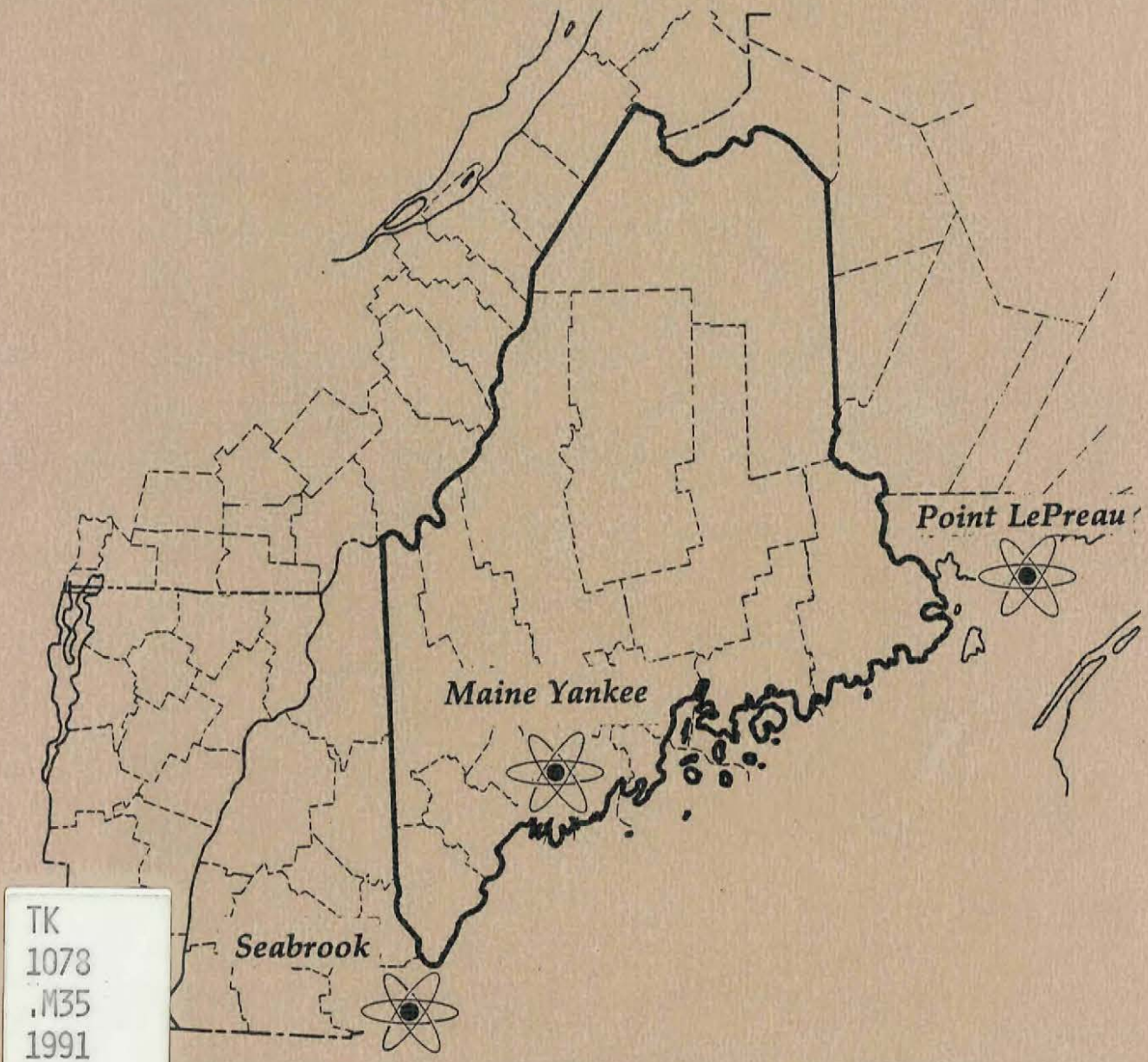
STATE OF MAINE

NUCLEAR SAFETY REPORT

submitted to the

115th Maine Legislature, 1991



Department
State Nuclear Safety Advisor

Maine State Planning Office
1991

STATE OF MAINE
EXECUTIVE DEPARTMENT
STATE PLANNING OFFICE

JOHN R. McKERNAN, JR.
GOVERNOR

RICHARD H. SILKMAN
DIRECTOR

December 20, 1991

Members of the 115th Legislature,

I am pleased to submit to you the 1991 annual report of the State Nuclear Safety Advisor.

This report discusses the 1990 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 includes discussions on the condition of the steam generators at Maine Yankee, the main generator hydrogen fire in the non-nuclear section of the plant on April 29, 1991, and the status of worker radiological safety. The report also briefly summarizes the emergency planning activities for the Seabrook and Point LePreau nuclear stations.

Maine Yankee continues to be of considerable interest in discussions of our energy needs in Maine. I am sure this report and the work of the State Nuclear Safety Advisor will contribute to informed decision-making.

Sincerely,

Richard H. Silkman
Director

184 STATE STREET, STATE HOUSE STATION 38, AUGUSTA, MAINE 04333 TEL. (207) 289-3261 FAX # 5756

TABLE OF CONTENTS

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. Most information on Maine Yankee is for the year 1990, however, major inspections by the Nuclear Regulatory Commission (NRC) and operational events at Maine Yankee occurring within the first half of 1991, (such as the main generator hydrogen fire on April 29, 1991 and the status of the Maine Yankee steam generators), are also reviewed in this report, to the extent that data is available.

The Seabrook and Point LePreau nuclear stations are discussed with regard to emergency planning activities which impact portions of Maine.

MAINE YANKEE NUCLEAR STATION

Operational History and Performance Indicators

Overall, Maine Yankee's operational performance compares favorably relative to other plants in the U.S. nuclear industry, and in most areas of operations the plant is following the improving trend occurring in the industry. In 1990, Maine Yankee's electrical production was about 70% of the previous year (which was a record year) at 4860 million kilowatt-hours. Since 1980, Maine Yankee's annual electrical production range from 4404 to 6922 million kilowatt-hours, averaging at 5227 million kilowatt-hours. Maine Yankee's operating time, and likewise electrical production, was reduced due to several factors. The scheduled refueling of the reactor consumed about 3 months in 1990 (April through June), and eight plant shutdowns for repairs, particularly for a leaking steam generator, contributed significantly to lost electrical production. Though Maine Yankee's operation in 1990 was disrupted by mechanical difficulties, in general the plant's performance and electrical production continues to be reliable.

On-Site Nuclear Safety

The authority to regulate activities at Maine Yankee primarily rests with the Nuclear Regulatory Commission (NRC). 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, the State of Maine Office of Nuclear Safety monitors all activities at Maine Yankee and meets regularly with the State Nuclear Safety Advisor.

In 1990, the NRC conducted and documented 27 inspections of Maine Yankee. This effort of inspection of Maine Yankee by the NRC is average for a nuclear power plant, and suggests that operations at Maine Yankee warrant normal attention and surveillance by the NRC.

More recently, the NRC conducted a comprehensive assessment of operations at Maine Yankee, and issued its Systematic Assessment of Licensee Performance (SALP). The assessment period was from November 1, 1989 to February 28, 1991. All areas evaluated by the NRC received good marks, with plant operations and maintenance/surveillance receiving high marks. Performance in the areas of radiological controls and security, which were identified as requiring attention in previous SALP reports, continued to show improvement. Within the SALP review, the NRC remarked on the number of reactor shut downs as due to design-related equipment problems and long-standing design deficiencies which indicated a need for Maine Yankee to improve design control based on operating experience. The NRC SALP review summarized Maine Yankee's performance as a"safe and conservative operation."

There were 10 NRC violations issued to Maine Yankee in 1990, all of minor severity involving no fines. Of the ten violations, four were related to an unplanned radiation exposure (within regulatory limits) of three workers at Maine Yankee, two were due to components that did not meet regulatory requirements, one was due to the improper implementation of Maine Yankee's licensed operator Recertification Course, one due to an improperly implemented procedure change involving the draining and venting of the Reactor Coolant System, one violation involving the Fitness-for-Duty rule and one concerning the use of Day Orders. Maine Yankee has implemented corrective actions to address all the violations.

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. Maine Yankee filed twelve LER's with the NRC for 1990. Of the twelve, six were due to component failures, two were issued for Technical Specification violations, one was due to a design flaw, and three were the result of personnel error.

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 to complete.

Although the radiological practices at Maine Yankee have drawn the attention of the NRC in the past, overall this area of operations appears to be improving. Maine Yankee is continuing to implement its Radiological Improvement Plan, which is 50 percent complete with a completion date at year's end in 1992. The NRC and the State Nuclear Safety Inspector view the Plan as effective in improving radiological practices at Maine Yankee. Although Maine Yankee did not achieve the planned total worker dose reduction in 1990 due to unplanned work in radiation areas, the practices in place at Maine Yankee may produce more positive results in 1991. However, in the area of controlling and reducing total worker radiation exposure, Maine Yankee has lagged the industry for several years. Improvement of Maine Yankee's radiological performance is desirable not only for worker protection, but for possible future regulation. The 1990 Recommendations from the International Commission of Radiation Protection call for reduced levels of worker radiation exposure that Maine Yankee presently would find challenging

to satisfy.

In 1990, Maine Yankee experienced its first steam generator(SG) tube leak in its 19 years of operation, and subsequently conducted a safe manual shutdown. Maine Yankee identified the failure mechanisms underlying the SG tube failures, and has implemented procedures to monitor and respond should a leak once again occur. Steam Generator tube failure is becoming a fairly frequent problem in the nuclear power industry world-wide. Many power plants here and abroad have had to replace steam generators that were irreparable, which is an expensive and labor intensive effort. Though Maine Yankee has experienced SG leaks, and more are likely to occur in the future, the predicted rate of tube failure is such that all three of the SGs should last the licensed life of the plant. The State Nuclear Safety Advisor is satisfied with action taken by Maine Yankee to monitor and respond to steam generator tube leaks.

On April 29, 1991, 6:32 p.m., Maine Yankee experienced a fire in the non-nuclear section of the plant. One of the two main transformers at Maine Yankee experienced an internal short circuit, which led to an electrical system overload causing electrical arcing nearby the main generator. Hydrogen gas, which is used to cool the generator, escaped through damaged piping by the generator and was ignited by the arching. All plant safety systems operated as designed. Upon sensing the short circuit from the transformer failure, the plant's turbines and generator were automatically shutdown, which subsequently and automatically safely shutdown the reactor. Damage to Maine Yankee from the fire involved one main transformer that needed to be replaced, and some damage to the main generator. Within one month, Maine Yankee had made the necessary repairs, and returned to service on June 1, 1991.

In addition to the failed transformer causing a fire at the main generator, the transformer ruptured and leaked some 200 gallons of mineral oil (no PCB content) which escaped into the Back River through storm drains. With the assistance of the U.S. Coast Guard and the Maine Department of Environmental Protection, Maine Yankee and Central Maine Power workers cleaned up the oil over several days. No adverse environmental impact is expected from the oil spill.

A special Nuclear Regulatory Commission investigation into the Maine Yankee fire found that Maine Yankee acted correctly and appropriately in responding to the fire. The NRC also found there were no radiological consequences from the fire, and this was confirmed by the State Nuclear Safety Inspector. The NRC inspected and evaluated the possibility that Maine Yankee's authorized power increase in 1989 from 2630 MWt(megawatts thermal) to 2700 MWt may have been responsible for this event. Their investigation, though not complete, has not found any design or maintenance shortcomings with the main transformer, main generator, or other related components.

In addition to the NRC investigation, the Federal Emergency Management Agency (FEMA) investigated the alert and notification procedures used by Maine Yankee and other responsible agencies during the evening of the Unusual Event. Their investigation found that "Maine Yankee personnel involved in offsite notification performed that notification in a timely manner and in accordance with established procedures. Human error resulted in the failure of the State Police Dispatcher to include the emergency classification level (Unusual Event) during

notification to the appropriate offsite response personnel." The FEMA report concluded with recommendations to the State which have been adopted.

In the last several years, Maine Yankee has been improving and increasing the electrical production of the plant with several component replacements and upgrades. During the refueling outage in April 1990, Maine Yankee completed the replacement of all the turbines by installing a new high pressure turbine. The replacement of this turbine enabled the plant to operate at the NRC approved power upgrade from 2630 through 2700 Megawatts thermal. Maine Yankee will be installing a new generator in their February 1992 refueling outage to increase the efficiency of the plant. Much of Maine Yankee's improved electrical production since the eighties is due to equipment and component improvements which have increased the efficiency of the plant.

Off-Site Nuclear Safety

On a routine basis, Maine Yankee (like all nuclear power plants) releases controlled and regulated quantities of gaseous and liquid radioactive effluent into the environment. All releases from Maine Yankee in 1990 (and since the beginning of operation in 1972) have been well below regulatory limits. However, the radioactive gaseous releases in 1990 were higher compared to the past several years. The primary cause for the increase is leaking fuel rods. Maine Yankee estimates 4 to 7 out of 37,480 may be damaged. According to regulations, Maine Yankee can operate with up to 375 rods leaking. As part of the many activities Maine Yankee will undertake during their up-coming refueling outage in February 1992, Maine Yankee plans to identify and remove all leaking fuel rods, and replace 68 of the spent fuel assemblies removed from the reactor with new fuel assemblies of an improved design to prevent leaking.

The estimated dose from all the radioactive gaseous releases from Maine Yankee for 1990 to members of the public living near the plant is 0.23 millirem. Radiation doses in this range are well within the fluctuations of exposure to natural background and are not expected to pose any undue risk to public health or adverse impact to the environment. For comparison purposes, the average person receives an annual dose of 300 millirem from sources of natural radiation. Prior to the release of this report, the NRC identified an instrument calibration error that provides information to calculate the quantity of radioactive gas released by Maine Yankee. The State Nuclear Safety Inspector and the NRC believe the error has resulted in underestimating, by a maximum of a factor of two, the continuous releases from Maine Yankee in 1990. Estimated doses resulting from this error will not significantly increase the estimated population dose, and thus will not have an impact on the public health or the environment. However, this error has raised concerns on the reliability of gaseous release data received from Maine Yankee. The implications of this matter will be brought to the attention of the newly created Radiation Monitoring Issues Committee.

The State operates three additional 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 1990 Maine Yankee sent 23 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 at least a period of five years.

Maine Yankee, similar to all nuclear power plants, produces 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 specially designed pool filled with borated water to cool the spent fuel and provide shielding from the radiation emitted. 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. 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 State Nuclear Safety Advisor is also researching the options that are available to Maine Yankee.

Emergency planning activities continue to be exercised between the State and Maine Yankee. A full participation, two day exercise was held from July 31 to August 1, 1990. An evaluation of the performance by the State of Maine will be disclosed in a report by the Federal Emergency Management Agency. Receipt of the report is expected in late 1991. During the two day exercise, Maine Yankee's performance was observed and inspected by the NRC. The NRC found no violations in Maine Yankee's performance during the drill, although three exercise weaknesses concerning the emergency operations facility were identified. Maine Yankee responded to the weaknesses identified by the NRC with a remedial exercise on October 10, 1990 where the NRC concluded that the state of emergency preparedness at Maine Yankee is adequate to provide protective measures for the public health and safety.

SEABROOK

The Seabrook Nuclear Power Station is located in the State of New Hampshire, approximately 13 miles south of the Maine border in Kittery. The plant received its full power license on March 1, 1990, and began operating at full power in the summer of 1990. Normal operational releases from Seabrook are not expected to have any impact on the public and environment of Maine. Analysis of environmental samples collected for 1990 in York County in the near vicinity of the plant indicated no detectable radioactivity from the operation of Seabrook. The State of Maine participated in an emergency exercise in December 1990 with the Seabrook Station and the State of New Hampshire. To date, notification of the results of the emergency exercise have not been received by the Federal Emergency Management Agency.

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. Maine 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 periodically exercised the limited emergency plan with the Emergency Measures Operations in Fredricton, New Brunswick, Canada. Though MEMA did not participate in an emergency exercise with Point LePreau in 1990, the agency did participate in an emergency exercise in February 1991.

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 and assessments 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. Most information presented on Maine Yankee is for the year of 1990, however, major inspections by the Nuclear Regulatory Commission and operational events at Maine Yankee occurring within the first half of 1991, (such as the main generator hydrogen fire on April 29, 1991 and the status of the Maine Yankee steam generators), are reviewed in this report, to the extent that data is available.

Also discussed in this report are the Seabrook and Point LePreau nuclear stations with regard to emergency planning activities which impact portions of Maine.

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 Wiscasset. 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 20% 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, while Maine Yankee's contribution remains relatively constant. The general trend of Maine Yankee's contribution relative to Maine's electrical consumption is shown in Figure 2. Here the graph shows that Maine Yankee's electrical output from 1972 to 1990 displays an increasing trend, but of smaller magnitude than Maine's total electrical consumption trend. This is due to Maine Yankee's improved operational performance and equipment improvements to the plant in the late eighties. Both Figure 1 and 2 also show that Maine Yankee's performance has remained fairly reliable since the plant began operation.

