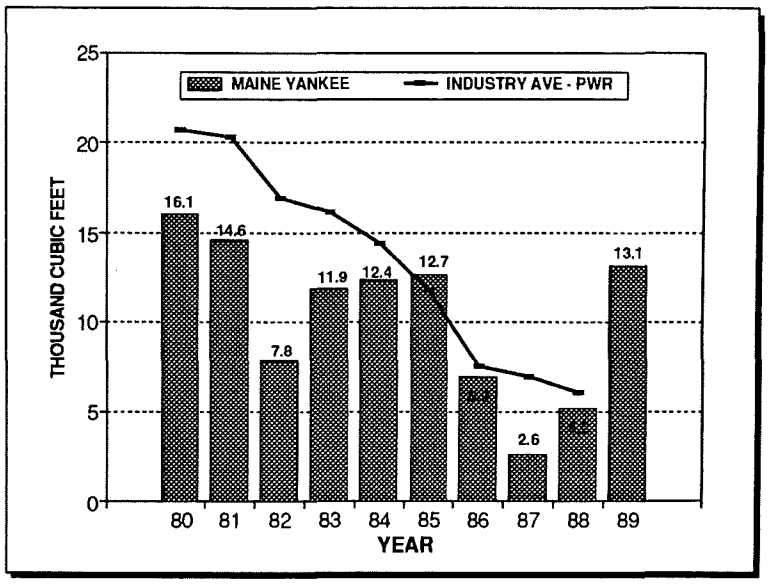


Figure 15 *Annual volume of low-level radioactive waste shipped from Maine Yankee compared to the U.S. pressurized water reactor (PWR) industry.*

Figures 15 and 16 display the Maine Yankee record for Volume and Curies, respectively, of low-level radioactive waste shipped since 1980. All U.S. nuclear power plants, including Maine Yankee, have made progress in reducing the volume of LLRW, as shown in Figure 15. The increase in volume shipped in 1989 may at first appear high since it was a non-refueling year. However, this is due to LLRW generated from the 1988 fuel outage but shipped in 1989. There were no transportation incidents reported for items shipped in 1989.

Until the end of 1992, it is expected that the majority of the LLRW will be disposed at the Barnwell, South Carolina facility, although a substantial portion is expected to be

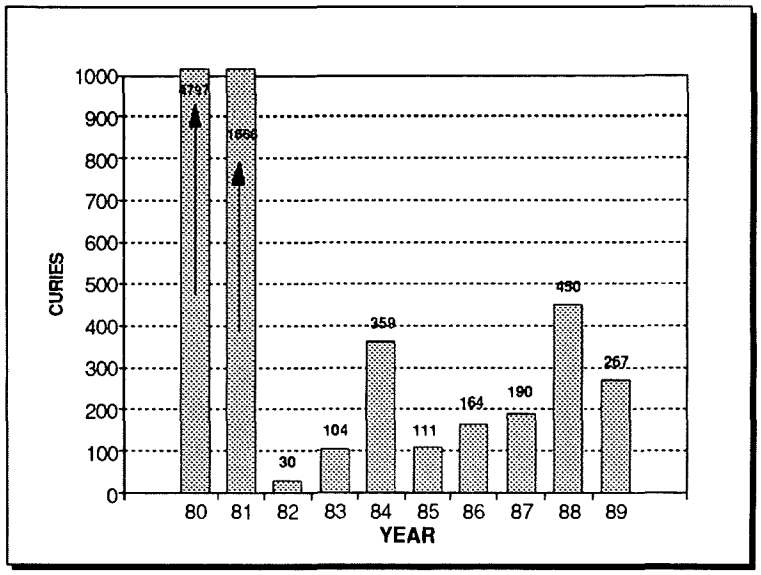


Figure 16 *Annual quantity of radioactivity in low-level radioactive waste shipped from Maine Yankee.*

trucked to the Beatty disposal facility in Nevada. As of 1993, it is expected that present disposal facilities will no longer be available to Maine Yankee or other generators of LLRW in the State of Maine. The State is presently pursuing several avenues simultaneously to assure Maine Yankee, as well as other generators in Maine, will be able to safely manage LLRW after 1993. In brief, the options being pursued by the state are as follows:

COMPACT OR CONTRACT OPTION

The Governor's Office is pursuing a compact or contract with another state or compact region to accept Maine's LLRW. Negotiations by the Public Advocate have resulted in a proposal to the State of Texas to form a compact with Maine. The proposal, submitted to Texas in January 1989, required that Texas be the host state for the LLRW facility. Texas is now considering the proposal. Also in 1989, the Public Advocate successfully negotiated a three-year contract with the Rocky Mountain compact, which guarantees Maine generators access to the LLRW facility in Beatty, Nevada to the end of 1992. The required ratification by Maine voters was obtained in November 1989. A compact or contract with another state to accept Maine's LLRW is the preferred option and will continue to be pursued by the Public Advocate. Under Maine law, voters must ratify any contract or compact for out-of-state disposal of LLRW.

LOW LEVEL RADIOACTIVE WASTE FACILITY IN MAINE

The State of Maine established the Low Level Radioactive Waste Authority (Authority) in November 1987 to site, construct, and operate a LLRW disposal facility in Maine, if necessary. Because there is a possibility that out-of-state disposal facilities will close prior to Maine having LLRW disposal capability, the Authority successfully pursued legislation in 1989 to site, construct and operate a storage facility after 1993. The Authority is presently engaged in attempting to site a disposal facility proposed for operation in 1996. However, Maine legislation provides that the Authority may pursue the development of an interim storage facility in the event that procurement of a permanent disposal facility is delayed, and on-site storage of LLRW by Maine generators becomes unmanageable. Such a facility would probably not become available before 1995. Thus, the Authority's plans contemplate that on-site storage may be necessary during the three-year interim period.

Regardless of the success or failure of the options being pursued by the State for LLRW management, Maine Yankee has the capability and a license from the Nuclear Regulatory Commission to store LLRW on-site for a period of five years. If storage requirements for LLRW extend beyond five years, the capacity of the Maine Yankee facility could accommodate some extra years, depending upon Maine Yankee's success in LLRW volume reduction. Storage beyond five years would require Maine Yankee to apply to the NRC for a license extension. Whether an extension would be granted is unknown since the NRC has never processed an application and has not developed any guidelines. In any event, storage of LLRW beyond five years enters the realm of long-term storage where the effects of the

storage environment upon the LLRW should be considered. As an example, some factors which should be considered are the LLRW container integrity over an extended period of time in a storage environment, additional radiation exposure to workers and unidentified radioactive pathways to the environment.

In conclusion, it is expected that Maine Yankee will be able to properly and safely manage its LLRW until 1998. However, should there come a time when Maine Yankee must consider on-site storage of LLRW, and a potential exists that storage may extend beyond five years, the State should investigate the impact of the storage environment upon the LLRW and container integrity.

2.3.4 Environmental Radiation Monitoring Network

Installed within a one-mile radius of Maine Yankee are seventeen remote radiation monitors controlled and operated by the State. The monitors continuously transmit radiation dose data to a central computer in the NSI's office at Maine Yankee. The purpose of the ERM network is to detect and record radiation dose levels from radioactive gaseous discharges at Maine Yankee. Though the sensitivity of the system has not been fully defined, there is confidence that it is adequate to detect a significant release from the plant. To date, the ERM network has not detected any releases from Maine Yankee. However, the ERM network has measured radon buildup from advancing weather fronts, an indication that the system is capable of measuring very low levels of radiation. As a task for 1990, the NSI plans to develop a calibration program for the system, to determine its precision and accuracy.