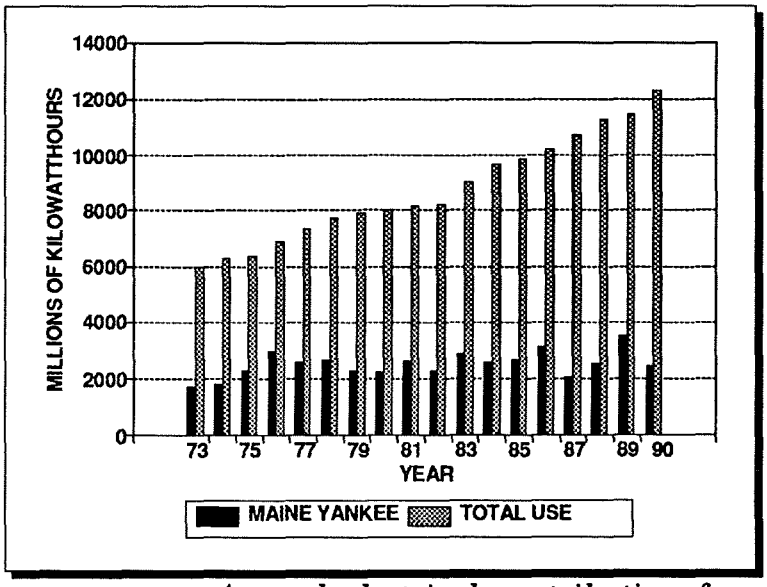


Figure 1 *Annual electrical contribution from Maine Yankee compared to the total annual electrical consumption in Maine.*

Maine Yankee continues to compare 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 the many aspects of nuclear power plant operations, and may or may not relate dependably to overall plant safety. That is, the ability of a nuclear power plant to efficiently and reliably generate electricity is dependent upon many factors including plant maintenance practices,

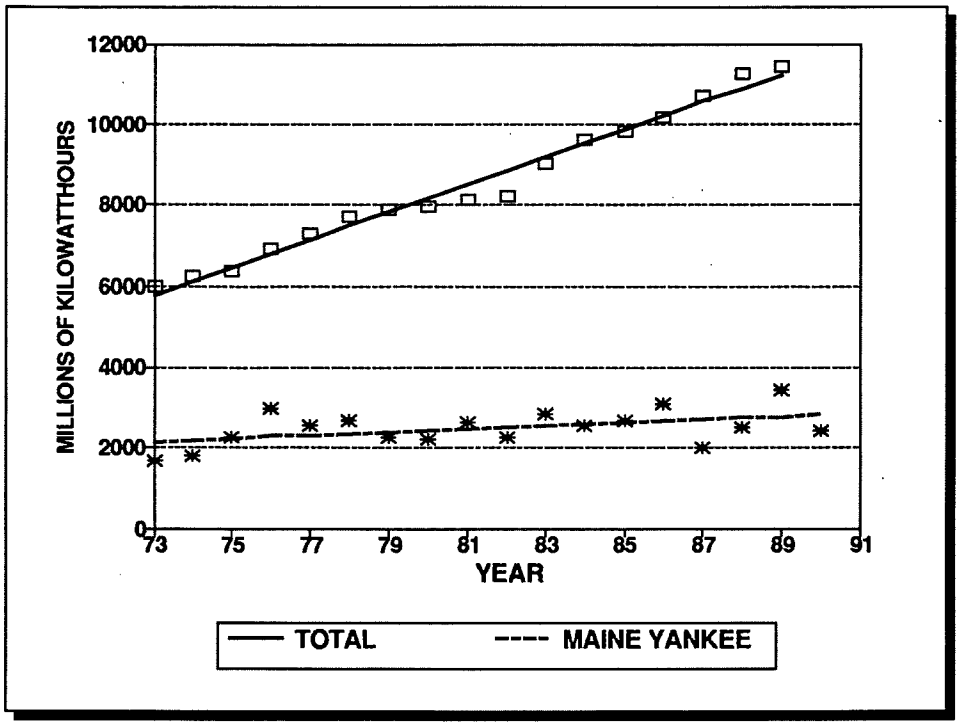


Figure 2 *General trend of Maine Yankee's electrical contribution and total electrical consumption in Maine.*

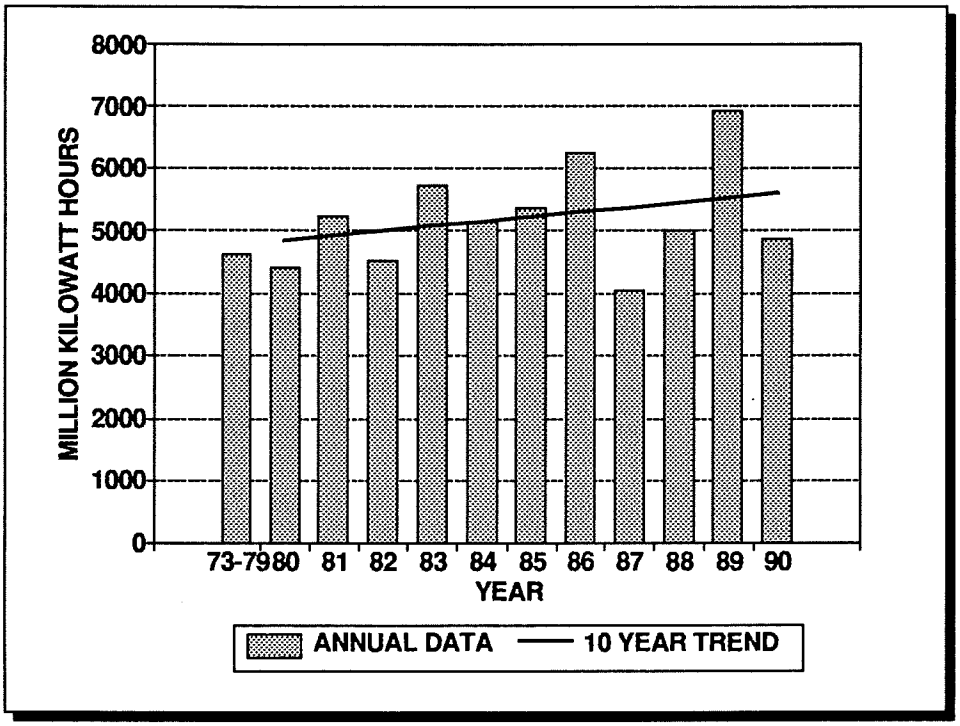


Figure 3 *Annual net electrical production for Maine Yankee, and general trend from 1980 through 1990.*

regulatory compliance and management which, with limitations, are related to plant safety.[1,2] Several performance indicators are discussed below, to convey the general operational record of Maine Yankee.

In Figure 3, the annual net electrical production for Maine Yankee is displayed. Maine Yankee's annual electrical production peaked in 1989 at 6900 million kilowatt-hours. The record production year was partially due to 1989 being a non-refueling year, increasing the power of the reactor (as approved by the Nuclear Regulatory Commission (NRC), and several plant efficiency improvements. In 1990, Maine Yankee underwent a scheduled refueling outage from April through June, and also experienced several plant shutdowns (discussed in this report). This resulted in a fairly average electrical production year of 4860 million kilowatt-hours. Because there are years when Maine Yankee's electrical production year is shortened due to refueling, it is more valid to look at the plant's performance over several years. Figure 3 also shows the general trend of the plant's net electrical production for the last ten years. The graph shows that the plants performance is gradually improving with regards to electrical production. This is the result of many factors including several equipment improvements for increased efficiency, effective maintenance and plant modernization, and overall plant management.

Figure 4 displays the annual capacity factor (CF) for Maine Yankee compared to the U.S. nuclear industry annual average. The capacity factor is the measure that describes the percent of maximum possible electricity generation by a nuclear power plant. As an example, a nuclear power plant generating all the electricity it could by design in one year 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 1990, Maine Yankee's annual CF of 66.8 was slightly below its lifetime average of 71.3. The lower CF for 1990 is not unexpected since the plant was shutdown for refueling, however, several unplanned shutdowns (which are summarized in Appendix I) contributed to loss of operating time. 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 5 shows Maine Yankee's three-year average CF compared with the U.S. nuclear industry annual average. The graph shows Maine Yankee's performance in this area is above the industry average, and follows the improving U.S. nuclear industry trend since the early eighties.

---

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

[2] Performance indicators should be evaluated as a set and in conjunction with plant inspections when assessing nuclear safety. The primary purpose in assigning and evaluating performance indicators is to focus attention on the need to assess and understand underlying causes of changes based on other information. Analysis and Evaluation of Operational Data, U.S. Nuclear Regulatory Commission, NUREG - 1272, VOL. 4, NO.1, page 3.

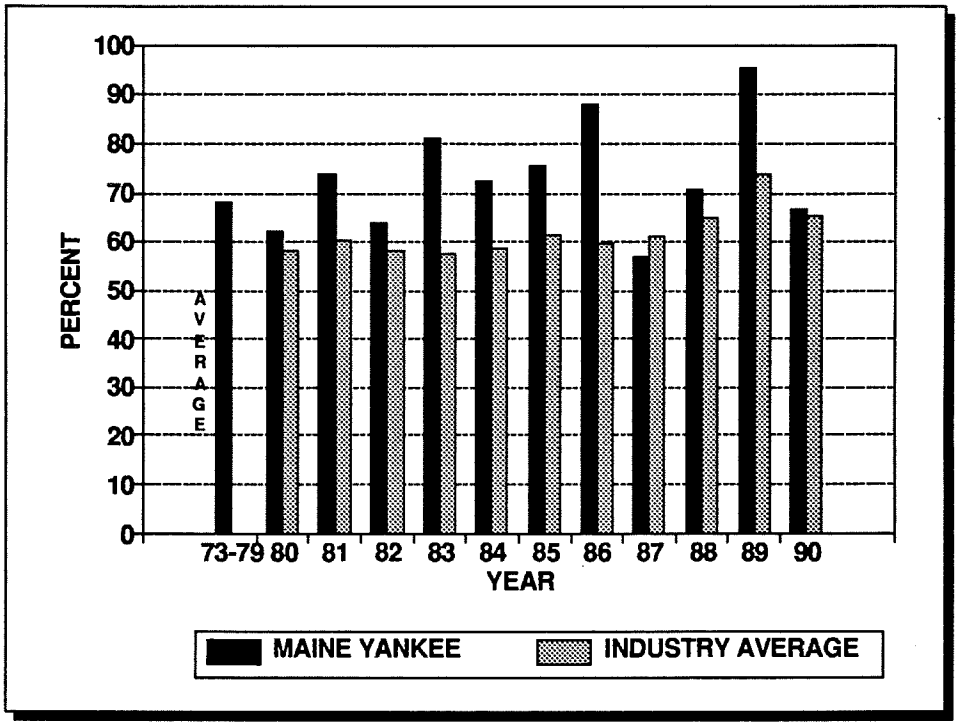


Figure 4 *Annual Maine Yankee capacity factor (MDC net) compared to the U.S. pressurized water reactor industry.*

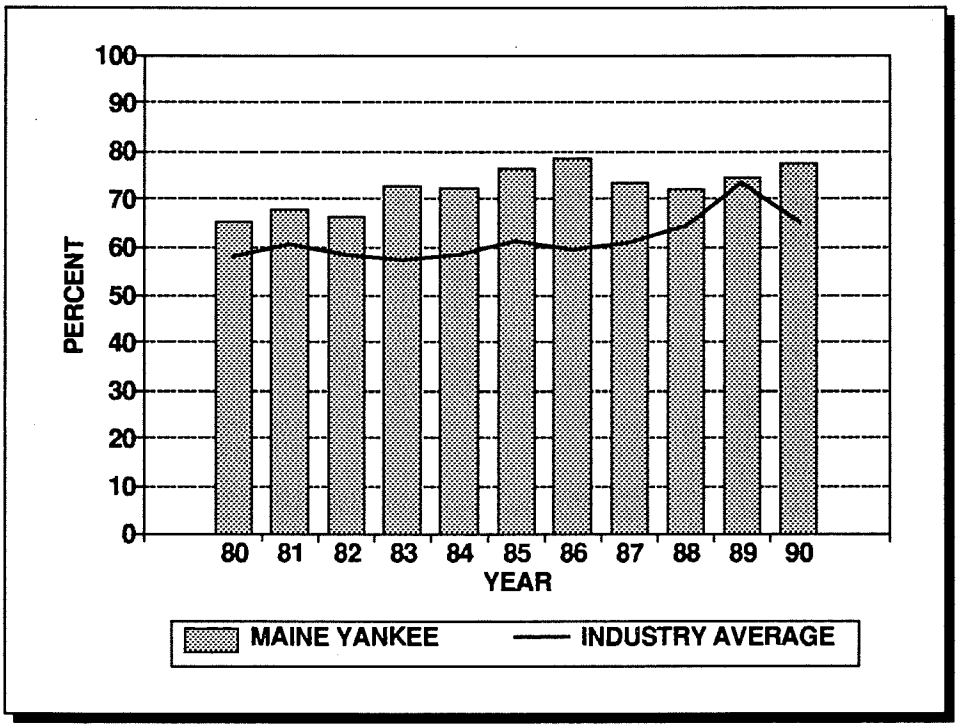


Figure 5 *Maine Yankee and U.S. pressurized water reactor industry three-year averaged capacity factor (MDC net).*

The unit availability factor (UAF) for Maine Yankee is shown in Figure 6. This performance indicator is a measure of the time a nuclear plant was in operation. As in the case of the previous mentioned indicators, the UAF is lowered from 100% when a plant is shutdown for refueling or equipment repairs. For 1990, Maine Yankee achieved a UAF of 66.9% with a lifetime UAF of 77.7%. Figure 6 also shows the 10 year trend for Maine Yankee's UAF, which is gradually improving.

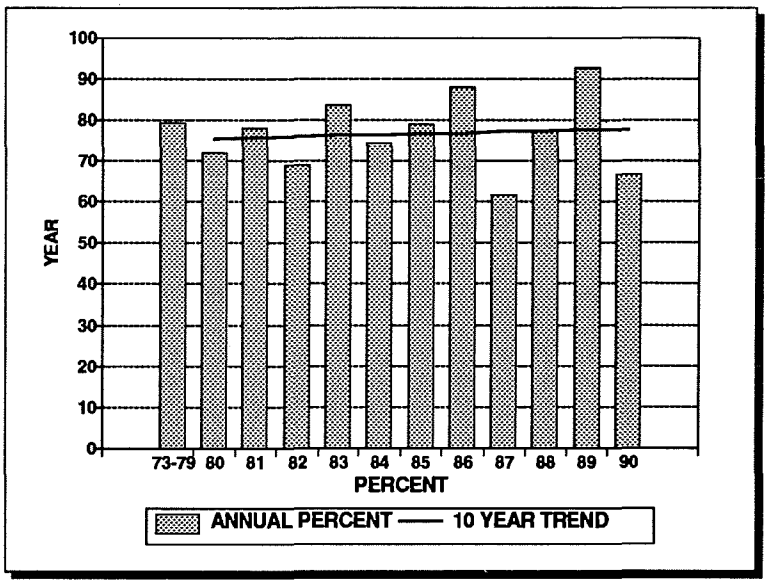


Figure 6 *Annual unit availability factor for Maine Yankee , and 10 year trend.*

A measure of the unplanned shutdown rate of a nuclear station is given by the annual forced outage rate (FOR) performance indicator. A low FOR is an indication that the plant is well maintained and conservatively operated, and a trend in the FOR can provide a perspective on overall plant performance. Figure 7 shows Maine Yankee's FOR for 1990 increased from the previous year from 5.9% to 10.6%. This was due to eight plant shut downs; seven for design related equipment problems or design deficiencies, and a steam generator leak that can be attributed to aging mechanisms. (A discussion of these shut downs relative to plant safety is discussed in 2.2.1.2, NRC SALP REPORT). Although there appears to be no apparent trend with the FOR for Maine Yankee and the industry as a whole, Maine Yankee's FOR ratings have been typically better than the U.S. industry.

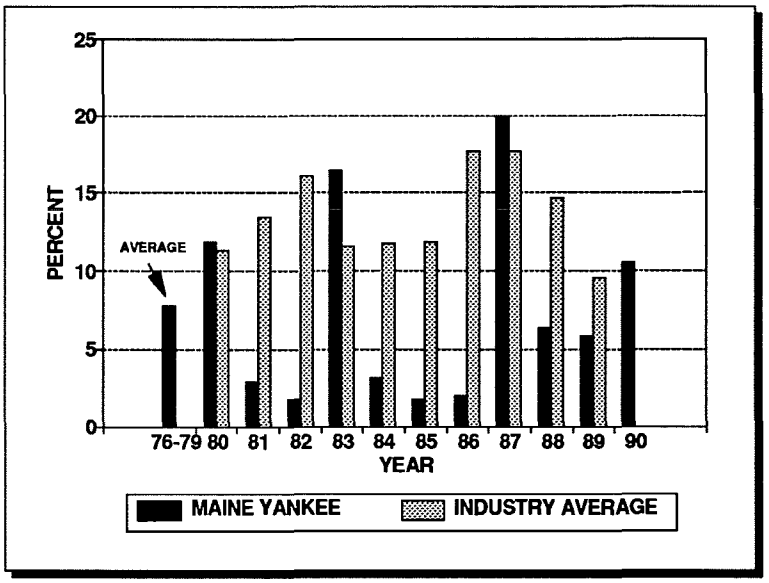


Figure 7 *Maine Yankee forced outage rate compared to the U.S. pressurized water reactor industry.*

Performance indicators are also used by the Nuclear Regulatory Commission to track the safety performance of operating plants. For the indicators of interest,

only data from 1985 to 1989 was available for review.[3]

The NRC trends the number of unplanned automatic reactor trips (scrams) per plant while the reactor is critical. Reactor trips are challenges to reactor safety systems and can result from initiating events that range from relatively minor incidents to events that are precursors of accidents. Figure 8 shows the trend of reactor trips per 1000 critical hours for the nuclear industry and Maine Yankee from 1985 to 1989. As shown, the number of reactor trips has been steadily declining for the nuclear industry and for Maine Yankee overall since 1985. Much of the decrease in automatic trips can be attributed to reactor operators attentive to and reacting to plant conditions prior to the reactor automatically shutting down, as well as to equipment improvements.

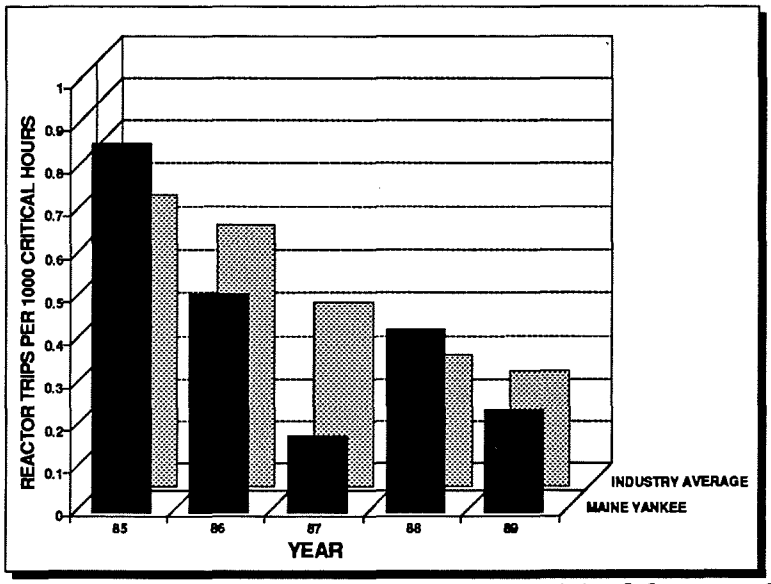


Figure 8 *Reactor trips per 1000 critical hours of operation for Maine Yankee and the U.S. pressurized water reactor industry.*

The NRC also monitors events at nuclear stations that involved the actuation of engineered safety features (ESFs). This indicator includes any event or condition that could prevent the fulfillment of the safety function of structures or systems. Figure 9 shows a decrease in the number of

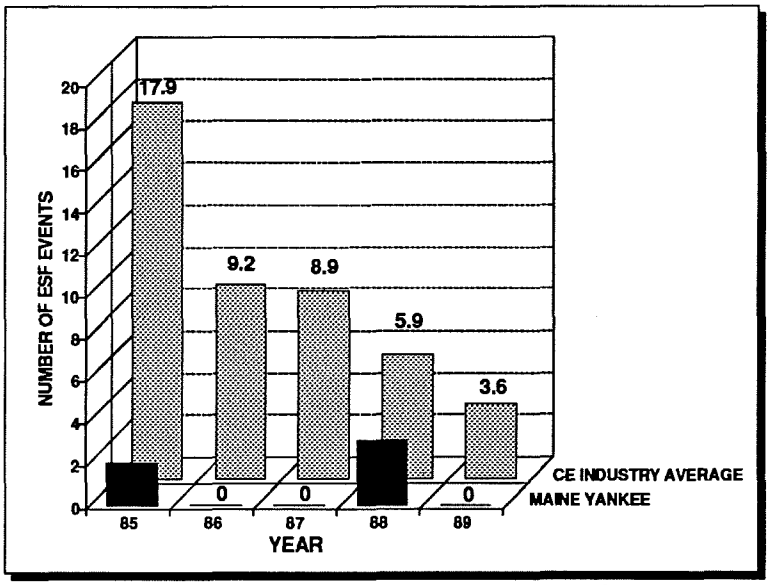


Figure 9 *Number of engineered safety feature (ESF) actuations at Maine Yankee compared to the Combustion Engineering industry average.*

[3] Analysis and Evaluation of Operational Data, 1989 Annual Report, Power Reactors, U.S. Nuclear Regulatory Commission, NUREG -1272, VOL. 4, NO. 1.

events for the industry between 1985 to 1989. The NRC believes this is due to several factors which include improvements in systems, plant activities (i.e. testing and maintenance), and other causes (i.e. equipment problems, personnel errors, procedural problems). Maine Yankee has performed better than the industry with no ESF events for some years or the number of events well below the industry average.