2.3.5 Volunteer Monitoring Program

Within a ten mile radius of Maine Yankee, radiation monitors are made available to the public for the detection of radioactive releases from Maine Yankee. In 1989, 40 person's volunteered to participate in this Volunteer Monitoring Program which is managed by the Division of Health Engineering (DHE). Citizens who participate record radiation data on a weekly basis and report their findings to DHE on a monthly basis. To date, all data received from the public indicates normal levels of radiation as expected from natural background sources.

2.3.6 Environmental Radiation Surveillance Programs

The Radiation Control Program within the Division of Health Engineering has an ongoing program of collecting environmental samples, to be analyzed by the Public Health Laboratory for radioactivity. The purpose of the program is to determine if there is any radioactive contamination in the environment resulting from releases of radioactive gaseous and liquid effluent at Maine Yankee. On a routine basis, the DHE collects samples of fresh water, salt water, seaweed, vegetation, milk, fish, sediment and air to test for radioactivity. A list of DHE sampling program items, with the number of stations sampled, and the frequency of testing is provided in Appendix III. Analyses of samples collected for 1989 have been completed and

reviewed by the Division of Health Engineering. Other than the seaweed samples, no detectable quantities of radioactivity were found which could be attributed to the Maine Yankee operation. Seaweed samples did reveal trace amounts of certain radionuclides which can only have been produced by the Maine Yankee operation. However, seaweed tends to concentrate radionuclides (which is the reason why it is sampled), and the quantities found approach the limit of instrument detection and do not pose any risk to public health. The natural radioactivity found in the seaweed far exceeds that which is attributable to the Maine Yankee Station.

On a routine basis, the DHE also collects environmental samples for the NRC to analyze. The samples collected are shown with an asterisk in Appendix III. Samples analyzed by the NRC did not show any significant radioactivity attributable to the Maine Yankee plant.

The NRC and the DHE have placed radiation detectors, called Thermoluminescent Dosimeters (TLD's) at various locations within a ten-mile radius of Maine Yankee. The purpose of these detectors is to establish the background radiation level. However, if a significant radioactive release occurred at Maine Yankee the TLD's would record the radiation dose. Data collected from the NRC and State TLD's since the initial operation of Maine Yankee in 1972 have not detected any levels of radiation beyond what could be expected from natural background.

In addition to the State and NRC programs to monitor environmental radiation, the NRC requires Maine Yankee to do the same. Appendix IV lists the samples collected, number of locations per sample, and the frequency of collection per sample for the Maine Yankee environmental radiation program. Environmental samples are analyzed by an independent laboratory, which in this case is the Yankee Atomic Electric Company Environmental Laboratory in Westborough, Massachusetts, and quarterly reports of the analysis are made available to the State. Reports received for 1989 reveal that no samples were found to have significant quantities of radioactivity which can be attributable to the Maine Yankee plant.

Of noteworthy interest, some of the samples collected, such as the fish and sediment, are split between the State and Maine Yankee for comparative analysis. Results of these results indicate a good laboratory precision between the State and the Yankee Atomic Laboratory.

2.3.7 Maine Yankee Emergency Planning

In the event of a radiological emergency at Maine Yankee, the State and Maine Yankee have emergency plans to protect the health and safety of the public. On a biennial basis, Maine Yankee, the State and local officials, all or in part, participate in an emergency exercise to assure the plan is well maintained and adequate to protect the public.

The last Maine Yankee emergency exercise, where State and local governments participated, was held on June 7, 1987. The Federal Emergency

Management Agency monitored this exercise and reported in May 1989 that while most of the exercise objectives were met, some were not. FEMA noted eight deficiencies which were primarily focused on alert and notification requirements within the ten-mile Emergency Planning Zone (EPZ). Most of the deficiencies were addressed by Maine Yankee through improved training or revisions to State and community plans. However, the primary deficiency involved the Public Emergency Alert System (PEAS), whose purpose is to notify residents within the ten-mile EPZ of a test or a real emergency. Originally residents within the ten-mile EPZ were notified by eight sirens and approximately 108 "Paul Revere" routes. FEMA's primary criticism of the PEAS was that some areas within the ten-mile EPZ were not alerted in the allotted time, and that a dependency upon "Paul Revere" routes is not a preferred or adequate method of notification. Maine Yankee responded to FEMA and the State's concerns by improving the PEAS, increasing the siren coverage from eight to 37 sirens and utilizing tone alert radios, which reduced the number of "Paul Revere" routes from 108 to ten. The majority of the work in installing the additional sirens and distributing some 500 tone alert radios was accomplished in 1989, and is expected to be completed, along with resolving other deficiencies noted, by Summer 1990.

Since the last full participation exercise at Maine Yankee was held in 1987, the next one was scheduled for November 1989. However, because FEMA was unable to observe the exercise as scheduled, due to demands on the agency associated with the hurricane damage in South Carolina and the major earthquake in California, the full exercise was cancelled for 1989 and rescheduled for July 31, 1990. Although a full participation exercise did not take place in 1989, State and local governments participated on a limited basis with Maine Yankee's emergency exercises four times in 1989. In addition, emergency preparedness training sessions were conducted last year for each of the sixteen communities and two counties in the ten-mile EPZ. Based on reports from the NRC, FEMA and MEMA, and our observations, there is reasonable assurance that measures to protect the public are adequate and can be implemented in the event of a radiological emergency at Maine Yankee.

3. SEABROOK

The Seabrook Nuclear Power Station is located in the State of New Hampshire, approximately 13 miles south of the Maine border in Kittery. Because of opposition from the State of Massachusetts reflecting concerns about the adequacy of Seabrook's emergency plan, the plant's start up had been delayed for years. However, on May 26, 1989 the Nuclear Regulatory Commission issued a low power test license to Seabrook. The plant subsequently received its full power license on March 1, 1990.

The normal operation of Seabrook is not expected to have an adverse impact on the public health and safety or the environment in New Hampshire, Massachusetts or Maine. During normal operation, Seabrook will be discharging radioactive effluent into the environment; however, the quantities are strictly regulated such that there is no undue risk to the public or adverse effect on the environment. Considering the distance from Seabrook to the southern Maine border exceeds ten miles, releases of radioactive gaseous effluent during normal plant operations will undergo considerable dilution such that radiation exposure in Maine will be negligible, as well as undetectable. The release of any radioactive liquid effluent from Seabrook would also undergo considerable dilution and is not expected to be of concern.

However, to assure that there is no adverse impact on the public and environment, the Division of Health Engineering currently has an environmental radiation monitoring program which consists of the following:

-- 15 TLD's are placed in York County to monitor cumulative radiation dose on a quarterly basis.

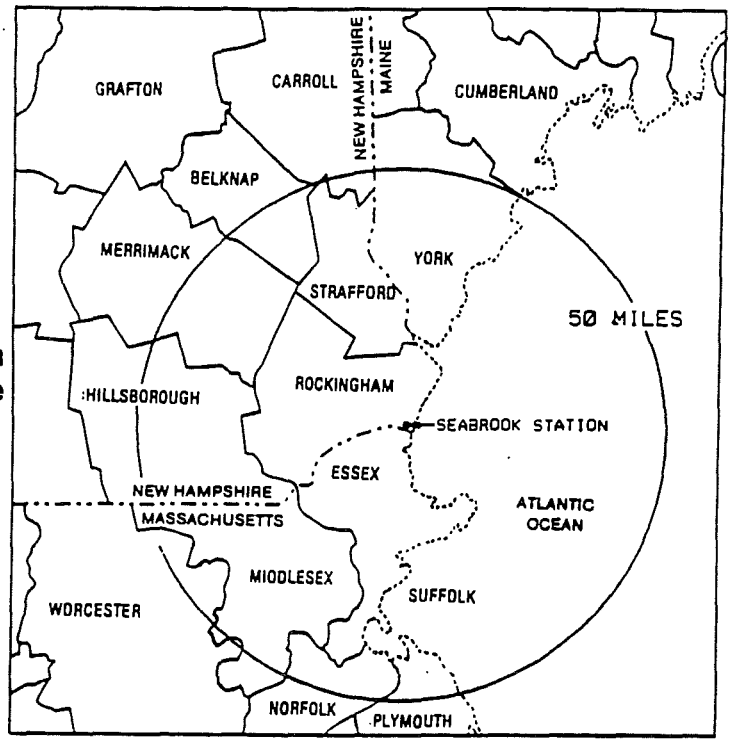
-- Water samples are collected from Boulter Pond (the public drinking water supply for Kittery) and analyzed for radionuclides on a quarterly basis.

-- Seaweed samples are collected at Moody Beach and Kittery Point and analyzed for radionuclides on a quarterly basis.

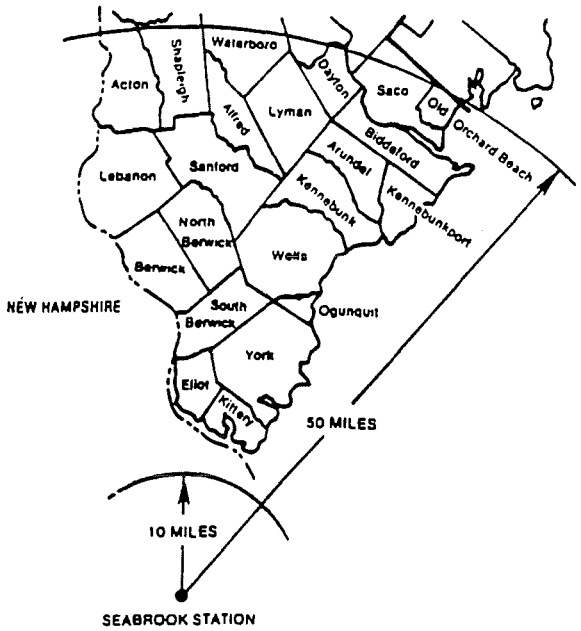
A radiological emergency at Seabrook Station will affect the State of Maine to the extent that York county is within the ingestion pathway zone, which is the area surrounding the power plant within 50 miles where the primary concern is the effects of radioactive releases on the food chain. The ingestion pathway zone for Seabrook is shown on Map 1. The State of Maine has an Ingestion Pathway Plan approved by the Federal Emergency Management Agency to mitigate the effects of radioactive releases on the food chain in a radiological emergency. This plan has been successfully exercised in June 1988 with the Seabrook Station and the State of New Hampshire. The next emergency exercise with Seabrook is planned for December 1990.

MAP 1

Seabrook Station Ingestion Zone



TOWNS IN YORK COUNTY



COMMUNITIES INVOLVED

Acton	Lyman
Alfred	North Berwick
Arundel	Ogunquit
Berwick	Old Orchard Beach
Biddeford	Saco
Dayton	Sanford
Eliot	Shapleigh
Kennebunk	South Berwick
Kennebunkport	Waterboro
Kittery	Wells
Lebanon	York

4. POINT LEPREAU NUCLEAR STATION

The Point LePreau Nuclear Power Station is located in New Brunswick, Canada, about 27 miles from Eastport, Maine. A portion of Washington County lies within the 50-mile radius of the plant which is designated as an ingestion pathway emergency planning zone. The ingestion pathway zone is the area where direct radiation exposure is not as much a concern as is radioactive material contaminating the food chain in the event of a radiological emergency.

State emergency planning activities with Point Lepreau have been primarily based on assuring that communication capabilities are adequate to alert and inform MEMA, the Maine State Police, and officials in Washington County. MEMA has successfully exercised the limited emergency plan with Emergency Measures Operations in New Brunswick, Canada in 1989.

A review of the effectiveness and adequacy of Maine's Point LePreau emergency plan will be reported in the 1991 State Nuclear Safety Report.

5. SPECIAL TOPICS

5.1 IMPACT OF RADIATION RISK REVISIONS

INTRODUCTION

Recently, two significant reports examining the health risks from ionizing radiation exposures have been released. They are the 1988 report of the United Nations Scientific Committee on the Effects of Atomic Radiation, (UNSCEAR 1988) and the 1990 report on the Biological Effects of Ionizing Radiation (BEIR V), of the National Research Council. Both of these reports have revised upwardly the risk estimates from radiation exposure, primarily as a result of reexamining radiation exposures linked to cancer occurrence in the Japanese survivors from the atomic bombings of Hiroshima and Nagasaki. The BEIR V report, in particular, received wide publicity in estimating that the risks of some forms of cancer are now believed to be three to four times higher. These studies have prompted governments to reevaluate radiation dose limits for the public and radiation workers. In this special topic, a preliminary discussion on the possible impact on the Maine Yankee nuclear station is given.

BACKGROUND

The BEIR V report estimated an increased level of risk from radiation exposure. However, it is important to note that there is a great deal of uncertainty in estimating radiation risks at low doses, particularly radiation doses which are below 50 times the amount received by a person each year from natural background radiation. The smaller the radiation dose, the greater the uncertainty. The uncertainty is primarily attributable to the lack of observed health effects as the radiation dose decreases. Thus, what we have is a fairly good understanding of radiation-induced health effects at high doses, and a speculative to questionable understanding at low doses. At low dose radiation exposure, such as that from natural background radiation, health effects in a population are no longer discernable, so an estimate of cancer occurrence at low doses is formulated by utilizing the known effects of radiation at high doses. In the process of predicting the effects from low dose radiation, assumptions and decisions are made which are not entirely "scientific" and involve subjective judgement. It is for this reason that there are differing views on the frequency and even existence of radiation-related health effects at low doses. Therefore, even though the radiation risk estimates have been revised upwardly, much uncertainty remains relative to their validity when applied to very low doses.[9]

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[9] The uncertainty in the revised radiation risk estimates is stated in the Executive Summary of the BEIR V report as: "The reported follow-up of A-bomb survivors has been essential to the preparation to this report. Nevertheless, it is only one study with specific characteristics, and other

DISCUSSION

The revised risk estimates are not expected to have a significant impact on the general public who receive very small doses from natural and man-made radiation sources.[10] However, it is not clear what the impact will be to those persons having occupations which involve radiation exposure. With some exceptions, radiation protection regulations in the United States and other countries permit workers to receive doses up to 25 times more per year than that received from natural background. The additional accumulated lifetime dose places the radiation workers at a statistically increased risk, and with the risk estimates being higher than previously thought, there is now a movement internationally to examine whether allowable occupational dose limits need to be reduced. In fact, in light of the new risk estimates, the United Kingdom has already issued interim guidelines recommending a reduction of the annual exposure limit for radiation workers to approximately one-third the previous limit.[11]