"Significant events" at nuclear power plants are tracked by the NRC. This indicator includes events that the NRC identifies as meeting certain selection criteria. Examples of such events include degradation of important safety equipment; unexpected plant response to a transient (temporary condition); a major transient; discovery of a major condition not considered in the plant safety analysis; and degradation of fuel integrity , primary pressure boundary, or important associated structures. The average number of significant events in the nuclear power industry has declined from 1985 through 1987, and remained fairly constant from 1987 to 1989. Maine Yankee's experience with significant events is consistent with that of the industry. Where Maine Yankee had one event in 1988 and no events in 1989, the industry experienced an average of 0.93 and 0.79 events in 1988 and 1989 respectively. The significant event at Maine Yankee in 1988 involved a reactor trip that was complicated by reserve electrical breakers which failed to close.

An indicator monitored by the NRC to assess a plant's readiness to respond to anticipated events and postulated accidents is the number of safety system failures (SSFs). This indicator includes any event or condition that could prevent the fulfillment of the safety function of structures or systems. The nuclear industry has been monitored by the NRC with an updated analysis procedure since 1987, and the results show an improving trend. The number of SSFs for Maine Yankee is below the industry average of 3.67 and 3.37 failures for 1988 and 1989 respectively, where Maine Yankee had two events in 1988 and no events for 1989. The two events in 1988 involved two excore neutron monitor cable assembles which failed due to manufacturer defects, and solenoid valves that did not meet proper performance standards.

Overall, the performance indicators suggest that Maine Yankee continues to operate efficiently and better than the average U.S. nuclear power plant, even though the frequency of plant shut downs was larger than that of previous years.

2.2 ON-SITE NUCLEAR SAFETY

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

2.2.1 NRC REPORTS AND INSPECTIONS

2.2.1.1 NRC PLANT INSPECTIONS

The authority to regulate activities at Maine Yankee primarily rests with the Nuclear Regulatory Commission (NRC). 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 1990, the NRC conducted and documented 27 inspections of Maine Yankee. The areas of the plant inspected by the NRC included plant operations, radiological controls, maintenance/surveillance, security, engineering/technical support, and safety assessment/assurance of quality. Overall, the inspections found satisfactory and safe performance of Maine Yankee. However, some of the inspections by the NRC did reveal issues requiring resolution by Maine Yankee, and where appropriate, the NRC issued a Notice of Violation. A brief summary of the inspections is provided in Appendix II, and Maine Yankee NRC violations for 1990 are discussed in section 2.2.1.3.

The number of hours that the NRC expends on inspecting Maine Yankee is about average compared to other operating power reactors in the U.S. During the 12 month period from March 1990 to March 1991, the NRC expended 3,113 on-site inspection hours at Maine Yankee. The on-site NRC inspection hours for the nuclear industry ranged from 1,252 to 8,218 with an average of about 3,000. During that same period, the NRC expended 7,868 off-site hours on Maine Yankee's operation. Again, this is about average for a nuclear power plant with the range varying from 3,010 to 20,462 hours, and averaging about 8,000 hours. The number of inspection hours expended by the NRC suggests that operations at Maine Yankee warrant normal attention and surveillance by the NRC.

2.2.1.2 NRC SALP REPORT

In addition to the routine inspection of Maine Yankee by the NRC, at 18 month intervals the NRC performs a comprehensive assessment of operations at Maine Yankee and issues a report called the Systematic Assessment of Licensee Performance (SALP).[4] The purpose of the SALP review is to provide (1) a rational

[4] Maine Yankee Systematic Assessment of Licensee Performance (SALP) for November 1, 1989 to February 28, 1991 (50-309/89-99), Nuclear Regulatory Commission, Region 1, May 16, 1991.

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 May 16, 1991, assessing the performance for the period November 1, 1989 to February 28, 1991. The functional areas assessed and ratings are indicated in Table 1. Each area reviewed is given a rating of one, two or three -- a one indicating the utility management is safety-oriented and a three indicating that, although the utility meets regulatory standards, its overall performance is marginal and warrants attention. In addition, at the close of the SALP review, the ratings are assessed as improving or declining. Future NRC inspection activities at a utility can be expected to reflect the SALP scores.

Table 1

MAINE YANKEE

SALP PERFORMANCE TABULATION

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

* August 1, 1988 to October 31, 1989
** November 1, 1989 to February 28, 1991

Performance Categories

1. *<u>High</u> plant and personnel performance <u>substantially exceeds</u> NRC requirements.*
2. *<u>Good</u> performance, <u>above</u> NRC requirements.*
3. *Performance <u>does not significantly exceed</u> NRC requirements.*

As shown on Table 1, Maine Yankee's most recent SALP review, compared to the previous period, has remained relatively unchanged. All areas of Maine Yankee's operation received good marks, with Plant Operations and Maintenance/Surveillance receiving high marks. Although the Category ratings have not changed, the NRC evaluated Maine Yankee's performance in Plant Operations as declining from its superior rating and the area of Emergency preparedness is no longer trending toward improvement. In contrast, the area of Security was found trending towards improvement.

A summary of the NRC findings for the seven areas reviewed by the SALP Board are briefly outlined below.

Plant Operations

Plant operations at Maine Yankee have been evaluated as a Category 1 by the NRC, thus remaining unchanged for the last 3 SALP periods. The rating indicates that NRC finds that Maine Yankee is continuing to operate the plant safely, competently and professionally. However, several personnel errors and minor events that occurred in this SALP period resulted in the NRC noting that Maine Yankee's performance in this area is declining.

The NRC characterized the decline in performance due to weaknesses in: the use of infrequently exercised procedures during routine outage-related activities; attention to detail in procedure implementation and revision; and communications between the control room and in-plant operators.

Positive performance in this area as noted by the NRC included Maine Yankee's conduct during emergency shutdowns for the reactor coolant pump seal failure in November 1989 and the steam generator tube leak in December 1990. The NRC also commented favorably on management involvement and oversight of plant operations, adequate staffing with appropriate use of overtime, good training and qualification of operators, technical competence and professionalism of operations personnel, and good analysis of events and corrective actions.

Maine Yankee management has discussed and identified the weaknesses noted by the NRC and has undertaken initiatives to improve their operations program.

Radiological Controls

Maine Yankee's SALP performance in radiological controls has improved considerably since the NRC rated Maine Yankee's performance with a Category 3 in 1987. Since 1989, Maine Yankee undertook a concerted effort to improve their

radiological program. For this SALP period, the NRC rated radiological controls unchanged at Category 2, but noted the program has improved since their last evaluation.

Areas identified by the NRC as improvements included heightened attention and oversight by management, a significant improvement in the As Low As Reasonably Achievable (ALARA) program to reduce radiation exposures, good transportation and solid radwaste practices, and excellent performance in radioactive effluent and environmental monitoring.

Areas identified by the NRC requiring improvement included radiological controls for routine areas that were found in general not to be covered as well as is done for specific jobs, and weaknesses in completing radwaste shipping manifest.

Maine Yankee's continuing improvement in radiological controls is due in most part to their establishment and implementation of the Radiation Protection Improvement Plan (RPIP). The RPIP program which began in August 1989, is expected to be completed in December 1992. Although Maine Yankee was unable to reduce the average radiation exposure to workers in 1990 as planned due to unplanned maintenance work, the NRC and the State Nuclear Safety Inspector have noted an overall improvement in radiological practices at the plant.

Maintenance and Surveillance

Maine Yankee's performance in maintenance and surveillance activities have historically received high marks from the NRC. The NRC continued to recognize Maine Yankee's performance in maintenance and surveillance as an effective program when assigning a rating of Category 1.

NRC's favorable comments on Maine Yankee's maintenance and surveillance program were primarily based on evidence of a professional and highly qualified staff of maintenance personnel with strong management support. During the SALP period there were several maintenance and surveillance events where the NRC noted improvement was needed. Corrective actions for these concerns were identified by Maine Yankee through self-assessment and implemented.

Emergency Preparedness

At the end of the last SALP period, the NRC rated Maine Yankee's Emergency Preparedness (EP) as Category 2, improving. During this SALP period, the NRC assessed Maine Yankee as having a good emergency response capability, but noted some problems regarding staffing for EP program functions and some training deficiencies. The NRC assessment earned Maine Yankee a Category 2, indicating an

improvement during the SALP period.

Security

Maine Yankee's security program received critical review from the NRC two SALP reviews ago. Since then Maine Yankee began taking steps to improve the program with marginal success initially but with encouraging progress during the later part of last year's SALP review. The considerable improvements recently implemented at Maine Yankee have resulted in the NRC upgrading this area from a Category 2 to a Category 2, improving.

Notable improvements in security identified by the NRC were found in the protected area lighting, intrusion detection, assessment and response capabilities, and access control. The NRC further stated that weaknesses identified in the previous SALP were promptly and effectively addressed. While the NRC recognized the overall improvement in the security program, the SALP report noted "a need for continued management attention to potential weaknesses, personnel performance and attitude, and plant and security staff understanding of program objectives."

Engineering and Technical Support

Maine Yankee's rating for engineering and technical support remained unchanged from the previous SALP period at Category 2. The SALP report cited an excellent performance by Maine Yankee of an investigation into the root-cause and generic implications of a control rod assembly that became mechanically stuck. The report further stated Maine Yankee as proceeding with conservatism in their approach to safety evaluations and decisions for repairs. In general, the report noted good management involvement in routine plant activities, and an experienced and knowledgeable engineering personnel that is adequately staffed.

A weakness identified by the NRC was a lack of attention to detail in design and safety evaluation activities. The NRC also commented that several shutdowns were related to Engineering/Technical Support inadequacies.

Safety Assessment / Quality Verification

This area has remained unchanged from the previous SALP at Category 2. The NRC's remarks in Maine Yankee's safety assessment/quality verification generally characterize a conscientious safety perspective of plant management. Instances were cited in the SALP report where plant management exhibited a conservative approach to operations and promoted self assessment to better the performance and reliability of plant operations.

Weaknesses expressed by the NRC included comments on eight reactor shutdowns, of which four were due to long-standing design deficiencies and four due to design related equipment problems. The NRC stated that "Collectively, the design-related shutdowns indicate a need to improve design control based on operating experience."

The NRC SALP Board concluded the review of Maine Yankee by describing it as a "safe and conservative operation". The State Nuclear Safety Advisor found the NRC's analysis and findings of the SALP ratings as consistent with the NRC inspection reports of Maine Yankee for the SALP period, and with reports and discussions from the State Nuclear Safety Inspector.

On April 29, 1991, Maine Yankee experienced a main transformer failure and a main generator hydrogen fire occurred. The initial assessment by the NRC is that the event is expected to produce findings relevant to all SALP areas, but would not result in a change of the SALP ratings for this period. (Refer to section 2.2.1.7 for a discussion of the NRC's findings of the April 29, 1991 main generator hydrogen fire at Maine Yankee.)

2.2.1.3 NRC Violations

For 1990, the NRC issued 10 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.

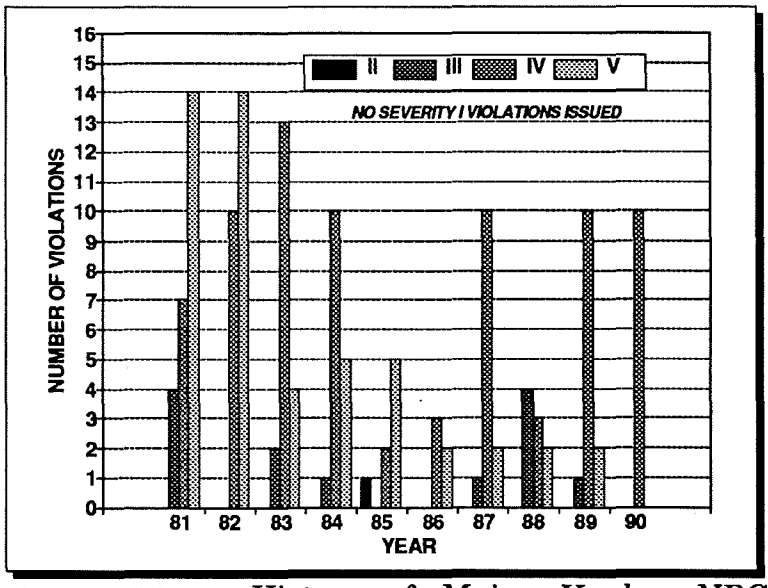


Figure 10 *History of Maine Yankee NRC violations by severity level.*

Figure 10 displays violations issued by the NRC to Maine Yankee by severity level for the years 1981 to 1990. There were 10 violations issued to Maine Yankee in 1990, all of severity level IV. Of the ten violations, four were related to an unplanned radiation exposure (but well within regulatory limits) of three workers at Maine Yankee, two were due to components that did not meet regulatory requirements, one was due to the improper implementation of Maine Yankee's licensed operator Recertification Course, one due to an improperly implemented procedure change involving the draining and venting of the Reactor Coolant System, one violation involving the Fitness-for-Duty rule and one concerning the use of Day Orders. Maine Yankee has implemented corrective actions to address all the violations.

2.2.1.4 LICENSEE EVENT REPORTS

Maine Yankee is required to file a report to the NRC within 30 days of events occurring which are specified in the 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 loses 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 twelve LER's with the NRC for 1990. Of the twelve, six were due to component failures, two were issued for Technical Specification violations, one was due to a design flaw, and three were the result of personnel error. A description of the LER's can be found in Appendix III.

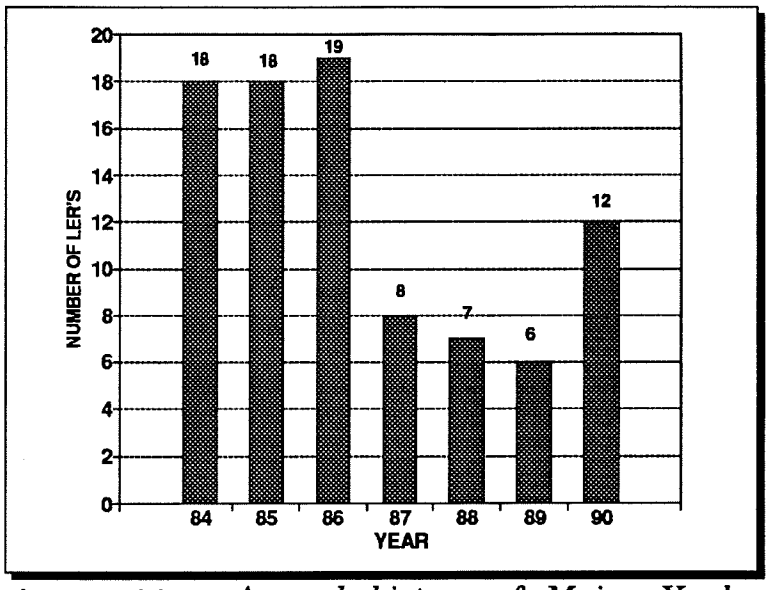


Figure 11 *Annual history of Maine Yankee Licensee Event Reports filed with the NRC.*

Figure 11 is a graph depicting the frequency of LER's generated at Maine

Yankee for the years 1984 through 1990. Data prior to 1984 is not shown since a change in NRC regulations concerning LER reporting requirements occurred. As shown, the number of LER's generated by Maine Yankee increased in 1990. The increase was largely due to an increase in component failures and plant shutdowns to make repairs as compared to events at Maine Yankee in 1989. Because the safety significance of LER's vary, the number of LER's submitted by Maine Yankee should not be viewed as an overall measure of the plant's safety performance. Here the frequency of LER's generated at Maine Yankee is provided to convey the number of events that have some safety significance with regard to the Maine Yankee operation.

2.2.1.5 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 has received approval from the NRC of a design change to comply with the ATWS rule. Maine Yankee will implement the design change during their February 1992 refueling outage.

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 (SBO) 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.

On September 12, 1990, the NRC determined that Maine Yankee is not yet in conformance with SBO Rule and that specific items remain to be resolved. To date, this USI is still in review with the NRC.

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. Maine Yankee provided the NRC with a letter of resolution concerning this USI on June 30, 1887. Maine Yankee's basis for meeting the seismic qualifications was their participation and successful completion of a similar NRC sponsored seismic program. While the NRC accepted this basis for resolution to resolve a number of the seismic issues, the NRC was not satisfied that all issues were satisfied. Maine Yankee has requested that the NRC reassess this decision and the matter is still under review.

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 (submitted in Fall 1990) to this safety issue.

2.2.1.6 RADIOLOGICAL SAFETY

Worker Exposure

Some personnel at Maine Yankee can be exposed to radiation when working on the nuclear-side of the plant. To protect the health and safety of these workers, Maine Yankee is required by Federal law to monitor their exposure to radiation to assure doses do not exceed allowable levels. In addition, Maine Yankee, like all facilities where a potential exists for radiation exposure, is expected to follow good radiation protection practices that will reduce radiation dose to workers, individually and collectively, as low as is reasonably achievable.