Whether the U.S. and other countries will adopt lower dose limits for nuclear workers depends greatly upon the findings of the International Commission on Radiological Protection (ICRP). The ICRP is currently reviewing the recommended limits on radiological exposure to nuclear workers, and is expected to issue its findings in 1990 or 1991. It is expected that the ICRP will recommend reducing radiation exposure limits by a factor of 2 or 3. Many countries will accept the recommendations unilaterally, and although the U.S. is not bound by these recommendations, it is unlikely that the U.S. Nuclear Regulatory Commission would continue to use higher dose limits than those adopted by the rest of the world. The Nuclear Regulatory Commission and the Committee on InterAgency Radiation Research and Policy Coordination are presently conducting investigations to evaluate if U.S. radiation protection regulations need revision and to determine the impact on industries and others utilizing radiation.

Though the NRC and the ICRP are not expected to release their findings earlier than 1991, there is no doubt but that the impact of dose reduction will primarily affect the nuclear power industry, for it is the nuclear worker who receives the largest average occupational dose in the U.S. The Electric Power Research

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large studies are needed to verify current risk estimates."

[10] The significance of the revised risk estimates with respect to low dose radiation received by the majority of the world population was stated in the UNSCEAR 1988 report, "The radiation doses an individual receives from various man-made sources are normally compared with the dose he receives from natural sources of radiation. An extra dose that is small in relation to the background dose will not significantly affect the individual, i.e., it will not change his total exposure situation noticeably. While the individual might still wish to avoid such a small extra dose, he would know that it does not in itself present any substantial risk."

[11] The United Kingdom issued a radiation dose guideline of 1.5 rem/year as compared to the previous regulatory limit of 5 rem/year.

Institute (EPRI) performed a study to examine the impact on the nuclear power industry and released a report titled "Implications of Possible Reduction in Radiation Exposure Limits" (EPRI NP-6291). The study found that while the U.S. nuclear industry has been successful in achieving a dose reduction, by a factor of two in recent years, the dose received by workers in this country is still high enough that dose reduction will have a significant economic impact on many U.S. utilities. However, the report states that the impact could be lessened by nuclear utilities planning and implementing steps now to reduce radiation exposure.

As with most nuclear power plants in the nation, Maine Yankee will have to substantially increase its efforts to reduce worker exposure if reduced radiation dose regulations are enacted. The magnitude of impact upon Maine Yankee can be determined by examining Maine Yankee's personnel radiological data. Figure 17 shows the annual collective radiation exposure[12] at Maine Yankee from 1980 to 1989. The years in which Maine Yankee was not refueling and/or performing major maintenance are evident from the small person-rems recorded (e.g., the years 1983, 1986, and 1989). Figure 17 also demonstrates a lower person-rem in the early eighties as compared to the mid and later eighties. This was due to the smaller work force in the early eighties. The work force increased by approximately a factor of two in the mid-eighties. Also, Maine Yankee undertook significant maintenance projects in the mid to late eighties which resulted in increasing the total radiation exposure to personnel.

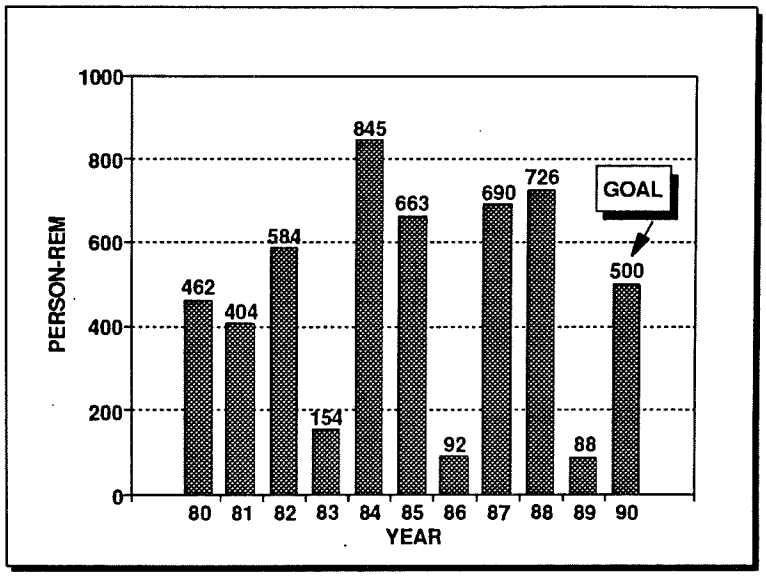

Figure 17 *Annual collective radiation dose for Maine Yankee personnel.*

Overall, it appears that Maine Yankee's radiological performance during fuel outage years beginning in 1984 has resulted in consistently elevated total person-rems. Maine Yankee has recognized the need for improvement and has reevaluated the priority of radiological protection and has set a goal of not to exceeding 500 person-rem for 1990.

[12] The annual collective radiation dose is the product of the number of individuals times their dose, e.g. if 100 persons each received a dose of 0.1 rem per year, the annual collective radiation dose is 10 person-rem.

A comparison of Maine Yankee's radiological performance with other similar U.S. plants is shown in Figure 18. This graph shows Maine Yankee's three-year average collective radiation exposure compared to the U.S. Pressurized Water Reactor (PWR) industry average. A three-year averaged dose is a more accurate representation of radiological performance since a particular year may be high or low depending on whether it was a refueling year or non-refueling year, respectively. From this graph it is evident that Maine Yankee's radiological performance was better than average from 1980 to 1984, but as the industry average began decreasing in 1983, Maine Yankee's performance did not follow the trend. This may have been due to Maine Yankee's emphasis on performing maintenance to upgrade and improve the efficiency of the plant. Maintenance activity accounts for the majority of the radiation exposure to personnel in nuclear power plant operations.

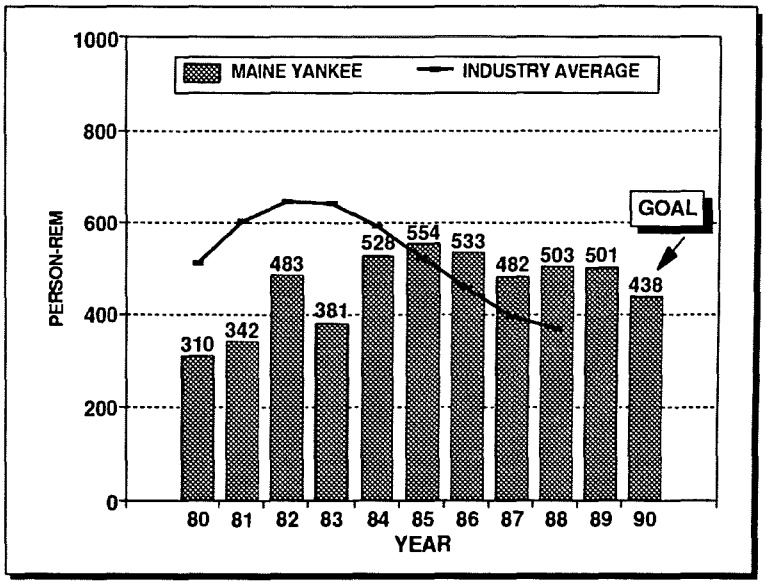

Figure 18 *Annual 3 year averaged collective radiation dose for Maine Yankee personnel and the U.S. pressurized water reactor industry.*

The potential impact of a reduced dose limit on Maine Yankee can be projected by examining the distribution of annual doses received by personnel as shown in Figure 19. This figure shows the number of persons who received annual radiation doses greater than one rem/year at Maine Yankee for the years 1985 through 1989. It is noteworthy to mention that the vast majority of Maine Yankee personnel received doses less than one rem/year. Though Maine Yankee's performance in holding down the collective radiation exposure needs improvement, they have been successful in assuring that doses to individuals are well below their self- imposed administrative limit of four rem per year, and the regulatory limit of five rem/year.