The NRC assesses Maine Yankee's performance in protecting workers from radiation exposure by conducting announced and unannounced plant inspections and audits. A recent comprehensive assessment of Maine Yankee by the NRC, called the SALP (Systematic Assessment of Licensee Performance) report, found Maine Yankee's performance in radiological protection to be good, with considerable improvement from several years ago.

The on-going improvements of Maine Yankee's radiation protection program were initiated by plant management in 1989, when the NRC found Maine Yankee's performance as meeting regulatory requirements, but in need of considerable attention (as noted in the NRC 1989 SALP report). Maine Yankee responded to the NRC's concerns by acquiring various expert groups to conduct an in-depth review of the company's radiation program. The review identified the areas where improvement was needed, and a plan was developed to reorganize the program in June 1990 under the name of the Radiation Protection Improvement Plan (RPIP). The RPIP is a two and one-half year project with a completion date at year's end in 1992. The plan is now about fifty percent complete, and is proving to be effective in improving radiological practices at Maine Yankee.

In controlling radiation exposure to workers, Maine Yankee met its planned refueling person-rem goal, but unexpected events during and after the refueling outage resulted in additional radiation exposure. The additional exposure increased Maine Yankee's 1990 goal of limiting total worker radiation dose to 500 person-rem. As shown in Figure 12, the annual collective radiation exposure at Maine Yankee for 1990 was 682 person-rem. Radiation exposures for the previous years when Maine Yankee conducted refueling activities are essentially in the same range, thus the 1990 total dose essentially portrays no improvement in reducing worker exposure. (The years in which Maine Yankee was not refueling are evident from the small person-rems recorded, e.g. the years 1983,1986,1989).

The inability of Maine Yankee to reduce radiation exposure was due solely to out-of-scope work performed during refueling and afterwards. In preparing for the

1990 refueling outage, Maine Yankee estimated that all the refueling outage activities, which included scheduled maintenance and inspections, would require 440 person-rem to complete. Radiological controls for the outage were well planned and implemented for the originally scheduled activities, that were accomplished with 419 person rem, below the goal of 440 person-rem. However, during the refueling outage, several unplanned inspections and repairs were required that demanded an additional 106 person rem in radiation exposure. Shortly after the refueling outage and plant start-up, several major repairs were once again required, and combined with routine activities resulted in an additional 157 person rem.

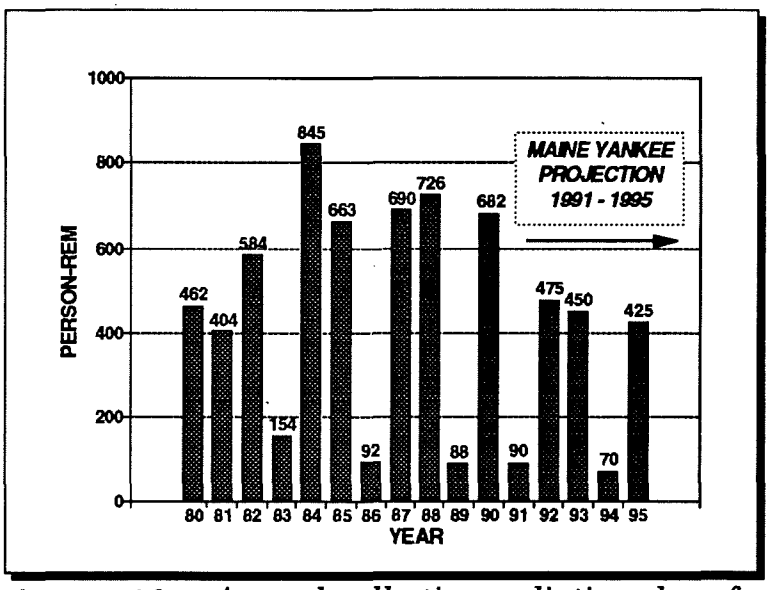


Figure 12 *Annual collective radiation dose for Maine Yankee personnel.*

As is evident from Maine Yankee's experience in 1990, controlling personnel radiation exposure is dependent primarily on the frequency of repairs and maintenance activities on the nuclear-side of the plant. Though the higher annual doses at nuclear power plants typically occur when refueling activities are scheduled, (at 18 month intervals), most of the radiation exposure is from the non - refueling activities. In addition to removing and replacing one - third of the fuel in a reactor during an outage, nuclear power plants perform necessary inspections and maintenance activities that cannot be done while the reactor is operating. (See 1990 refueling activities in section 2.2.2). Figure 13 shows the apportionment of radiation exposure by work function for the U.S. nuclear power industry. Refueling a reactor accounts for only a small portion of the total

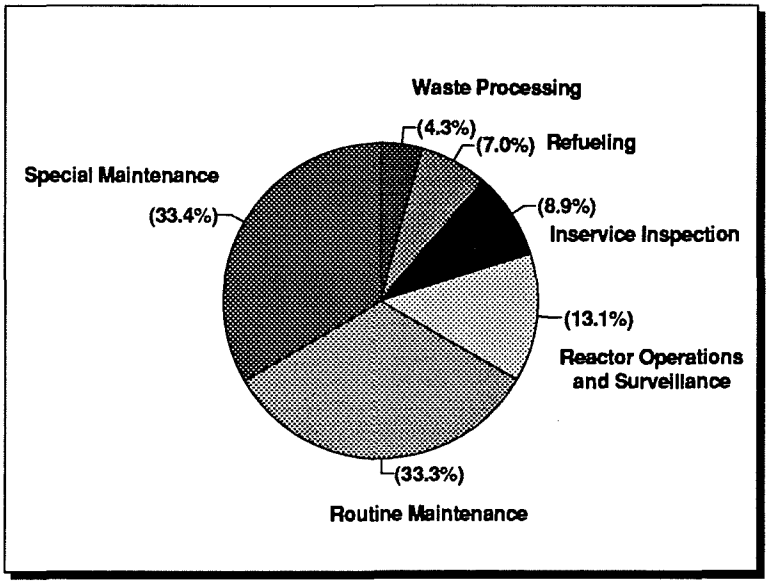


Figure 13 *Apportionment of radiation exposure by work function for the U.S. nuclear power industry.*

dose (7 percent), while routine and special maintenance activities are the major contributor to the collective personnel dose at approximately 67 percent. Therefore, any reduction in total dose is highly dependent on careful planning and work practices to minimize radiation exposure for scheduled and unplanned repairs and maintenance activities. NRC inspection reports have indicated that Maine Yankee has made considerable progress in reducing and controlling radiation dose for specific tasks, but further stated that radiological controls for the routine activities in the plant could be improved.

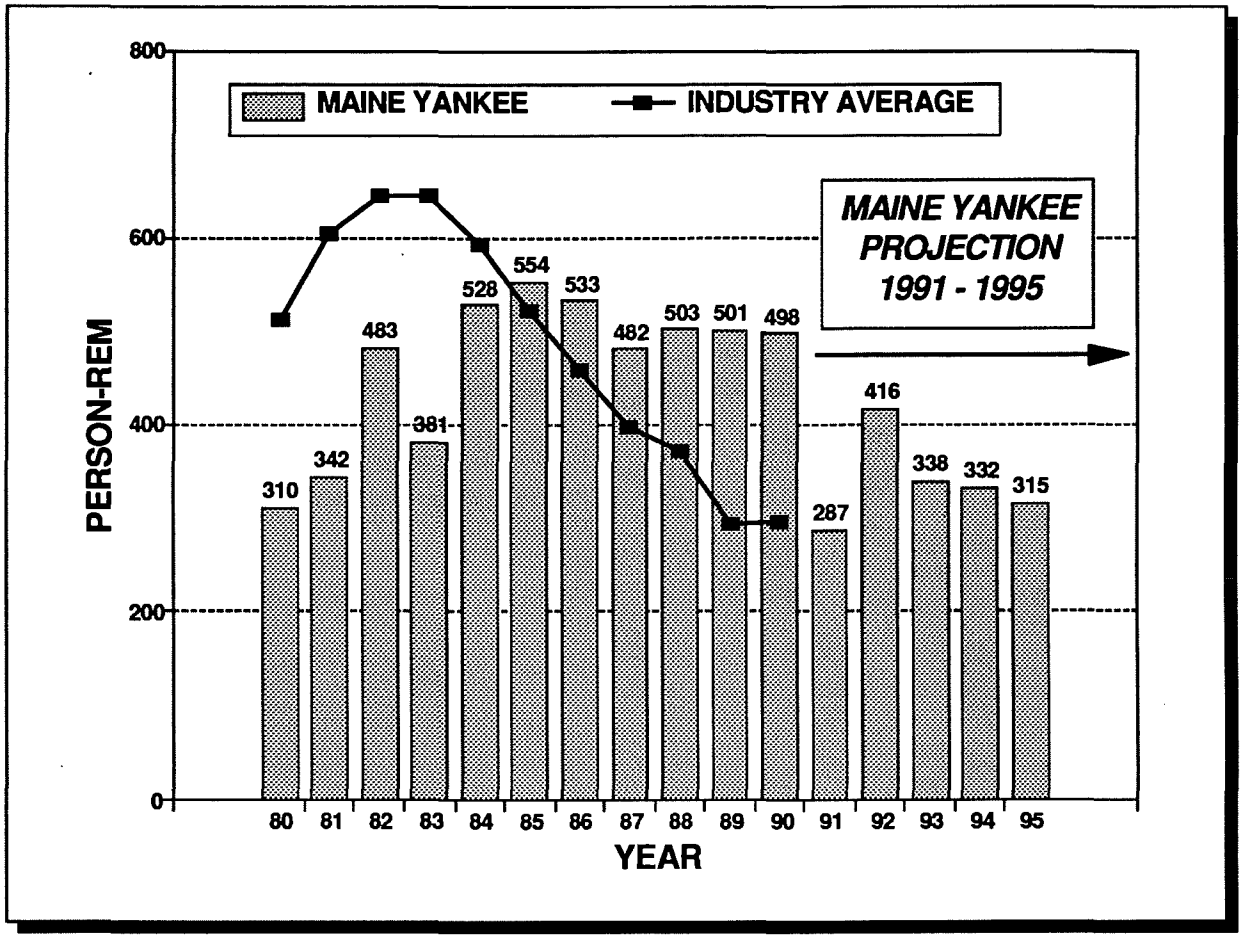


Figure 14 *Annual 3 year averaged collective radiation dose for Maine Yankee personnel and the U.S. pressurized water reactor industry.*

Maine Yankee's radiological performance compared to the U.S. industry average is shown in Figure 14. The graph displays 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. As shown, 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 and remained relatively stable. This is due in part to Maine Yankee's emphasis on performing maintenance to upgrade and improve the efficiency of the plant, and to the additional radiation exposures due to unplanned repairs and maintenance activities.

Maine Yankee has announced its goal to reduce radiation exposure in the next five years to levels that are characteristic of the overall nuclear power industry. To accomplish dose reduction, Maine Yankee's efforts will include reducing the major sources of radiation exposure in the plant, by removing radioactive contamination that has built-up in the pipes and steam generators over the nineteen years of operation. Decontamination programs have been developed at other nuclear power plants that may be applicable to Maine Yankee, such as a particularly novel project at the Indian Point nuclear power plant in New York, where the entire reactor coolant system will be flushed to remove contamination.

Revised Radiation Protection Regulation

Maine Yankee, as well as all NRC licensees, will be updating their radiation protection programs to conform with the revised federal regulations for radiation protection (10 CFR 20) that are to be implemented by nuclear power plants by January 1, 1993. These are derived from the 1977 recommendations of the International Commission of Radiation Protection (ICRP), Publication 26. The most significant change in the revised regulation is a new system to calculate dose and limits to radiation exposure. More specifically, the calculation of dose will relate more clearly to the total risk to the worker from radiation exposure. It will change the limits to radiation exposure to 5 rem per year, where under the previous regulations a worker could have received up to 12 rem for a number of years. For the first time, the regulations contains a radiation dose limit to an unborn child, and the practice of maintaining exposure to radiation as low as reasonably achievable (ALARA), is now explicitly stated in regulation. Maine Yankee has stated their intent to begin the implementation of the revised 10 CFR 20 in mid 1992.

However, the ICRP has now updated its 1977 recommendations. The new ICRP 90 recommendations are based upon more recent studies that have upwardly revised risk estimates for radiation exposure by a factor of 2 to 4. The most notable and far reaching recommendation from ICRP 90 is new dose limits for occupational exposure. The ICRP decided to set an annual dose limit of 5 rem per year (which is no different than the previous recommendation), but added that the dose averaged over 5 years should not exceed 2 rem. Dose limits from ICRP's previous recommendations for members of the public remained unchanged at 100 millirem per year averaged over 5 years.

With the publication of the new ICRP recommendations in 1991, the process in the U.S. to consider revising radiation dose limits begins once again. Since the

release of the ICRP 1977 recommendations, a period of approximately 13 years elapsed before the U.S. radiation protection regulations in 10 CFR 20 were updated. Although the adoption of the ICRP 90 recommendations in regulation is also likely to be a lengthy process, the additional reduction in occupational dose as recommended by ICRP 90 is being accomplished in the most part by the practice of ALARA in the work place. Already the average dose to occupationally exposed individuals is well below the limits recommended by ICRP 90, with 97% of the workers in the nuclear power plants and other industries where the higher radiation exposures occur, receive annual doses less than two rem.

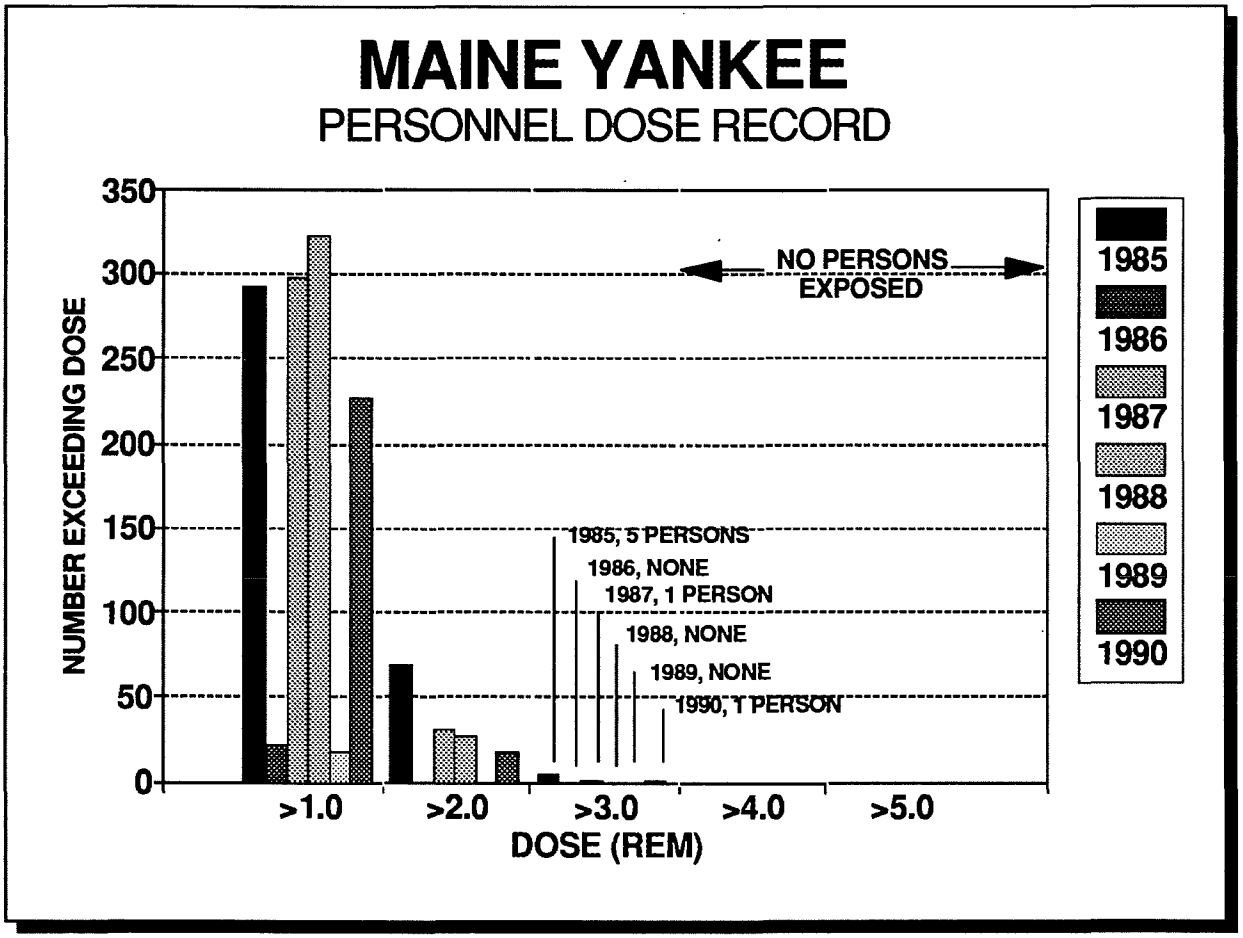


Figure 15 *Number of personnel at Maine Yankee exceeding annual radiation doses greater than 1,2,3,4 and 5 rem.*

Figure 15 shows how at Maine Yankee most of the workers have received doses below two rem, and a small number have received doses greater than two rem. No workers have exceeded Maine Yankee's administrative dose limit of 4 rem per year, which is set below the federal limit of five rem per year. Since the new ICRP 90 occupational dose limits are not that far from the doses received from the current radiation practices in the U.S., Maine Yankee and the US nuclear power industry have an opportunity to continue making progress in dose reduction such that future reduced dose limits will not adversely impact their operations.

2.2.1.7 Main Generator Hydrogen Fire

On April 29, 1991, 6:32 p.m., Maine Yankee experienced a fire in the non-nuclear section of the plant. One of the two main transformers at Maine Yankee experienced an internal short circuit, which led to an electrical system overload causing electrical arcing nearby the main generator. Hydrogen gas, which is used to cool the generator, escaped through damaged piping by the generator and was ignited by the arching.

All plant safety systems operated as designed. Upon sensing the short circuit from the transformer failure, the plant's turbines and generator were automatically shutdown, which subsequently and automatically safely shutdown the reactor.

Maine Yankee declared and reported the fire to the State and the NRC as an "Unusual Event" at 6:42 p.m. as the fire lasted longer than 10 minutes. An Unusual Event is an emergency classification category for commercial nuclear power reactors, and is used to alert state, local, and federal officials of conditions at a plant which require monitoring. The fire was placed under control within minutes by the Maine Yankee fire brigade, with the Wiscasset fire department standing-by, if needed. As a safety precaution, the remaining hydrogen in the generator was burned-off under a controlled and monitored procedure which took about three hours. The fire was fully extinguished and Maine Yankee terminated the Unusual Event at 12:03 a.m. on April 30, 1991.