It has been suggested that the new limit may be as low as 1.5 rem/year to 2.5 rem/year. In examining Maine Yankee's individual dose record, very few persons received three rem/year and a small number of workers received annual doses exceeding two rem/year. However, as expected in the nuclear industry, a substantial number of workers (especially during fuel outage) receive annual doses between one and two rem/year. Since there are a small numbers of persons who receive doses larger than two rem/year at Maine Yankee, it is reasonable to assume that Maine Yankee would be able to cope with a revised limit of 2.5 rem/year without a substantial impact on their operation. However, revised regulations limiting exposure to 1.5 rem/year, such as the present guideline in the

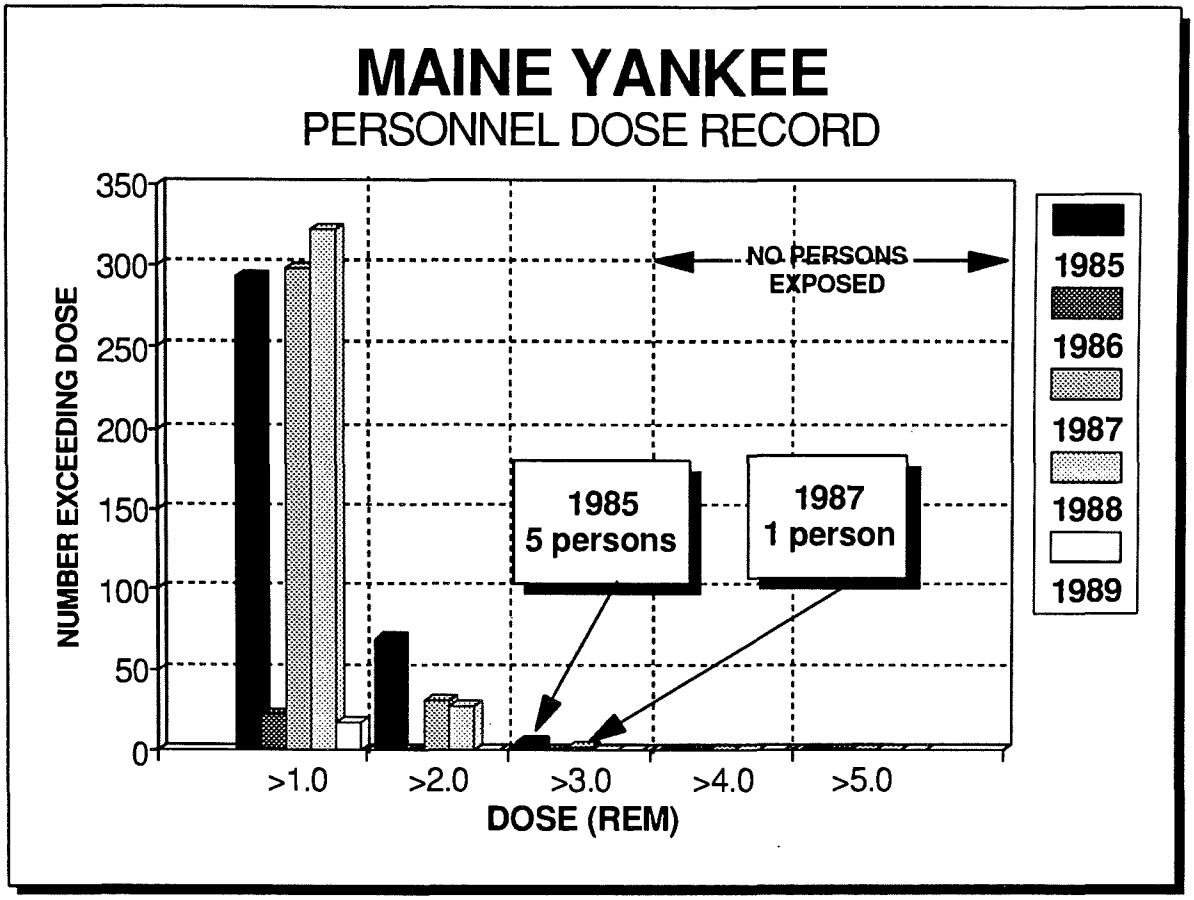

Figure 19 *Number of personnel at Maine Yankee exceeding annual doses greater than 1,2,3,4 and 5 rem.*

United Kingdom, will surely require Maine Yankee to substantially increase its efforts in radiological protection.

Though Maine Yankee is not presently preparing for possible new regulations on radiation exposure, recent improvements in their Radiological Protection Department, as noted by the NRC and the State Nuclear Safety Inspector, may reduce dose and initiate a downward trend, and thus reduce the operational and financial impact of possible reduced dose limits. An indication whether the ongoing improvements in Maine Yankee's Radiation Control Department are successful in initiating a downward dose trend will be the plants radiological performance during the 1990 outage when considerable maintenance activities are undertaken.

CONCLUSION

Overall, the impact on Maine Yankee from reduced dose regulations will depend upon their new commitment to radiological protection while continuing their efforts in maintaining and modifying the plant for improved safety, efficiency, and reliability. However, even with radiological improvements at Maine Yankee, reduced dose limits will have an operational and financial impact on Maine Yankee and other nuclear power plants in the U.S. The degree of impact is dependent on the decrease in allowable dose. Maintenance activities, in particular will be affected, such that more radiological planning and preparation will be necessary.

5.2 Construction Period Recapture

INTRODUCTION

The NRC has ruled that the duration of operating licenses (OLs) can be amended to reflect a 40-year period beginning at the issuance date of the OL rather than the issuance of the construction permit (CP). Since Maine Yankee received its CP in 1968 and OL in 1972, Maine Yankee could potentially recapture four years of operation, therefore extending its current OL expiration date of 2008 to 2012.

BACKGROUND

Prior to 1984, the duration of nuclear power plant OL's issued by the NRC were computed on the basis of a 40-year operating lifetime starting from the date of the CP for the facility. For the 78 nuclear plants licensed before 1984, five years or more elapsed from the date of issuance of the CP to the issuance of the OL. In response to requests from utilities, the NRC agreed to extend the dates of expiration of the OLs by computing the 40-year period of the license from the date of issuance of the OL.

The original reason for selecting a 40-year period for an operating license does not reflect any engineering or economic judgement about the lifetime of a nuclear power plant. The drafting of the Atomic Energy Act of 1954, in seeking some limit for an operating license, simply borrowed the amortization period of 40-years generally used by utilities for large capital investments.