Damage to Maine Yankee from the fire involved one main transformer that needed to be replaced, and some damage to the main generator. Within one month, Maine Yankee had made the necessary repairs, and returned to service on June 1, 1991.

In addition to the failed transformer causing a fire at the main generator, the transformer ruptured and leaked oil into the surrounding containment berm. Water from the transformer sprinkler system also collected into the berm, and caused some 200 gallons of a mixture of mineral oil (no PCB content) and water to escape into the Back River through storm drains. With the assistance of the U.S. Coast Guard and the Maine Department of Environmental Protection, Maine Yankee and Central Maine Power workers cleaned up the oil over several days. No adverse environmental impact is expected from the oil spill.

A special Nuclear Regulatory Commission investigation into the Maine Yankee fire was held from May 1 through May 10, 1991.[5] The NRC found that Maine Yankee acted correctly and appropriately in responding to the fire. The NRC also found there were no radiological consequences from the fire, and this was confirmed by the State Nuclear Safety Inspector. The NRC also inspected and evaluated the

[5] U.S. Nuclear Regulatory Commission, Region 1, Report No. 50-309/91-80, May 16, 1991.

possibility that Maine Yankee's authorized power increase in 1989 from 2630 MWt(megawatts thermal) to 2700 MWt may have been responsible for this event. Their investigation, though not complete, did not find any design or maintenance shortcomings with the maine transformer, maine generator, or other related components.

In addition to the NRC investigation, the Federal Emergency Management Agency (FEMA) investigated the alert and notification procedures used by Maine Yankee and other responsible agencies during the evening of the Unusual Event. Their investigation found that "Maine Yankee personnel involved in offsite notification performed that notification in a timely manner and in accordance with established procedures. Human error resulted in the failure of the State Police Dispatcher to include the emergency classification level (Unusual Event) during notification to the appropriate offsite response personnel."[6] The FEMA report concluded with recommendations to the State which have been adopted.

Provided in Appendix IV through VI are selected parts of reports from Maine Yankee, the Nuclear Regulatory Commission and the Federal Emergency Management Agency which can provide more insight into the Unusual Event at Maine Yankee. Appendix IV is a report from Maine Yankee detailing the event and their response to several issues which were raised. Appendix V is an overview of the NRC's finding from their investigation into the fire at Maine Yankee, and Appendix VI is the recommendations from their investigation of offsite response and notification with regards to the Unusual Event.

[6] Review of Offsite Notification During the Incident at the Maine Yankee Nuclear Power Plant on April 29, 1991. Federal Emergency Management Agency, Region 1, June 6, 1991.

2.2.1.8 Status of Maine Yankee Steam Generators

The Maine Yankee Station utilizes three steam generators (SGs) to produce the steam required to generate electricity. The SGs provide a barrier between the water which circulates and cools the reactor and the steam system that powers the turbines which spin the generator. Leakage within a SG is undesirable for it can lead to a release of radiation to the environment, an increase in worker radiation exposure, and a loss of cooling water which is needed to prevent damaged to the reactor.

Several events have taken place at Maine Yankee in the last year that have drawn attention to the condition of the company's SGs. During Maine Yankee's refueling outage in April 1990, an inspection of their three SGs identified defects in some of the tubes, (of which there are 5703 per SG). The discovery of the defects led Maine Yankee to perform a comprehensive investigation into the condition of the three SGs. Subsequently, on December 17, 1990, Maine Yankee conducted a controlled shutdown as it experienced its first steam generator tube leak in its 19 years of operation.

Steam Generator tube failure is not unique to Maine Yankee. Currently, many reactors in the U.S. and abroad are experiencing degradation of their SG's.[7] In most cases the degradation in the SG can be repaired, however, replacement of degraded SGs is becoming more frequent world-wide as the average age of nuclear power plants increases.

At present, the condition of Maine Yankee's SGs is better than the nuclear industry in general and better than other Combustion Engineering (CE) reactors similar to Maine Yankee. Of the 17,109 tubes comprising Maine Yankee's SGs, only 128 have been found to be flawed and were subsequently place out-of-service. Other CE reactors that are about the same size and age as Maine Yankee, such as Calvert Cliffs 1 and 2, are also performing well with minimum degradation to the SGs. However, there are CE reactors, such as St. Lucie-1 and Millstone-2, which have experienced considerable degradation requiring over a thousand tubes to be placed out-of-service. Moreover, the Palisades reactor in Michigan, which is the same age as Maine Yankee, has experienced substantial SG degradation which led to the recent replacement of its two SGs (March 1991). This was the first SG replacement for a CE reactor, and the seventh SG replacement at a U.S. nuclear power plant. The replacement of the SGs took 93 days at a cost of $97-million excluding the cost of the two SGs.

The degrading mechanisms of SG's is complex and varies among nuclear power plants even from the same manufacturer. Maine Yankee has investigated and identified the failure mechanisms responsible for their SG tube failures to the NRC's

---

[7] 1991 NRC Regulatory Information Conference, Steam Generator Issues, Emmett Murphy, Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation.

satisfaction.[8] Where Maine Yankee recognizes that there will be failures of SG tubes in the future (which is not unusual in the nuclear industry), they have taken several steps to avert any serious tube failures by implementing actions for early detection of any SG flaws. Among the actions that Maine Yankee has taken are as follows:

-- increased the monitoring of the SGs for leaks.

-- reduced the allowable SG leakage rate to assure the reactor can be shut-down safely before a tube break.

-- Increased training of plant operators in early detection of SG tube leaks and operator response to a SG leak.

-- expanded the SG inspection program during refueling outages.

-- Continuing analysis and testing to establish the optimum reactor operating conditions to minimized any future degradation to the SGs.

Maine Yankee has successfully demonstrated the effectiveness of the initiatives implemented to monitor and respond to a SG leak. On December 17, 1990 Maine Yankee identified and monitored a SG leak and the operators safely shut down the reactor and probably averted a SG tube break. Maine Yankee's performance in this event was commended by the NRC.[9]

In all, the NRC appears to be satisfied with Maine Yankee's response to the recent SG problems. Maine Yankee believes they have a good understanding of the degradation mechanism for the SGs, and predicts that the SGs will perform through the licensed life of the plant.

[8] Maine Yankee presentation of steam generator issues to State of Maine officials, November 14, 1990.

[9] Letter dated January 22, 1991 from Thomas T. Martin, NRC Regional Administrator, to Charles D. Frizzle, President of Maine Yankee Atomic Power Company.

2.2.2 REVIEW OF MAJOR PLANT ACTIVITIES

In 1990, Maine Yankee undertook several notable activities in the area of equipment replacements, operational changes, maintenance, and inspections. A summary of the major plant activities is listed below:

Equipment replacements:

-- High Pressure Turbine

A new high pressure turbine was installed at Maine Yankee during the refueling outage from April to June 1990. The purpose of the replacement was to provide an increase in reliability, availability, and efficiency, and to enable the plant to be operated at a high power level (from 2630 Megawatts thermal to 2700 Megawatts thermal), as approved by the NRC in 1989.

-- Feedwater Heaters

The remaining feedwater heaters with copper alloy tubing were removed and replaced with units bearing ferritic stainless steel tubing. The purpose of the change was to prolong the life of the steam generators and to increase the thermal efficiency.

-- Control Element Assembly Replacement

On June 7, 1990, a control element assembly (CEA) would not fully insert into the core during a testing procedure. Maine Yankee's analysis found the CEA which is of the original design for their reactor, experienced a failure mechanism that could occur to 23 other assemblies that control the reactor. Maine Yankee corrected the problem by replacing the 22 assemblies with a new design, and scheduled the replacement of the remaining one during the refueling outage in February 1992.

Inspections:

-- Core Barrel and Thermal shield

Nuclear power plants are required to conduct an inspection of the reactor vessel and its internals every ten years. Maine Yankee conducted an inspection in 1982 and found missing positioning pins

which secure the thermal shield. Repairs were made and Maine Yankee committed to the NRC to perform the next inspection prior to the ten year requirement. In 1990 Maine Yankee performed a detailed visual inspection of the core barrel and thermal shield, and found the components maintained their integrity. However, six roll pins were found to be missing indicating a design deficiency. Maine Yankee corrected the deficiency with a revised design.

-- Safety Related Motor-Operated Valve (MOV) Testing & Surveillance

In 1989, the NRC requested that licensees establish a program for the testing, inspection, and maintenance of MOVs in safety related equipment. This NRC action was prompted by a number of significant operating events at nuclear power plants where MOVs have failed to operate as designed. Maine Yankee inspected one-third of the MOVs in the 1988 and one-third in 1990. The remaining MOVs will be inspected during the up-coming refueling outage in February 1992.

-- Rosemount Transmitters

A reactor-core monitoring system using Rosemount Transmitters was found to fail under certain conditions at the Millstone nuclear power plants in Connecticut. The NRC issued a Bulletin in March 1990 for nuclear power plants using these transmitters to perform an inspection. Maine Yankee completed inspection of all the transmitters and found all to be free of defects except one, which was repaired and replaced. One transmitter was from a suspect manufacturing lot, and was subsequently replaced.

Maine Yankee will be performing their next refueling outage in February 1992. An outline of refueling outage projects is provided in Appendix VII.

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

Overall, radioactive gaseous releases have increased at Maine Yankee in 1990 as compared to the past several years. The primary cause for the increase is from leaking fuel rods, similar to Maine Yankee's experiences in 1974, 1980 and 1986.[10]

Leaking fuel occurs when a fuel rod in the reactor vessel develops small defects (either through a manufacturing flaw, debris in the reactor cooling system, or by other mechanisms), that allow small amounts of the radioactive fission gaseous to escape and enter the reactor coolant system. Maine Yankee identified evidence of leaking fuel when the reactor was returned to operation after refueling in June 1990. Their analysis estimated that of the 37,480 fuel rods in the reactor, four to seven were leaking. Since the leaking fuel was identified, Maine Yankee has been monitoring the condition and has found that the leaking is not increasing and remains stable.

According to Federal regulations, Maine Yankee can operate with up to one percent of the fuel rods leaking (375 rods). Although Maine Yankee can continue to operate with the leaking fuel, Maine Yankee officials have stated their intent to locate and replace the leaking fuel rods during their refueling outage in February 1992. Also, during the refueling outage, Maine Yankee will remove 68 fuel assemblies from the reactor and replace them with fuel assemblies designed to better withstand damage from the more common mechanism (debris induced fretting).

---

[10] Prior to the release of this report, the NRC identified a calibration error by Maine Yankee of an instrument used in providing the discharge flow rate of the plant vent stack. The flow rate of vent stack is needed to calculate the concentration of gaseous radioactive releases. Thus, 1990 data by Maine Yankee of gaseous radioactive releases from the primary vent stack could potentially be underestimated by a factor of two within this report. In considering the consequences of the potentially incorrect data to the public health and safety, the maximum dose from releases from Maine Yankee for 1990 remains well below the regulatory limit, and is not expected to have any adverse impact on the public health or the environment.

The occurrence of this calibration error has raised concerns by the State Nuclear Safety Advisor, and the State Nuclear Safety Inspector in the accuracy and reporting of radioactive releases by Maine Yankee. A discussion on the impact of this event on the State's ability to monitor releases from Maine Yankee will be directed to the Radiation Monitoring Issues Committee.

As shown in Figures 16,17, and 18, the leaking fuel has resulted in levels of radioactivity released to the environment that are higher than the last two years, but are still representative of releases from Maine Yankee in the eighties. This is because Maine Yankee also experienced leaking fuel in the years 1980 and 1986.

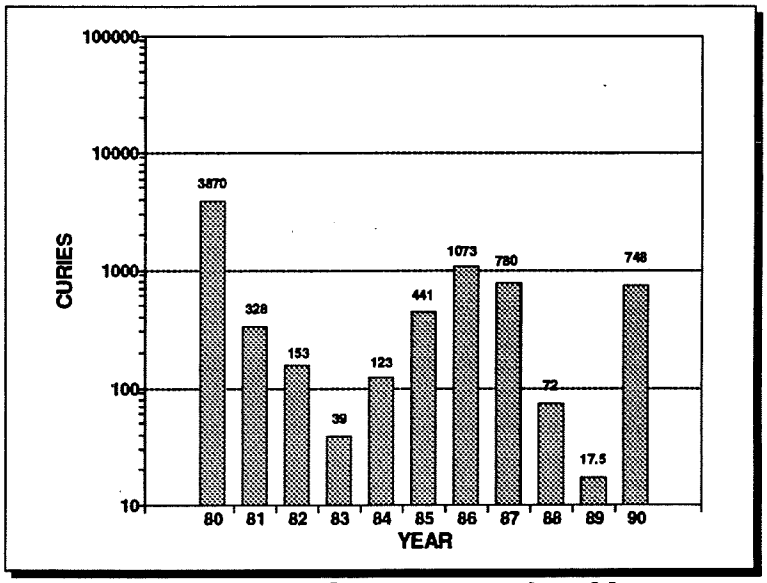


Figure 16 *Annual quantity of noble gaseous releases from Maine Yankee.*

The effect of leaking fuel rods on environmental releases is most pronounced in the amount of radioactive noble gas that is released. As shown in Figure 16, Maine Yankee released about 748 Curies, as compared to the 17.5 Curies in 1989 when Maine Yankee operated with no leaking fuel. Most of the noble gas release occurred during two shutdowns of Maine Yankee at October 19 and December 17, 1990 when the containment building was vented to allow entry for necessary repairs.

The release of radioactive Halogens, as shown in Figure 17, also increased from 0.151 milliCurie in 1989 to 3.26 milliCurie in 1990, but is typical of past releases from the plant. Releases of gaseous radioactive Tritium are shown in Figure 18. The 1990 release of 17.6 Curies is well within regulatory limits, but is elevated from any of the annual releases for the past 10 years. This increase is due to the increase in the plant shutdowns in 1990 that required venting of the containment building to accommodate personnel entry to necessitate repairs. In all, in 1990 Maine Yankee

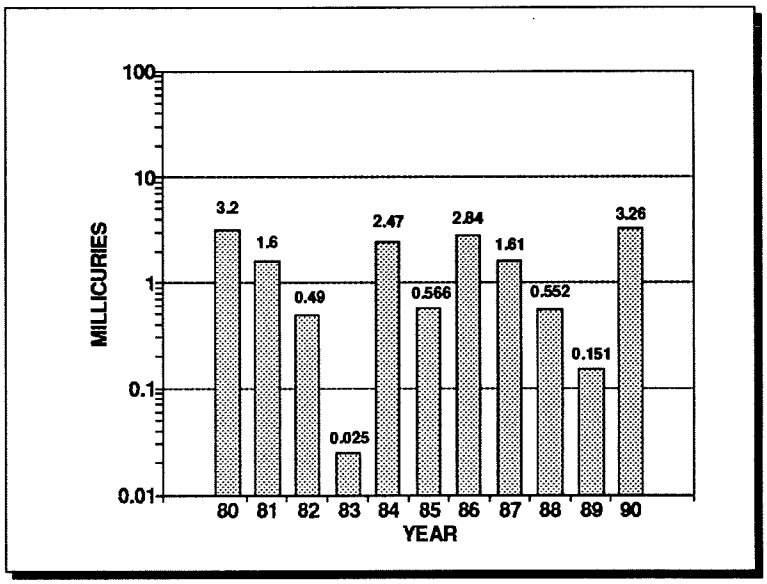


Figure 17 *Annual quantity of gaseous halogens released from Maine Yankee.*

had 88 gaseous releases, which totaled about 765 Curies.[4,5]

Relating the quantity of radioactive material released to the environment from the Maine Yankee operation to a health-based risk requires calculating the potential radiation dose from each specific material released. Different materials, given the same quantity, present a greater or lesser hazard. Thus, 200 Curies of noble radioactive gas released from Maine Yankee would typically produce a very small dose, while the release of 200 Curies of a halogen, such as radioactive Iodine, would be unacceptable and of considerable concern to public health.

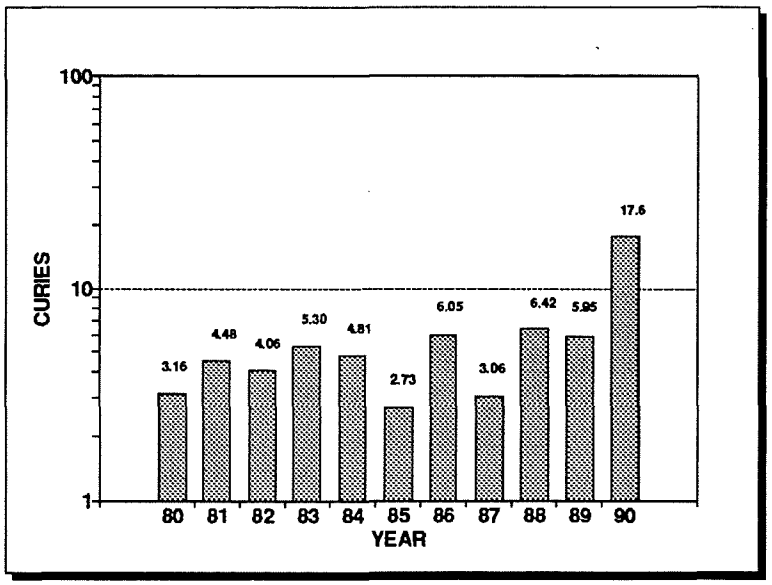


Figure 18 *Annual quantity of gaseous Tritium released from Maine Yankee.*

The estimated dose from all the radioactive gaseous releases from Maine Yankee for 1990 to members of the public living near the plant is 0.23 millirem.[6,7] This estimated dose is based on a theoretical person standing 24 hours a day for 365 days at the boundary of the Maine Yankee site. Radiation doses in this range are well within the fluctuations of exposure to natural background and are not expected to pose any undue risk to public health or adverse impact to the environment. For comparison purposes, the average person receives an annual dose of 300 millirem from sources of natural radiation.[8] Current Federal regulations limit radiation dose to the public to 500 millirem per year from man-made sources of radiation, excluding

---

[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.

[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 Report from Maine Yankee to the Nuclear Regulatory Commission, dated March 29, 1991.

[8] From Health Effects of Exposure To Low Levels Of Ionizing Radiation, BEIR V, National Academy Press, Washington, D.C. 1990.

medical radiation where there is no limit, due to the assumption that the benefit from exposure is greater than the risk undertaken. Beginning in January 1993, the Federal limit is reduced to 100 millirem per year.