DISCUSSION

To date, the NRC has granted 24 requests from nuclear power plant licensees to recapture the years spent on construction; another 22 are being processed. Applications from licensees are primarily reviewed by the NRC with respect to aging concerns, to assure that the plant can operate safely for the additional years requested. So far, the NRC has not denied an OL extension request for the recapture of years lost in construction. Of the Yankee plants in New England, Vermont Yankee is the first to request an extension. On the basis of the issuance of the OL for Vermont Yankee, it is eligible for an extension of its operating license expiration date from December 11, 2007 to March 21, 2012.

Maine Yankee has not applied to the NRC to recapture the four years while in construction, nor has it publicly stated any intention to seek license extension. However, it is probable that an application from Maine Yankee would be approved, since (1) the plant is recognized by the NRC as being well maintained, and (2) embrittlement and other aging factors do not at this time appear to be of concern with respect to the plant's continued operations.

CONCLUSION

In years to come, energy and environmental demands may lead to Maine Yankee seeking additional years of operation based on recapturing years in construction. If so, a primary concern for the State with regard to nuclear safety will be the management of the additional high and low-level radioactive waste generated in those years. However, four years of additional waste represents a small fraction of the total which would be generated under Maine Yankee's current operating license, and a solution for waste management will be needed many years prior to the expiration of Maine Yankee's current operating license. For purposes of prudent planning, the Maine Low Level Radioactive Waste Authority should consider the impact of additional wastes on storage and/or disposal plans. This recommendation is for the factual and accuracy merits of waste projecting by the LLRW Authority, rather than a recommendation for Maine Yankee to seek a license extension based on recapturing years in construction.

6. UPCOMING ISSUES

6.1 SPENT FUEL STORAGE AT MAINE YANKEE

INTRODUCTION

Maine Yankee, as with all nuclear power plants, produce highly radioactive waste in the process of making electricity. This waste is the spent nuclear fuel removed from a reactor during refueling operations. Since the beginning of Maine Yankee's operation in 1972, the spent fuel removed from the reactor has been stored on-site in a spent fuel pool. By 1996 the pool is expected to be full, having only sufficient capacity to accommodate the removal of all fuel from the reactor, if necessary.

Removal of the spent fuel from the Maine Yankee site by the Department of Energy (DOE) is unlikely to occur in time to alleviate the need to increase spent fuel storage capacity at Maine Yankee. The Department of Energy's schedule to begin operating a high level waste repository has been moved up from 2003 to 2010, for technical and legal reasons. Although the DOE is requesting Congress to approve the development of an interim storage facility to accept spent fuel by 1998, the proposed capacity will be limited and the 1998 target date is perhaps optimistic. Therefore, if Maine Yankee is to continue its operations in the late 1990's and beyond, an expansion of on-site storage capacity for spent fuel will be necessary. As discussed below, Maine Yankee has undertaken steps in the past to assure capacity for spent fuel, and it is now reexamining the options available.

BACKGROUND [13]

Approximately every 18 months, Maine Yankee undergoes a scheduled shutdown to refuel the reactor. Each refueling requires the removal of at least 72 fuel assemblies which are then referred to as spent fuel. Spent fuel is stored on-site in the spent fuel pool which has a capacity to hold 1467 assemblies. Presently the pool contains 937 assemblies, and in 1996 only 217 spaces will remain available, (enough capacity for a full core removal.)

Since the beginning of the Maine Yankee operation in 1972, the on-site management of spent fuel has required considerable revision. As planned when Maine Yankee was first constructed, the spent fuel pool was designed to handle about one and one-third cores of fuel assemblies. The intent was to store the spent fuel for a short time prior to removal and shipment to a reprocessing facility. However, it soon became apparent that reprocessing facilities would not be

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[13] From State of Maine, Division of Health Engineering, Office of Nuclear Safety, State Nuclear Safety Inspector 1990 Report.

operating in time to accept spent fuel, so in 1975 Maine Yankee applied for and received a licensed amendment permitting a reracking of spent fuel into high density racks. (Reracking is a practice of rearranging spent fuel assemblies such that more assemblies will fit in the original area.) In 1979, it became apparent that more storage capacity would be necessary at Maine Yankee, due to President Carter's position on non-proliferation which precluded reprocessing. To assure adequate storage capacity for the licensed life of the plant (2008), Maine Yankee applied to the NRC to further increase the pool capacity by the combined processes of reracking and pin consolidation. (Pin consolidation is the method whereby 84 fuel pins are removed from the assembly and placed in an assembly with smaller dimensions). Due to a safety concern with the density of the spent fuel increasing in the pool, in 1979. the State of Maine via the Attorney General's Office and Sensible Maine Power (SMP) intervened in the NRC's ruling over Maine Yankee's spent fuel capacity request. In October 1982, the NRC issued a favorable Safety Evaluation Report on Maine Yankee's proposal, and in Spring 1983 an agreement was reached between Maine Yankee, the State of Maine, and SMP such that reracking was allowed but only one fuel assembly would be consolidated as a demonstration project during that year. Maine Yankee successfully consolidated a fuel assembly that year and was granted an amendment to their license by the NRC to perform pin consolidation to 20 additional assemblies. Efforts to further consolidate fuel were postponed until July 1989 when Maine Yankee began operations to perform pin consolidation, consolidating eight fuel assembles down to five consolidated pin cages. Due to technical difficulties and a shortage of manpower, the Fuel Pin Consolidation Program was placed on indefinite hold pending an examination by Maine Yankee of the entire issue of on-site spent fuel storage. Maine Yankee is presently engaged in researching alternatives to the management of spent fuel, such as on-site dry cask storage, and it expects to present a plan sometime in 1992. The 1992 completion date is in anticipation of loss of the fuel core discharge capability in 1996 and allowance for delays due to intervenors and NRC review.

DISCUSSION

In realizing that on-site storage is eminent, the NRC and DOE have conducted research on storage alternatives, particularly the dry cask method. Dry cask storage of spent fuel is widely practiced in Europe and is utilized by several commercial nuclear power plants in this country as a method to increase spent fuel storage capacity. The technology entails placing spent fuel in a cask constructed of concrete and/or metal which rests on a steel reinforced concrete pad (typically) at the nuclear power plant site. Dry cask storage is considered to be a safe alternative to the wet storage method (or spent fuel pool) due to the passive feature of air cooling and a benign environment which inhibits corrosion. This is not to say that wet storage is not an acceptable practice for spent fuel storage. The NRC in examining the safety of dry and wet storage "has concluded that spent fuel can be stored safely and without significant environmental impact, in either wet storage, or wet storage followed by dry storage, for at least 100 years." The NRC's confidence that all aspects of safety and environmental impact have been addressed for dry cask storage resulted in the issuance of Title 10 of the Code of Federal Regulations, Part 72 which enables nuclear power plant licensees to amend their

license for the on-site storage of spent fuel using NRC approved dry casks. As part of an application to the NRC for on-site dry cask storage, the licensee is required to perform a safety analysis per 10 CFR 50.59.

If Maine Yankee were to opt to increase the capacity of their spent fuel pool, this would also require submittal of an application to the NRC for review and approval.