2.3.2 Radioactive Liquid Releases

Radioactive liquid releases from Maine Yankee were lower than the previous year. For 1990, Maine Yankee had 212 releases totaling 248.2 Curies, of which approximately 98% was radioactive Tritium.[5] The quantity of radioactive Tritium produced and released is related to the time Maine Yankee is operating. Maine Yankee experienced considerable down-time in 1990, due to refueling activities and shutdowns, that resulted in less Tritium production as compared to operations in 1989 when the plant had a record year for the production of electricity. Figure 19 depicts Maine Yankee's record for Tritium liquid effluent releases since 1980. Shown in Figure 20, is the history of liquid releases of fission and activation products from Maine Yankee since 1980. Releases in 1990 were low, and characteristic of previous years. Calculated doses to members of the public living in proximity to Maine Yankee from the release of liquid effluent are estimated at 0.0056 millirem[5]. This dose is well below Maine Yankee's license limit of 3 millirem per year, and is comparable to a radiation dose from natural sources when standing outdoors for one hour.

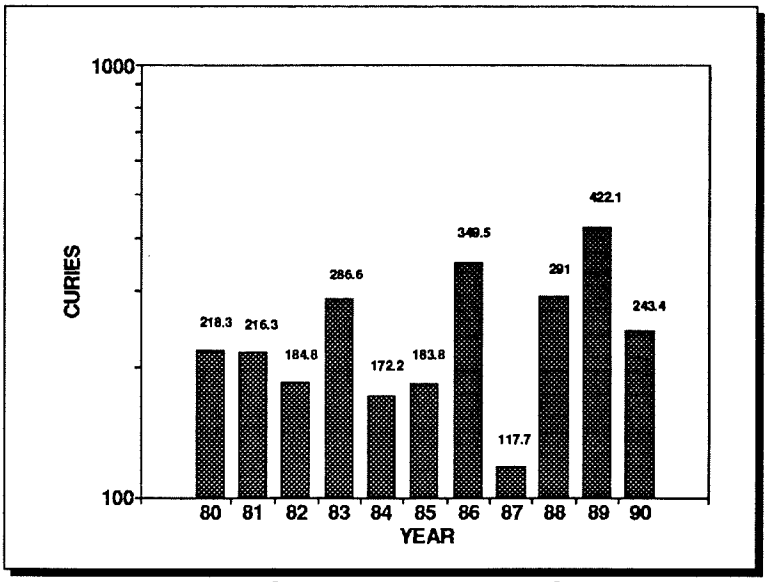


Figure 19 *Total annual Tritium liquid effluent releases from Maine Yankee.*

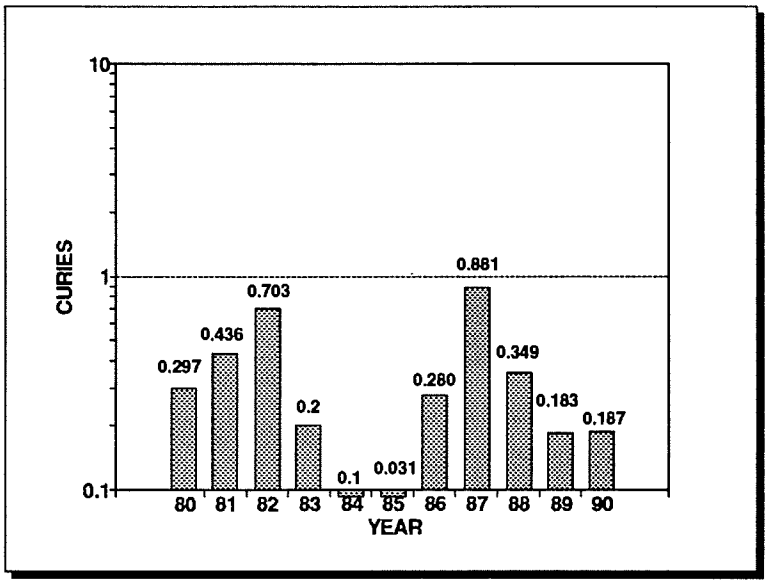


Figure 20 *Annual releases of liquid fission and activation products from Maine Yankee.*

2.3.3 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 exposure rate data to a central computer located at the Office of the State Nuclear Safety Inspector at Maine Yankee. The purpose of the State Environmental Monitoring Network (ERM) is to detect and record radiation exposure levels from radioactive gaseous discharges at Maine Yankee. Though the sensitivity of the system appears to be fairly good from the apparent detection of natural Radon build-up from advancing weather fronts, detection of Maine Yankee gaseous releases are difficult to verify, if at all. Since the system became operational in March 1989, radiation measurements recorded have ranged within the fluctuations of natural background radiation levels.

Concerns have been raised whether the present state monitoring capabilities and activities of Maine Yankee are adequate to protect the public health and safety. This concern was brought forth to the Legislature in L.D. 800, An Act to Protect the Public Health by Strengthening Maine's Radiation Protection Program. Because agreement could not be reached by the concerned parties and the Legislative Committee on the measures necessary to improve the state monitoring of Maine Yankee emissions, the bill was amended to form a study committee. The bill, approved by the Governor on June 24, 1991, formed the Radiation Monitoring Issues Committee to study the adequacy of exiting monitoring systems and evaluate the need for, and potential nature of, additional systems. The committee, chaired by the State Nuclear Safety Advisor, will submit a report of its findings to the Joint Standing Committee on Human Resources no later than January 1, 1992.

2.3.4 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 1990, approximately 47 persons 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, except a monitor placed in Edgecomb where elevated readings were reported on July 25, 1991. The Division of Health Engineering, Radiation Control Program, investigated the event and found no correlation to any activities at Maine Yankee, and so the event remains unexplained.

2.3.5 Environmental Radiation Surveillance Programs

The Radiation Control Program within the Division of Health Engineering (DHE) 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 VIII. Analyses of samples collected for 1990 have been completed and reviewed by the Division of Health Engineering. Other than the seaweed samples, no detectable quantities of radioactivity were found that 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 lower-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 VIII. Samples analyzed by the NRC did not show any 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 exposure. 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 IX 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, as well as an annual report of the analysis are made available to the State.

Maine Yankee compiled and submitted to the NRC a summary and analysis of the radiological environmental data collected for the calendar year of 1990.[9] With few exceptions, the vast number of environmental samples did not reveal any detectable radioactivity from Maine Yankee. The exceptions are a marine algae sample and a sediment sample.

The marine algae sample contained low-levels of radioactive Cobalt and Silver. The samples were taken in the general area of the Maine Yankee plant diffusers and is the result of controlled plant discharges. No impact on man or the environment is expected since marine algae is not consumed in anyway from the area, and the low-level of radioactivity detected is well below allowable levels for edible fish and invertebrates. Subsequent sampling taken at the same location showed no detectable radioactivity, with the exception of naturally occurring radionuclides.

Sediment samples taken from the Back River have been found to contain small amounts of radioactive Cesium. Though some of the radioactivity is due to nuclear weapons testing fallout, a portion can also be attributed to the early operation of Maine Yankee when the plant routinely released liquid effluent discharge into this area. Liquid effluent from Maine Yankee is now discharged into the main channel of the Back River and a diffuser was installed to correct this problem. The low-levels of radioactivity found in the sediment are not expected to have any adverse impact on man or the environment. Also, measurements over the past several years suggest the levels are decreasing. In addition to the radioactive Cesium found in the sediment, natural radioactivity was also detected as expected.

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 the inter-comparative analysis indicate a good laboratory precision between the State and the Yankee Atomic Laboratory.

2.3.6 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. Annually, Maine Yankee conducts an emergency exercise that is inspected and observed by the NRC. The State of Maine monitors and participates in these exercises, but not to the full extent as during the biennial exercises that are scheduled and observed by the Federal Emergency Management Agency (FEMA). The biennial emergency exercises include full participation by Maine Yankee, the

[9] Maine Yankee Atomic Power Station, Annual Radiological Environmental Monitoring Report, January - December 1990, submitted to the Nuclear Regulatory Commission, King of Prussia, PA., April 30, 1991.

State of Maine, and the 16 cities and towns surrounding the plant.

A full participation, two day exercise was held from July 31 to August 1, 1990. An evaluation of the performance by the State of Maine will be disclosed in a report by FEMA. Receipt of the report is expected in late 1991.

During the two day exercise, Maine Yankee's performance was observed and inspected by the NRC. The NRC found no violations in Maine Yankee's performance during the drill, although three exercise weaknesses concerning the emergency operations facility were identified.[10] Maine Yankee responded to the weaknesses identified by the NRC by committing to conduct an NRC observed remedial drill to demonstrate the adequacy of their corrective actions. The remedial emergency exercise was conducted on October 10, 1990. Findings by the NRC noted that Maine Yankee corrected the exercise weaknesses identified in the July 31, 1990 full-participation exercise.[11] In both emergency exercises conducted at Maine Yankee in 1990, the NRC concluded that the state of emergency preparedness at Maine Yankee is adequate to provide protective measures for the public health and safety.

[10] Nuclear Regulatory Commission, Inspection No. 50-309/90-14.

[11] Nuclear Regulatory Commission, Inspection No. 50-309/90-21.

2.4 RADIOACTIVE WASTE MANAGEMENT

2.4.1 LOW LEVEL RADIOACTIVE WASTE

Maine Yankee had a total of 23 outgoing shipments of low-level radioactive waste (LLRW) in 1990, with a total volume of 18,240.6 cubic feet. Of the total, 14 (shipments totaling 15,689.8 cubic feet) were sent for volume reduction prior to disposal. In 1990, Maine Yankee generated 16,401 cubic feet of LLRW, of which 15,963 cubic feet was dry active waste (DAW), with the remaining 438 cubic feet being processed liquid waste (such as resins, filters, and evaporator bottoms). The total volume of LLRW from Maine Yankee buried in out-of-state facilities in 1990 was 6757.5 cubic feet, with an activity of 192.5 curies.

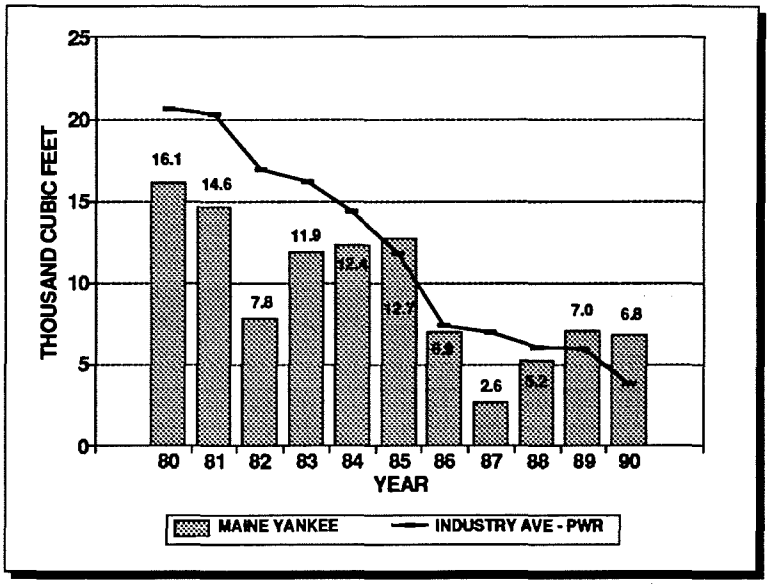


Figure 21 *Annual volume of low-level radioactive waste buried from Maine Yankee compared to the U.S. pressurized water reactor (PWR) industry.*

Figures 21 and 22 display the Maine Yankee record for Volume and Curies, respectively, of low level radioactive waste shipped since 1980. As shown, Maine Yankee's production of LLRW for 1990 is greater than the industry average, however, Maine Yankee's overall performance in LLRW production is somewhat representative of the declining LLRW waste production that is occurring in the U.S. nuclear power industry.

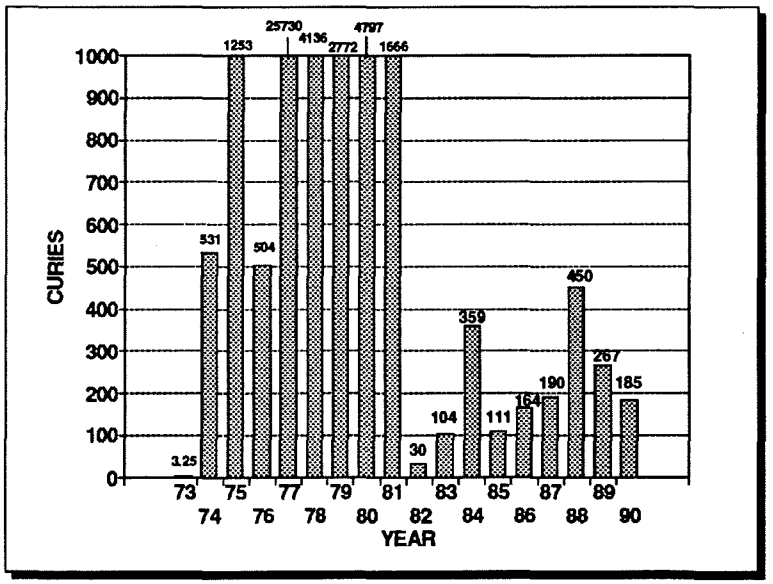


Figure 22 *Annual quantity of radioactivity in low-level radioactive waste buried from Maine Yankee.*

Until the end of 1992, it is expected that the majority of the LLRW will continue to be disposed at the Barnwell, South Carolina facility, which is one of the three facilities

currently available. As of 1993, it is expected that the out-of-state disposal facilities will no longer be available to LLRW generators 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 continuing to pursue a compact or contract with another state or compact region to accept Maine's LLRW. Past 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. In December 1990, the State of Maine submitted a revised financial incentive plan to the original proposal made to Texas. The revised plan proposed that Maine contribute up to $20 million toward the cost of constructing Texas' LLRW disposal facility. Provisions of this proposal include that Texas reserve an agreed upon amount of capacity at its facility each year for the disposal at no cost of LLRW produced by Maine generators. To date, Texas has not accepted Maine's offer, however, Texas has opened an avenue for serious negotiations by enacting a new law that would permit LLRW from other states to be disposed in Texas.

While the Governor's Office is continuing negotiations with Texas, negotiations are also taking place with California which is the host state for the Southwest Compact. The LLRW disposal facility in California is expected to be in operation by 1996, making it the first new facility developed since the enactment of the Federal LLRW law in 1980 which directed responsibility for LLRW disposal to the states. To date, negotiations with California have yet to move beyond a tentative stage despite regular contacts between the Governor's Office and California officials. On August 27, the Southwest Compact voted to reject all pending requests for out-of-region access to the California facility (including Maine's). It is not yet clear whether contacts may be renewed in the future.

A contract was successfully negotiated by the Public Advocate in 1989 with the Rocky Mountain Compact. This three-year contract guarantees Maine generators access to the LLRW facility in Beatty, Nevada to the end of 1992. The contract was pursued in part to meet the 1990 Federal milestone requirements per the Low-level Radioactive Waste Policy Amendments Act of 1985, Public Law 99-240, and to assure Maine generators access to a disposal facility in the event access is denied prior to 1993 for lack of meeting federal

milestone requirements.[12] The required ratification by Maine voters for this contract 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. If an agreement with another state or compact is reached, Maine voters will have an opportunity to accept or reject the contract or compact by referendum as required by Maine law.

LOW LEVEL RADIOACTIVE WASTE FACILITY IN MAINE[13]

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. The Authority has undertaken a site selection approach using two methodologies concurrently which will result in several potential sites. Specifically, sites within the State of Maine can be volunteered for consideration by private land owners while the Authority continues a technical process of identifying preferred sites. All sites will be evaluated against criteria established for final site selection.

By Fall 1991, the Authority expects to identify ten to fifteen candidate sites, along with an unspecified number of volunteer sites. These sites will be compared to allow the selection of one preferred candidate site and two alternative sites by May, 1992.

Although the Authority's siting plan provides for an in-state disposal facility to become operational by December 31, 1996, it may be difficult to meet this timetable due to potential legal challenges to the siting process and the challenge of obtaining the necessary voter approvals for site selection as required by Maine Law. Moreover, access to out-of-state disposal facilities is likely to be denied as of December 31, 1992. With these likely occurrences, Maine generators of LLRW may be required to store their wastes on-site for four years or more, unless an out-of-state agreement is reached.

Maine Yankee, being the largest producer of LLRW in Maine, will be

---

[12] The Federal Low-Level Radioactive Waste Policy Amendments Act of 1985 set out a series of milestones that each state must meet. Failure to meet the requirements of the milestones could result in a loss of access to existing LLRW disposal facilities. Maine has been successful in meeting both the 1988 and 1990 milestones, but the Authority does not anticipate meeting the next milestone in 1992.

[13] Information on Maine's activities in siting an in-state LLRW disposal facility was obtained from the Maine Low-Level Radioactive Waste Authority, Draft 1991 Siting Plan, Revision 3. The full report is available from the Maine Low-Level Radioactive Waste Authority, 99 Western Avenue, P.O. Box 5139, Augusta, Maine 04332-5139. Telephone 1-800-422-4911 or (207) 626-3249.

able to safely manage its LLRW by on-site storage in the event that shipping the waste for burial out-of-state is no longer possible. Guidance issued by the Nuclear Regulatory Commission currently allows on-site storage of LLRW for a period of 5 years with provisions to obtain extensions. The capacity of Maine Yankee's storage facility could conceivably contain LLRW from 10 years of operation. The NRC is currently reviewing the regulatory and safety issues with regards to the on-site storage of LLRW beyond 5 years in anticipation that interim storage practices will increase as existing disposal sites close and the operation of new facilities is delayed.[14]

2.4.2 HIGH LEVEL RADIOACTIVE WASTE

Maine Yankee, similar to all nuclear power plants, produces 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 specially designed pool filled with borated water to cool the spent fuel and provide shielding from the radiation emitted. 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.

The disposal of the spent fuel from the Maine Yankee site is the responsibility of the U.S. Department of Energy (DOE). However it is unlikely the DOE will be able to take possession of the spent fuel in time to alleviate the need to increase the spent fuel storage capacity at Maine Yankee. The Department of Energy's schedule to begin operating a high level waste repository has been moved back 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 is likely to be needed.

Maine Yankee's near exhaustion of on-site spent fuel storage capacity can be better understood by providing some background to this issue.[15]

---

[14] SECY-90-318 (Sept.12, 1990), LLRWPAA Title Transfer and Possession Provisions, 55 Fed. Reg. 50,064 (Dec. 4, 1990).

[15] *From State of Maine, Division of Health Engineering, Office of Nuclear Safety, State Nuclear Safety Inspector 1989 Report.*

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 1008 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 operating in time to accept spent fuel, so in 1975 Maine Yankee applied for and received a license 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 then 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 all the fuel pins are repacked into a tighter array, thus permitting more than one assembly to be stored in the same area as the original. 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 limited fuel assemblies would be consolidated as a demonstration project. Maine Yankee successfully consolidated a fuel assembly in 1984. 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.