CONCLUSION

Maine Yankee will require increased spent fuel storage capacity, possibly sufficient capacity to accommodate the plant until its present operating license expires in 2008. There are many issues and concerns to be addressed from the States perspective, and therefore it is advisable that Maine Yankee work closely with State officials in its research and assessment of the various options available to store spent fuel. Hopefully, early collaboration would address concerns on a timely basis and lead to a solution which is acceptable to both parties.

7. 1990 WORK TASKS

The projected calendar 1990 work tasks for the Nuclear Safety Advisor include the following:

-- Evaluate activities and events at the Maine Yankee Station as required, and (1) review NRC plant inspections of Maine Yankee and (2) requests from Maine Yankee to the NRC for Technical Specifications changes.

-- Participate in emergency exercises for Maine Yankee and Seabrook.

-- Review the adequacy of Maine's radiological emergency plan for the Point LePreau nuclear station in New Brunswick, Canada.

-- Review the adequacy of Maine Yankee's gaseous and liquid effluent monitors.

-- Investigate options for spent fuel storage being considered by Maine Yankee.

-- Begin researching identified nuclear power plant aging concerns and assess how they apply to Maine Yankee.

-- Consult with the Division of Health Engineering to determine the accuracy and precision of the State-operated Environmental Monitoring System at Maine Yankee.

-- Meet with the Illinois Department of Nuclear Safety to review their monitoring program for nuclear power plants.

APPENDIX I [13]

MAINE YANKEE SHUTDOWNS FOR 1989

In 1989, Maine Yankee experienced a total of six manual and automatic shutdowns as described below.

Manual Shutdowns

EQ PENETRATION INADEQUATE QUALIFICATION

A manual shutdown of Maine Yankee occurred on February 14, 1989, caused by Environmental Qualification (EQ) discrepancies identified in the containment electrical connector seals associated with low voltage electrically operated valves and post accident monitoring instrumentation. Apparently, the EQ of the heat shrink tubing associated with 51 connectors could not be fully determined. Because of the large number, Maine Yankee decided to shutdown and repair the connector seals. The seals were repaired and the plant was returned to power on February 21, 1989.

MFRV #3 VALVE STEM FAILURE

Upon returning the plant to power on February 22, 1989 after a shutdown on February 14, 1989 to repair containment penetration connector seals, the control room operators noted that Steam Generator #3 water level was dropping rapidly. An operator was dispatched to the mezzanine level of the turbine building to check the #3 Motor-Operated Feedwater Regulator Valve (MFRV) because it was recording a 100% open signal. Upon arrival the operator immediately observed that the valve stem on the #3 MFRV was sheared off. To prevent a cool down of the reactor and a subsequent power excursion, the plant was shutdown to repair the valve. At the time of repair, the other two MFRV's were inspected and both stems were found cracked. Noting the common mode of failure, Maine Yankee ensured that all three MFRV's were repaired prior to plant startup. An autopsy of the sheared stem indicated that it failed due to stress fatigue.

REACTOR COOLANT PUMP #2 SEAL FAILURE

On October 10, 1989, the plant was manually shutdown due to an anticipated Reactor Coolant Pump #2 (RCP#2) seal failure. Maine Yankee observed the deterioration of the RCP#2 seal for about a month prior to shutdown. In anticipating the seal failure rate, Maine Yankee scheduled an orderly shutdown to replace the seal. However, in preparation to the shutdown, two containment ventilation/purge valves failed their leak test. Maine Yankee was then compelled to shutdown 12 hours earlier than originally scheduled.

An autopsy of the failing RCP #2 seal revealed that a lock ring detached from inside the seal cartridge and was slowly grinding the face of the third stage of the seal. The failure mode is rare in that industry experience with these types of seals

is very good, and the failure mode had only occurred once before. Maine Yankee opted to replace only the #2 RCP seal and leave the others undisturbed, and returned to power on October 17, 1989.

REACTOR COOLANT PUMP #1 SEAL FAILURE

Less than a month after the failure of RCP #2, Maine Yankee manually shutdown on November 7, 1989 due to the rapid failure of RCP #1 seal. Just after shutdown, the seal failed spilling about 2800 gallons of seal coolant into the containment building. The failure mode of the seal was identical to the RCP #2 seal failure. Because the RCP #3 seal was from the same manufacturing lot as the two seals which failed, Maine Yankee replaced seals for both RCP #1 and RCP #3. In this case, the two seals were replaced with a new design called N9000 which are expected to have a longer life and improved reliability.

AUTOMATIC SHUTDOWNS

EHC POWER SUPPLY FAILURE

On January 10, 1989, the plant automatically shutdown due to a loss of the Electro-hydraulic Control (EHC) power supply. The EHC system is an electronic system which controls the position of the turbine control valves. The system controls both the turbine speed and the electric load on the generator. Loss of the EHC power results in the loss of turbine control valves which regulate the steam flow to the High Pressure Turbine. The power supply was repaired and the plant returned to power on January 11, 1989.

INADVERTENT ACTUATION OF THE GENERATOR PROTECTIVE RELAYING

On April 5, 1989, the plant automatically shutdown due to a loss of load condition caused by an inadvertent actuation of the generator protect relaying. The cause of the shutdown was attributed to a Central Maine Power (CMP) inspector restoring a 345 kilovolt breaker relay to service. Apparently, the CMP inspector did not ensure that the output or trip switches were closed prior to restoring the relay to service. Subsequent actions by the inspector caused the tie breakers to open and resulted in the turbine and reactor trips. The plant was returned to power the same day.

APPENDIX II

MAINE YANKEE LICENSEE EVENT REPORTS FOR 1989

The following summary of Licensee Event Reports (LERs) are from Maine Yankee's 1989 annual report of safety issues to the Maine Public Utilities Commission as required by Maine state law 35 MRSA, sec. 3341.

Reference: Maine Yankee Licensee Event Report 89-001

On January 10, 1989 with the plant operating at 100% power, an unscheduled automatic reactor shutdown (trip) occurred because of an electrical problem in the system which controls the valves which control steam flow to the turbine.

The Electro-hydraulic Control (EHC) system positions the turbine control valves. Control power for EHC is provided from five DC power supplies (busses). Low voltage on any one of these busses actuates a switch (relay) that automatically stops (trips) the main turbine. When the main turbine trips and power is above 15% reactor power, the reactor also trips automatically.

The EHC system vendor, Westinghouse, personnel inspected and tested the system and determined the low voltage condition to be spurious and not repeatable.

Even though the root cause of the low voltage signal could not be determined, several potentially suspect electronic components were replaced as a precautionary measure. Also, increased monitoring of some of the busses was instituted.

There were no effects on human health or the environment.

Cost of the corrective action was less than five thousand dollars.

Reference: Maine Yankee Licensee Event Report 89-002

On February 14, 1989, the plant was manually shut down because of concerns about the design performance of some containment electrical cable penetrations during certain hypothetical accident situations.

The containment building has many electrical cables which penetrate through its walls. These penetrations are especially designed to assure that conceivable accident environments within the containment building will not cause damage to vital electrical cables or cause release through the penetration.

During the 1988 refueling outage, fifty-one penetrations were installed in a manner which was not completely in accordance with vendors' instructions. While it appeared initially that the penetrations would pass rigorous design standards for environmental qualification, subsequent conservative testing raised questions on the performance of the penetrations. As soon as the results from this testing were known, the company commenced shutdown for repair of the penetrations.

The penetrations were repaired and the plant returned to power operations on February 21.