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. The plant received its full power license on March 1, 1990, and began operating at full power since summer 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.

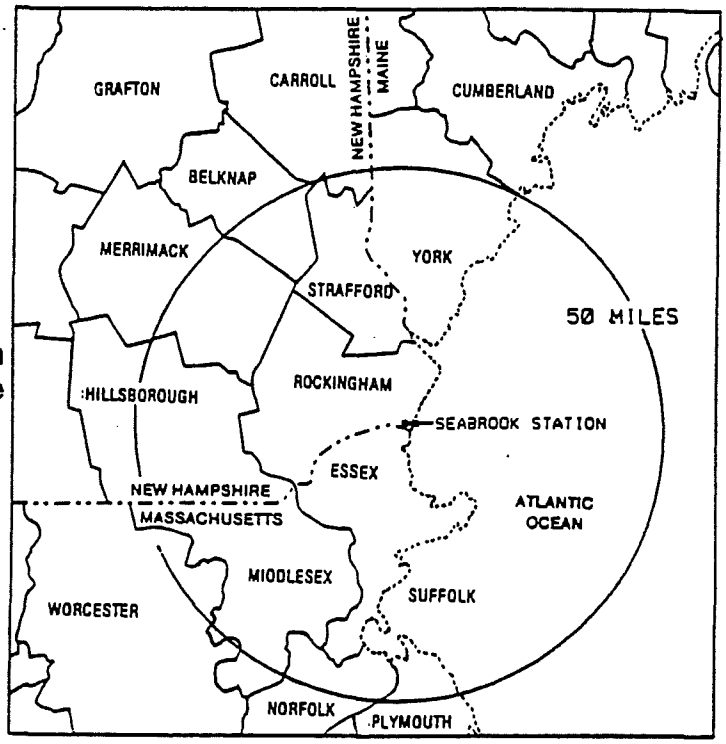
-- Seaweed samples are collected at Moody Beach and Kittery Point and analyzed for radionuclides on a quarterly basis.

Analysis of environmental samples collected for 1990 indicated no detectable radioactivity from the operation of Seabrook.

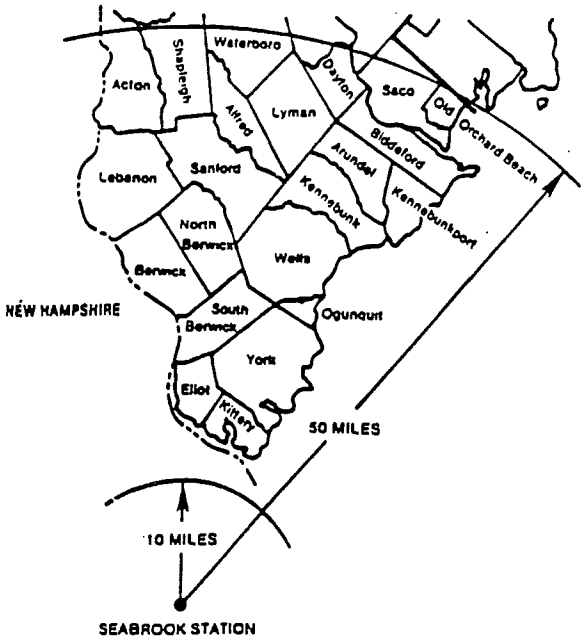
A radiological emergency at Seabrook Station will affect the State of Maine to the extent that York county is within the ingestion pathway zone, which is the area surrounding the power plant within 50 miles where the primary concern is the effects of radioactive releases on the food chain. The ingestion 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. The plan was exercised in December 1990 with the Seabrook Station and the State of New Hampshire. To date, notification of the results of the emergency exercise have not been received by FEMA.

MAP 1

Seabrook Station Ingestion Zone



TOWNS IN YORK COUNTY



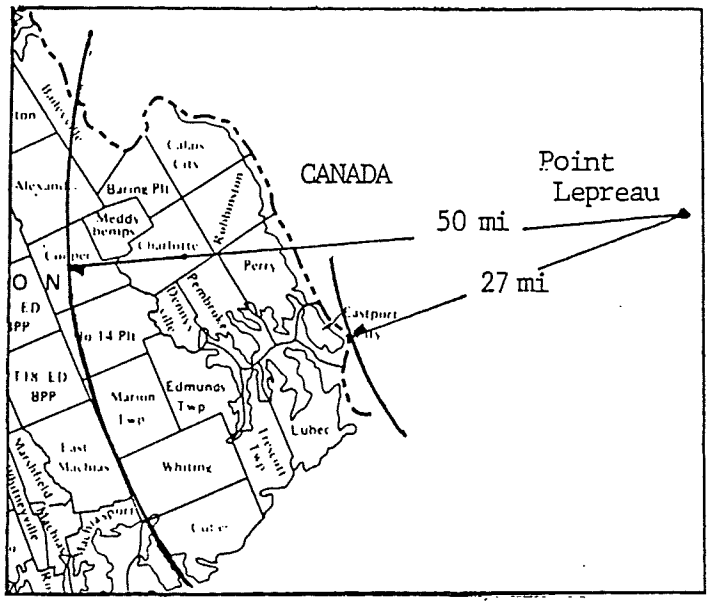
COMMUNITIES INVOLVED

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. A map depicting the area of Maine in the ingestion pathway zone of Point LePreau, and the communities involved is shown below.

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 periodically exercises the limited emergency plan with the Emergency Measures Operations in Fredricton, New Brunswick, Canada. Though MEMA did not participate in an emergency exercise with Point LePreau in 1990, the agency did participate in an emergency exercise in February 1991.



5. 1991 - 1992 WORK TASKS

The projected calendar 1991-1992 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.

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

-- Chair the Radiation Monitoring Issues Committee.

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

-- Provide the Low Level Radioactive Waste Authority with technical assistance as needed.

APPENDIX I

MAINE YANKEE SHUTDOWNS FOR 1990

MAINE YANKEE SHUTDOWNS FOR 1990[1]

In 1990, Maine Yankee experienced eight shutdowns excluding the scheduled refueling shutdown. They are chronologically listed below.

SECONDARY COMPONENT COOLING VALVE STROKE TIME TEST

On January 15, 1990, the Plant Shift Superintendent observed that the stroke times for one of the isolation valves for the secondary component cooling system (SCC-A-460) did not meet the stroke time requirement of 4.0 seconds. The measured stroke time for the valve was 5.5 seconds. The function of this butterfly valve is to isolate the cooling of the non-safeguards components from the safeguards portion to ensure adequate cooling during an accident situation. Because the valve can only be tested at 0% reactor power, at 1915 on January 15, the control room initiated a power reduction to enable the valve to be properly tested. At 2345, the same day, the valve was stroke tested, and found to meet the specification at 2.7 seconds. The plant was returned to full power on January 17, 1990.

ELECTRO-HYDRAULIC CONTROL POWER SUPPLY FAILURE

On July 2, 1990, as the plant was returning to power, smoke was seen coming from the Electro-Hydraulic Control (EHC) cabinet, and a CO_2 extinguisher was used to put out the smoldering. With the secondary power supplies failed, a power reduction was initiated at about 1100 to take the main generator off-line. At 1137, the generator was disconnected from the grid and the turbine tripped to affect repairs. With the failed power supplies replaced, the plant was brought back on-line to full power on July 9. The EHC system provides the hydraulic force to position the turbine stop and control valves. The failure was due to an inadequate design change causing the voltage to be too high.

MAIN EXCITER OIL SEAL RING

On July 31, 1990, Maine Yankee conservatively initiated a shutdown to check for an oil leak on the #9 bearing. The leak found was caused by the improper installation of the bearing seal ring. The seal was replaced, and the plant returned to full power on August 6, 1990.

LETDOWN VALVE (LD-M-2) WEDGED SHUT

On August 14, 1990, while investigating a reactor coolant system (RCS) leak, the control room placed alternative letdown into service thus requiring letdown valve, LD-M-2 to be shut. Upon the completion of the RCS investigation, the operators

[1] From 1990 Report of the State Nuclear Safety Inspector.

attempted to restore normal letdown. However, the valve did not open and failed in its safeguards position. The failure was ascribed to inadequate design and the plant was manually shutdown to repair the valve on August 14. After repairs, the plant returned to power on August 19.

FAULTY MAIN TURBINE LUBE OIL DISCHARGE PRESSURE GAUGE INDICATION

On September 29, 1990, operators observed that the main lube oil pump discharged pressure was dropping. Maintenance lifted the cover to the pump and observed oil spraying from the main lube oil pump shaft seal. The control room commenced a power reduction at 1345 on September 30. The unit was off-line at 11:45 AM on October 1st to replace the shaft seal that supposedly failed. The seal rings were replaced and the reactor was made critical on October 5. As the reactor was ramping-up in power with the turbine at its rated speed, Maine Yankee operators observed that the lube oil pump discharge pressure remained low. Maintenance rechecked the lube oil pump shaft seal and found oil spraying from it. Plant engineers reexamined the situation and found that according to the manufacturer the main lube oil pump is designed to spray and the shaft seals were not failing. Upon further investigation, Maine Yankee found that a sensing line failure was the cause for the erroneous pressure gauge readings. After correcting the problem, Maine Yankee returned to power on October 7.

ELECTRO-HYDRAULIC CONTROL (EHC) VALVE CONTROL ERRATIC

On November 24, 1990, operators were conducting their monthly turbine valve testing when the #3 turbine stop valve would not open after closing. Plant management initiated a shutdown of the plant due to operational concerns of the High Pressure turbine. On November 25, the problem was found to be from a test solenoid that was stuck open. The test solenoid was replaced, and failed and replaced once again. The plant was returned to power on November 27.

STEAM GENERATOR TUBE LEAK

On December 17, 1990, Maine Yankee shut down the reactor when reactor coolant system leakage through a tube in steam generator number 1 exceeded administrative limits of 0.35 gpm.

Maine Yankee performed inspections and identified one tube with an axial crack at the apex of the U-bend. All tubes in this area of the steam generator number 1 were inspected. Maine Yankee also inspected the remaining two steam generators for defects. As necessary, the identified defected tubes were plugged, and on January 7, 1991 repairs to all three steam generators were completed. The reactor achieved criticality on January 8. On January 9, the plant was shut down from 19% power to replace a failed main steam non-return bypass valve.

APPENDIX II

SUMMARY OF NRC INSPECTION REPORTS OF MAINE YANKEE FOR 1990

REVIEW OF NRC INSPECTIONS OF THE MAINE YANKEE ATOMIC PLANT PERFORMED IN 1990

NRC REPORT	DATE	SUMMARY
50-309/90-01	3/12/90-3/15/90	An evaluation by the NRC of Maine Yankee's reactor operator requalification program. As evaluated by the NRC, all but one reactor operator passed all portions of the examination. A violation was identified by the NRC with regards to Maine Yankee's requalification procedures being in conflict with NRC requirements.
50-309/90-02	1/23/90-3/5/90	Routine resident inspection including operational safety, maintenance, surveillance, physical security, and radiation protection. No inadequacies were found in the areas of radiation protection and security. Maintenance and surveillance activities observed by the inspector were found to be well performed. Plant operational activities were reported as "conducted deliberately and professionally." No violations were reported.
50-309/90-03	3/6/90-3/9/90	Routine announced Radiological Controls Inspection involving the Maine Yankee radiological controls organization, staffing and qualifications, licensee actions on previous findings, planning and preparation for the April 1990 refueling outage, and implementation of the Radiological Controls Improvement Plan. No violations were identified.
50-309/90-04	3/6/90-4/9/90	Routine resident inspection of plant operations, previous NRC findings, reports, events, maintenance, surveillance, security, radiation protection, and fire protection. The inspector noted Maine Yankee's contracting of the Westinghouse Radiological Services to perform a critical assessment of Maine Yankee's Radiological Controls Improvement Plan "as a very positive contribution to improved performance." No violations were identified.
50-309/90-05	4/30/90-5/3/90	Special announced physical security inspection. Maine Yankee was found to be in compliance with NRC requirements in the areas inspected. No violations were issued by the inspectors, however, a licensee-identified violation in the area of Vital Area Access was noted.
50-309/90-06	4/10/90-5/15/90	Routine inspection during Maine Yankee's scheduled refueling outage. Areas inspected were operations, radiological controls, maintenance/surveillance, security, engineering/technical support, and safety assessment/assurance of quality. The inspector noted Maine Yankee's decisions as conservative with regard to the inspection of the steam generators and the evaluation and repair of the thermal shield positioning pins. No violations were identified.
50-309/90-07	4/18/90-4/20/90	Routine announced inspection of Maine Yankee's program to ensure adequate quality of the fuel oil for the Emergency Diesel Generators. No violations were observed, however, the inspector identified several deficiencies in the licensee's Emergency Diesel Generators fuel oil program/system. The deficiencies noted in the inspection report have

		been addressed by Maine Yankee.
50-309/90-08	5/7/90-5/11/90	Routine unannounced inspection of Maine Yankee's activities during the refueling outage which included the Inservice Inspection Program, steam generator inspections, Primary-to-Secondary Leak Detection, Copper Replacement Program, and Thermal Shield repositioning pins. The NRC noted that Maine Yankee expended significant effort to assure all cracked tubes were identified and removed from service. No violations or deviations were identified. However, it was noted that Maine Yankee's program for monitoring primary- to secondary system leakage could be improved, particularly after finding evidence of circumferential cracking of steam generator tubes.
50-309/90-09	5/7/90-5/11/90	Routine unannounced inspection of the Radiation Protection Program. This inspection occurred during a scheduled refueling outage. No violations were identified, however, the inspection noted a need for Maine Yankee to improve its radiological controls for steam generator work activities.
50-309/90-10	5/16/90-6/19/90	Routine inspection including operations, radiological controls, maintenance/surveillance, security, and engineering/technical support. This inspection took place during refueling operations. Highlights of the inspection were as follows: -- An unplanned exposure was received by personnel performing work on a valve. The incident was reviewed and documented in Inspection Report 50-309/90-11. -- Maine Yankee's actions to correct a control element assembly failure was found to be "aggressive and thorough." The inspector found that satisfactory actions were taken to inspect and test Rosemount Transmitters as required by NRC Bulletin 90-01. -- Maine Yankee identified and promptly reported to the NRC on uncompensated degradation of a vital area barrier when a security guard was found to be inattentive to duties. The guard was fired. -- Administrative limits established for primary to secondary leakage were found to be acceptable following the identification of circumferential cracking of steam generator tubes. The inspector also noted acceptable performance in the motor-operated valve inspection program. -- An uncontrolled reduction in reactor vessel inventory occurred when the pressurizer was drained while the plant was shut down. Maine Yankee received a Severity IV violation for this event.
50-309/90-11	6/5/90-6/7/90	A special radiological controls inspection conducted to review the circumstances of an unplanned, unmonitored radiation exposure of three contractor workers repairing a valve. The exposures were not beyond regulatory limits. Maine Yankee was issued four Severity IV violations for this event.
50-309/90-12	6/11/90-6/15/90	A routine unannounced inspection of Maine Yankee's radiological environmental monitoring and radioactive effluent control programs, including management controls, calibration of effluent/process monitors, offsite dose calculation manual, air cleaning systems, meteorological monitoring program, laboratory QA/QC, and implementation of the above programs. The inspection noted that the above programs were effectively implemented, and no violations were identified.

50-309/90-13	6/20/90-7/31/90	A routine inspection conducted by the resident NRC inspectors at Maine Yankee. The inspection took place at the later part of Maine Yankee's refueling outage, and extended into the reactor reaching full power. The areas inspected included operations, radiological controls, maintenance/surveillance, security, engineering/technical support, and safety assessment/quality verification. The inspector identified no violations, and in general reported satisfactory performance. However, the inspector did note a concern for weaknesses observed in procedure quality and adherence, warranting increase attention by Maine Yankee senior management.
50-309/90-14	7/30/90-8/3/90	A routine, announced, emergency preparedness inspection and observation of the licensee's full participation emergency preparedness exercise conducted on July 31, 1990. The State of Maine and surrounding towns participated. An ingestion pathway exercise followed the inhalation pathway exercise. The Federal Emergency Management Agency observed both exercises. A team of three Region I and NRC headquarters personnel observed the exercise. No violations were identified. Although three weaknesses were identified, the state of emergency preparedness at Maine Yankee is adequate to provide protective measures for the public health and safety.
50-309/90-15	7/9/90-7/13/90	A Special, announced inspection to review Maine Yankee's implementation of the post accident monitoring instrumentation in accordance with Regulatory Guide (RG) 1.97, Revision 3. Based on the results of the review conducted, the inspectors determined that Maine Yankee had adequately implemented a program to meet the recommendations of regulatory guide. No violations were identified.
50-309/90-16	8/27/90-8/31/90	The NRC administered examinations to three senior reactor operators (SRO) upgrades, one SRO instant, and five reactor operator candidates. All operators passed and were issued licenses.
50-309/90-17	7/31/90-9/18/90	A routine inspection performed by the NRC resident inspectors at Maine Yankee. Areas inspected were operations, radiological controls, maintenance/surveillance, emergency preparedness, security, engineering/technical support, and safety assessment/quality verification. During the inspection period, Maine Yankee was shut down on July 31 to replace oil seals in the exciter of the main generator. Repairs were made and the plant returned to full power on August 4. Also, operators declared an Unusual Event on August 14, as a result of an unexplained decrease in the reactor cooling system greater than 10 gallons per minute. Subsequently, the reactor was shut down on August 16, repairs were made and full power was achieved on August 23. In general, the inspectors reported satisfactorily on the areas inspected, and no violations were reported.
50-309/90-18	8/21/90-8/23/90	An announced, initial inspection of the Fitness-For-Duty (FFD) Program at Maine Yankee. The inspector found that the development and implementation of the FFD program is responsive to both the spirit and intent of the NRC FFD rule. However, during the inspection, an apparent violation was noted requiring Maine Yankee to attend an NRC enforcement conference to discuss the event.
50-309/90-19	9/19/90-10/31/90	A routine inspection by the NRC resident inspectors. Areas inspected

		included operations, radiological controls, maintenance/surveillance, security, engineering/technical support, and safety assessment/quality verification. Areas inspected were found to be satisfactory except for several apparent violations. Two violations involved a lack of Containment Isolation Valve position indication limit switch environmental qualification (EQ) from October 1985 to October 1990 and a failure to promptly correct this EQ deficiency when identified in February 1990. Two additional violations involved the failure to provide qualified power supplies for the Containment Isolation Valve position indication system from October 1985 to October 1990 and the failure to provide accurate associated information to the NRC in March 1985. An enforcement conference was scheduled with the NRC to discuss the apparent violation with Maine Yankee.
50-309/90-20	9/24/90-9/27/90	A routine, unannounced safety inspection to examine Maine Yankee's actions with respect to open items from NRC Inspection Reports 50-309/88-200 and 50-309/88-80. The inspection identified no deficiencies, and stated Maine Yankee's actions to resolve the issues were acceptable, thorough, and timely.
50-309/90-21	10/10/90-10/11/90	A special, announced emergency preparedness inspection and observation of a remedial exercise conducted at Maine Yankee on October 10,1990. The inspection was performed by a team of NRC Region I personnel. No violations were identified. The report noted that Maine Yankee corrected the exercise weaknesses identified in the July 31, 1990 full-participation exercise.
50-309/90-22	10/22/90-10/26/90	A routine, unannounced inspection of the radiological and non-radiological chemistry programs. Areas reviewed included: confirmatory measurements-radiological, standards analyses, and laboratory QA/QC. The purpose of this inspection is to (1) determine Maine Yankee's ability to measure radioactivity in plant systems and effluent samples, and the ability to measure chemistry parameters in various plant systems, (2) and for Maine Yankee to demonstrate the acceptability of analytical results through implementation of a laboratory QA/QC program. The NRC noted measurements of split sample were in good agreement between the NRC and Maine Yankee. No violations were identified.
50-309/90-23	11/5/90-11/9/90	An announced safety inspection to verify that Maine Yankee had taken adequate measures to address the issues discussed in NRC Bulletin 88-04, Potential Safety Related Pump Loss. The inspectors observed that engineering evaluation and documentation at Maine Yankee for those systems addressed by the bulletin were generally good. However, certain issues addressed in the NRC report require resolution by Maine Yankee. No violations were identified.
50-309/90-24	11/1/90-11/27/90	A routine safety inspection performed by the NRC resident inspectors. Areas inspected included operations, radiological controls, maintenance/surveillance, engineering/technical support, and safety assessment/quality verification. No violations were identified, and in general areas inspected were found acceptable. The inspector did conclude that although Maine Yankee self-assessments were informal and lacking in structure, a competent safety perspective was evident in meetings and critical self-assessment was observed.