Further corrective action included improvements in the vendor supplied instruction manual to include detailed instructions and materials listed for each penetration assembly type.

There were no effects on human health or the environment.

The cost of corrective action was approximately two hundred thousand dollars.

Reference: Maine Yankee Licensee Event Report 89-003

On April 5, 1989, an unscheduled automatic plant shutdown (trip) occurred as a result of a testing error made in the 345,000 volt switch yard outside of the plant.

The 345,000 volt switch yard includes unit tie breakers which direct the plant's electricity output to the various parts of the electricity transmission system. When the breakers open and the plant is at power, the turbine and the reactor trip on loss of load. Various relays control the breakers. A technician conducting tests in the switch yard mistakenly caused a relay to operate which caused the tie breakers to open and resulted in the turbine and reactor trips.

A caution has been added to the relevant test instructions which warn the tester to avoid the switch lineup which caused the error.

There were no effects on human health or the environment.

Cost of corrective action was less than five thousand dollars.

Reference: Maine Yankee Licensee Event Report 89-004

On October 10, 1989, the plant was manually shutdown because an outside portion of a containment building ventilation penetration had an air leakage rate which exceeded the amount allowed by plant Technical Specification limits.

Containment integrity was not compromised by this leakage because a redundant valve in the same penetration line maintained an adequate containment seal.

Following shutdown, maintenance was conducted on the valve so that it performed within Technical Specification limits.

There were no effects on human health or the environment.

Cost of the corrective actions were less than one thousand dollars.

Reference: Maine Yankee Licensee Event Report 89-005

During plant heatup on October 15, 1989, while shutting down the Residual Heat Removal (RHR) system, operators identified leakage past the B train RHR pump suction valve, RH-7. During normal operation, the RHR pump serves as the B train Low Pressure Safety Injection (LPSI) pump. Technical Specifications require RH-7 to be locked shut for Emergency Core Cooling System (ECCS) operation. Additionally, RH-7 is one of the locked shut containment isolation barriers for the RHR penetration.

Investigation determined that the position indication slot was too short on the RH-7 handwheel pedestal. As a result, the position indication pin was restrained by the bottom of the slot, preventing full valve closure. The position indication pin was removed.

Technical Specification requirements for containment integrity were met because the RHR containment penetration was isolated in accordance with the plant Technical Specifications for containment integrity. The ECCS function of the valve was met by the containment isolation valves and the A train RHR pump suction valve, RH-6.

ECCS valves with similar local position indication arrangements were checked and none were found with valve position adversely impacted. The position indication slots for three other valves have been elongated, to prevent impacting by the position indication pins. Post-maintenance functional testing requirements are being revised to ensure the position indication does not prevent full stroke valve operation.

There were no effects on human health or the environment.

Cost of the corrective actions were less than one hundred dollars.

Reference: Maine Yankee Licensee Event Report 89-006

While developing a design change package to improve the reliability of 120 volt inverters, plant engineers discovered a design deficiency that would limit the operating time of emergency battery 2 to less than that stated in Maine Yankee's Final Safety Analysis Report (FSAR).

To limit the discharge on the battery, a Non-Nuclear Safety Class inverter (Inverter-5) powered from Emergency DC bus 2 was intended to trip shortly after the associated battery charger stopped supplying power. However, due to an improper design, Inverter-5 would not have tripped until the battery was depleted.

Calculations by plant engineers have shown that battery 2 could, under worst case, supply emergency power to its associated bus for one hour. In order to ensure FSAR assumptions remain valid, Inverter-5 has been tagged out of service. A review of the safety class battery capacity calculations showed no other loads which are assumed to trip upon loss of the battery charger.

There were no effects on human health or the environment.

Cost of the corrective actions were less than one hundred dollars.

APPENDIX III [14]

STATE OF MAINE ENVIRONMENTAL MONITORING PROGRAM SUMMARY FOR MAINE YANKEE ATOMIC POWER COMPANY

Medium	Number of Stations	Frequency
TLD[15]	52	Quarterly
	41	Quarterly**
	9	Monthly
Salt Water	2	Weekly
Fresh Water	1	Weekly
	1	Monthly(Composite)
	4	Quarterly
Seaweed	3	Weekly
	1	Monthly (Control)
	1	Quarterly (Control)
Milk	1	Monthly**
	2	Monthly[16]
	2	Monthly[17]
Fresh/Salt Water for Tritium	9	Quarterly
Air	2	Weekly**
Fish	Split[18]	Yearly**
Sediment	Split	Yearly**
Vegetation	1	Yearly**

** Monitoring performed under contract with U.S. Nuclear Regulatory Commission.

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[14] Data from State of Maine, Bureau of Human Services, Division of Health Engineering, Radiation Control Program.

[15] "TLD" is an abbreviation for Thermoluminescent Dosimeter. TLD's are used to establish background radiation levels in the vicinity of the plant.

[16] Milk samples from local dairies within 5 miles of Maine Yankee.

[17] Milk samples from distant dairies, one to represent in-state milk (e.g. Newport area) and one to represent milk coming in from Massachusetts (e.g. Cumberland Farms outlet in York County).

[18] "Split" refers to samples which are divided between Maine Yankee and the State for analysis.

APPENDIX IV

ENVIRONMENTAL RADIATION MONITORING PROGRAM FOR MAINE YANKEE ATOMIC POWER COMPANY

Table 1 from the Environmental Radiation Surveillance Program report, November 17, 1989, prepared for the Maine Yankee Atomic Power Company by the Yankee Atomic Electric Company Environmental Laboratory, 25 Research Drive, Westborough, MA 01581.

TABLE 1

ENVIRONMENTAL RADIATION MONITORING PROGRAM
MAINE YANKEE ATOMIC POWER COMPANY

Sample (Code)	No. Stations	Frequency	Standard Analysis
Air - Particulates (AP)	5	W Q(c)	β γ
Air - Charcoal Filters (CF)	5	W	I-131 (by γ)
Estuary Water (WE)	2	W M(c) Q(c)	Collected for M Comp. γ H-3
Ground Water (WG)	2	Q	γ, H-3
Food Products (TF, TV)	3	Monthly when available (*1)	γ I-131 (Green leafy portion of vegetables)
Fish and Invertebrates (FH, HA, CA, MU)	2	1/in season or semi-annual if not seasonal of two of the media	γ
Algae (AL)	1	at time of fish or invertebrates	γ
Sediment Bottom (SE)	2	2/yr.	γ
Milk (TM)	3	M Q(c)	γ, I-131 Sr-89/90 **2
Vegetation (TG)	1	2/Growing Season	γ

TABLE 1
(continued)

ENVIRONMENTAL RADIATION MONITORING PROGRAM
MAINE YANKEE ATOMIC POWER COMPANY

NOTES

Frequency

W:	Weekly
M:	Monthly
Q:	Quarterly
Yr:	Annually
2/Yr:	Semi-Annually
(c):	Composite

Analyses

β:	Gross Beta
γ:	Gamma Spectroscopy
Sr:	Strontium 89, 90
H-3:	Tritium
I-131:	Iodine-131 by Radiochemistry except for CF
*1	Collected only when milk samples are not available.
**2	Not required per Tech Specs.

BASIS: Amendment No. 42, Docket No. 50-309
Facility License DPR-36
Table 4.8-1
Effective Date: 7/1/86