50-309/90-25	11/28/90-1/9/91	Resident inspection of plant operations, radiation protection, maintenance and surveillance, emergency preparedness, security, engineering and technical support, and safety assessment/quality verification. The report noted good plant operations, and professional performance by operators during the shutdown on December 14, 1990. Several other areas inspected received comments noting deficiencies or inadequacies. A Notice of Violation was issued concerning the use of Day Orders.
50-309/90-26	11/13/90-11/16/90	A routine unannounced physical security inspection. Areas inspected included: Onsite follow-up of a previously identified item, management supports and audits, protected and vital area physical barriers, detection and assessment aids, protected and vital area access control of personnel, packages and vehicles, alarm stations and communications, power supply, security training and qualifications, and testing, maintenance and compensatory measures. Maine Yankee was found to be in compliance with NRC requirements in the areas inspected. However, two potential weaknesses were identified in the areas of Protected and Vital Access Control of Personnel. One previously identified item was reviewed and closed.
50-309/90-27	12/10/90-12/14/90	A routine, announced radiological controls inspection. Areas reviewed were Maine Yankee's actions on previous inspection findings, radiological controls group organization and staffing, audits and assessments, radiological controls for plant operations with leaking fuel, planing for reactor control element assembly cutting and shipping, implementation of the Radiation Protection Improvement Plan, and plant tours. A special inspection was also conducted from December 21-22, 1990 to review Maine Yankee's establishment and implementation of enhanced radiological controls for the increase in primary to secondary leakage of the Number 1 steam generator. The increase in leakage to the secondary side prompted an emergency shutdown of the reactor. No violations were identified. Weaknesses were identified in Maine Yankee's training of radiation protection personnel, exposure controls and High Radiation Area access control. Maine Yankee was found to have implemented effective radiological controls, for the secondary side of the plant, following the increase in steam generator tube leakage and subsequent plant shutdown. No personnel contaminations or unplanned exposures occurred on the secondary side of the plant. No unmonitored releases or releases in excess of the Technical Specification limits occurred.

APPENDIX III

MAINE YANKEE LICENSEE EVENT REPORTS FOR 1990

The following summary of Licensee Event Reports (LERS) are from Maine Yankee's 1990 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 90-001:

On February 7, 1990, while operating at 98% power, Maine Yankee identified a failed environmental qualified (EQ) limit switch located inside the containment.

Investigation revealed that moisture entered the limit switch, due to inadequate sealing of the conduit and corroded a terminal. The limit switch provided position indication only and did not effect valve operation. The valve remained operable at all times.

The switch was replaced with an identical model which was bench assembled and sealed to ensure proper construction. During the 1990 Refueling Outage, Maine Yankee upgraded thirty-six EQ limit switch conduit seals with new presealed connector assemblies. The remaining 42 EQ limit switches were inspected and found satisfactory, and were later replaced during an October 1990 shutdown.

There were no effects on human health or the environment. Cost of the corrective action was approximately $50,000.

Reference: Maine Yankee Licensee Event Report 90-002:

On April 14, 1990, while in a refueling shutdown, an inadvertent actuation of Engineered Safeguards Features occurred.

During the process of returning an invertor to service, operators incorrectly opened the output breaker of an operating invertor. This invertor was supplying power to its own bus as well as alternate power for the invertor which had been out of service. Opening the output breaker caused a loss of power to the two vital AC busses connected to it. Due to the failsafe design of the Safety Injection Actuation System (SIAS) logic, the system actuated upon loss of power to two channels.

There were no effects on human health or the environment. Cost of the corrective action was less than $1,000.

Reference: Maine Yankee Licensee Event Report 90-003:

On June 6, 1990, while in a refueling shutdown, Maine Yankee determined that a seismically qualified instrument support rack was missing four attachment bolts. This could potentially have made the accident monitoring instrumentation susceptible to a seismic induced failure.

During the reassembly of a seismically qualified instrument support rack associated with Core Exit Thermocouples (CET), it was discovered that the rack was missing four attachment bolts. The CETs provide post-accident core temperature indication to the control room and provide temperature input to the core region saturation margin monitors (SMM).

Maine Yankee evaluated the missing bolts and determined that during a seismic event, displacement of the rack would not effect the reactor coolant system pressure boundary. The seismic qualifications of the CETs and SMMs could not be verified, therefore, a license event report was filed as it was assumed that the CETs and SMMs were not seismically qualified and could be inoperable during the unlikely occurrence of a LOCA with a subsequent design-basis seismic event.

Improved guidance, in the form of an updated controlled drawing and revised reassembly procedure, was provided to ensure proper reinstallation in the future.

There were no effects on human health or the environment.

Cost of the corrective actions were less than $1,000.

Reference: Maine Yankee Licensee Event Report 90-004:

On June 7, 1990, during control element assembly (CEA), cold functional testing prior to reactor heatup after the refueling shutdown, a dual CEA would not fully reinsert into the core.

Investigation revealed that the center finger of one of the CEAs was missing an end cap, spacer, and boron carbide pellets. Some of the pellets had fallen from the finger into the center guide tube, preventing the CEA from fully reinserting. All CEAs of the same design that were in the core during the previous cycle were tested to locate other failures. This testing revealed that two more CEAs were missing center finger end caps and six additional CEAs showed cracking. All twenty-three CEAs of a design similar to the failed assembly and that were to be used for cycle 12 were replaced.

There were no effects on human health or the environment.

Cost of the corrective action was approximately $1,900,000.00 to replace the twenty-three CEAs.

Reference: Maine Yankee Licensee Event Report 90-005:

On July 25, 1990, while operating at 98% power, technicians performing a periodic functional test of the power range safety channels discovered an improper switch alignment. This improper alignment may have rendered an input to three channel "D" reactor protective systems (RPS) functional units inoperable. During the period that the switch was mispositioned, it is conservatively assumed that the Technical Specification requirement to maintain four operable channels was not met, and therefore this license event report was filed.

The switch was returned to its normal position. Personnel oversight during maintenance is believed to be the cause of the event.

There were no effects on human health or the environment.

Cost of the corrective action was less than $100.

Reference: Maine Yankee Licensee Event Report 90-006:

On September 13, 1990, a determination was made that a feed train lineup utilized during hot standby operations may not conform with plant Technical Specifications. The feed train trip system is required to be operable whenever the reactor coolant system boron concentration is less than that required for hot shutdown. During hot standby operations, plant procedures permit a lineup of emergency feedwater (EFW) for preheating the EFW flow to minimize thermal stresses on feedwater piping and steam generator feed rings. This lineup resulted in the feed water trip system being single failure vulnerable below 2% reactor power.

A review of plant documentation revealed that the lineup had been analyzed, and was determined to be safe. A clarification was made to Technical Specifications to specifically permit system lineup below 2% power.

There were no effects on human health or the environment.

Cost of the corrective action was approximately $1,000.

Reference: Maine Yankee Licensee Event Report 90-007:

On October 2, 1990, with the plant in hot shutdown, all four power range safety channel nuclear instrumentation level I bistables were found to be out of calibration in a non-conservative direction.

Because their set points were high, the level I bistables inhibited the reactor protective system symmetric offset trip functions at a power level slightly above that permitted by Technical Specifications.

An evaluation of the safety analysis for design basis accidents and anticipated operational occurrences was performed for the affected power range with symmetric offset trip inoperable. This evaluation showed that events initiated from this lower power range continued to be bounded by the corresponding limiting events initiated from higher power levels.

There were no effects on human health or the environment.

Cost of the corrective action was approximately $40,000.

Reference: Maine Yankee Licensee Event Report 90-008:

On October 17, 1990, while operating at 100% power, Maine Yankee identified a failed environmentally qualified (EQ) limit switch located inside the containment. The limit switch provides main control board position indication of a containment isolation valve that automatically closes on a containment isolation signal (CIS).

Investigation revealed that moisture entered the limit switch through a conduit seal and corroded a terminal causing the switch to fail. Maine Yankee had experienced similar failures of the same conduit seals in the past, therefore, the plant was shutdown on October 19, 1990 to replace the remaining 42 Scotchcast #9 conduit seals with new pre-sealed connectors.

There were no effects on human health or the environment.

Cost of the corrective action was approximately $200,000.

Reference: Maine Yankee Licensee Event Report 90-009:

On October 20, 1990, while in hot shutdown condition, operators observed that all of the engineered safeguards feature (ESF) containment isolation (CI) valve position lights on both the Channel A and Channel B ESF light boxes were dimly illuminated with the exception of the shut valves, which were brightly illuminated as was normal. The ESF light boxes provide position indication for 30 of the 57 control room operated CI valves.

Investigation revealed that although the valve positions indicating circuits were separately mounted on the ESF panel, all the light box indications were inadvertantly powered from a common non-nuclear safety power supply.

Administrative controls were instituted to periodically verify operability of the light boxes and, in the event of a light box failure during an accident requiring containment isolation, to manually verify valve position. Maine Yankee is scheduled to resolve this condition with a design change during the next refueling shutdown.

There were no effects on human health or the environment.

Cost of the corrective action will be approximately $236,000.

Reference: Maine Yankee Licensee Event Report 90-010:

On November 11, 1990, a weekly test run of the diesel fire pump was conducted. During this test run, it was noted that the panalarm for the diesel fire pumps running did not function and was referred for repair.

During the repair of the panalarm it was discovered that the fire pump generator had failed, causing the panalarm to fail. Further investigation revealed that the failed generator would cause the diesel fire pump to automatically shutdown two minutes after an autostart.

The diesel fire pump generator was repaired and returned to service.

There were no effects on human health or the environment.

Cost of the corrective action was approximately $15,000.

Reference: Maine Yankee Licensee Event Report 90-011:

While performing the monthly surveillance of the 10 CFR 50, Appendix R diesel generator, the diesel was determined to be out of fuel oil. The fuel oil tank was locally checked and was low on fuel oil even though the local float style level indicator showed the tank 7/8 full. Reserve fuel oil was continuously available from the station's emergency diesel generator fuel oil bunkers and the day tank was subsequently refilled from this source.

Maine Yankee revised the surveillance procedures to require quarterly soundings of the fuel and plans to install high and low tank level alarms.

There were no effects on human health or the environment.

The cost of corrective action will be approximately $4,000.

Reference: Maine Yankee Licensee Event Report 90-012:

On December 17, 1990, Maine Yankee shut down the reactor when reactor coolant system leakage through a tube in steam generator number 1 exceeded administrative limits of 0.35 gpm.

Maine Yankee performed inspections and identified one tube with an axial crack at the apex of the U-bend. All tubes in this area of steam generator number 1 were inspected. Maine Yankee also inspected the remaining two steam generators for defects. As necessary, the identified defected tubes were plugged.

There were no effects on human health or the environment.

The cost of corrective action was approximately $1,900,000.

APPENDIX IV

MAINE YANKEE SUMMARY OF THE APRIL 29, 1990 FIRE

From the Maine Yankee report entitled,
"The April 29th Transformer Failure and Fire at Maine Yankee"
June 12, 1991

Maine Yankee
RELIABLE ELECTRICITY FOR MAINE SINCE 1972
EDISON DRIVE • AUGUSTA, MAINE 04330 • (207) 622-4868

June 12, 1991

The April 29th Transformer Failure and Fire At Maine Yankee

I. Technical Background

As electricity is produced at Maine Yankee, it exits from the main generator and travels to the two main transformers that are located outside the turbine hall. The transformers convert the electricity to a higher voltage which allows the electricity to be more efficiently transferred through the power lines which carry Maine Yankee's electricity throughout New England.

Also, during the production of electricity at Maine Yankee, a large amount of heat is created within the main generator. To protect the generator from being over-heated, it is cooled by transferring the heat to hydrogen gas which is contained inside the generator. The hydrogen gas is then cooled by a water-coolant system. Hydrogen gas is commonly used to cool large electric generators in most steam-generating electricity plants, including oil & coal plants.

II. Overview of the Transformer Failure, Fire and Related Events

A. The Transformer Failure and Fire

At 6:32 p.m. on April 29th, one of the Maine Yankee plant's two main transformers experienced an internal short circuit, which immediately overloaded the electrical systems connecting the transformer and the plant's main generator. The overloaded systems caused electrical arcing (large sparks) which damaged nearby hydrogen piping as well as main generator hydrogen seals and allowed hydrogen gas to escape from the main generator. The escaping hydrogen gas was ignited by the arcing, developing into several small hydrogen gas fires in the area beneath the main generator.

Safety systems associated with the main transformer immediately sensed the short circuit and, as a result, the plant's high and low pressure turbines, as well as the main generator, were automatically shut down. Plant safety systems also triggered an automatic and immediate shutdown of the plant's reactor.

The short circuit in the transformer led to a rapid build-up of heat and pressure inside the transformer, causing the transformer seams to rupture in several places allowing coolant oil to escape from the transformer. The escaping oil (which was PCB-free) was hot enough to activate a fire protection sprinkler system located above and around the transformer.

All of the above actions -- the igniting of fires near the generator, the reaction of plant safety systems shutting down the reactor, turbines and generator and the transformer oil loss -- occurred within 4 seconds of the initial main transformer short circuit.

The hydrogen gas fires in the area beneath the main generator were immediately spotted and reported to the Control Room by an on-duty security guard. The Plant Shift Superintendent in the Control Room dispatched the plant's fire brigade to the main generator area and also summoned the Wiscasset Fire Department to assist in the fire-fighting, if necessary.

In consultation with the Wiscasset Fire Department and plant management personnel, the Maine Yankee fire brigade leader made a proper decision to allow the gas fire to burn safely until the hydrogen gas was completely burned-off. To ensure that all hydrogen gas was eliminated, the fire brigade also performed a controlled purge of the hydrogen gas from the main generator, replacing it with non-combustible carbon dioxide. Under these carefully controlled circumstances, the fire was properly allowed to extinguish itself over a period of about three hours. By way of perspective, the ruptured hydrogen lines are roughly the size of an index finger and the burning hydrogen flames extended approximately three feet before burning out.

B. The Transformer Oil Spill

As the fire brigade was bringing the fire under control, leaking oil from the damaged main transformer and water from the transformer's sprinkler system were collecting within a containment berm around the main transformer area. (The berm's purpose is to contain oil in the event of a leak). Before the sprinkler system was shut off, the containment berm overflowed slightly and about 200 gallons of a mixture of water and oil escaped to the nearby Back River through storm drains located near the transformer. When this was discovered, plant workers immediately acted to plug the storm drains and construct a temporary oil containment system around the spill area in the river.

At roughly 8:00 p.m., plant officials informed the U.S. Coast Guard and Maine Department of Environmental Protection of the oil spill. Staff from both agencies arrived shortly thereafter to oversee and assist Maine Yankee environmental protection efforts. Central Maine Power workers also assisted in this effort. Clean-up efforts continued over the following several days and included collection and subsequent shipment for disposal of the oil-saturated soil around the transformer area as well as removal of all oil from the Back River area. As a result of these measures, there has been no adverse effect on the environment from the spilled oil.

C. Declaration of Unusual Event and Emergency Notification

Under Maine Yankee's Emergency Response Plan, if a fire at the plant lasts longer than 10 minutes, Maine Yankee is required to declare an "Unusual Event". An unusual event is an industry term used nationwide to classify emergency situations at commercial nuclear plants. This designation is the lowest of four emergency categories and is used as an early warning system to alert state and local officials of unusual plant conditions. In its 19 year history, Maine Yankee has declared a total of 10 unusual events, including the April 29th incident. Because the fire brigade had determined that the fire was a hydrogen gas fire and should be properly allowed to burn itself out, resulting in a fire that lasted longer than 10 minutes, Maine Yankee declared an unusual event at 6:42 p.m. In complete adherence to plant procedures governing unusual events, the Maine State Police were notified as well as off-site Maine Yankee officials. Appropriate Maine Yankee staff were asked to report to the plant to provide back-up assistance if necessary. Once the fires had burned out and been fully extinguished, the unusual event was terminated by Maine Yankee at 12:03 a.m. on April 30, 1991.

The Federal Emergency Management Agency (FEMA) has determined that the state police dispatcher who received notification from Maine Yankee did not accurately relay declaration of the unusual event to state and local officials, as required. Because of this error, the Maine Emergency Management Agency (MEMA) has issued new

procedures for state police dispatchers to follow when providing emergency notification to state and local officials.

D. Damage Assessment, Plant Repair and Cost Issues

Once the events of April 29th were essentially over, Maine Yankee quickly began an assessment of the damage from the transformer failure and fire. An evaluation team was assembled immediately and worked with representatives from Westinghouse (the generator manufacturer) and General Electric (the transformer manufacturer). The initial focus was to determine the extent of damage to the main generator. If the generator had been seriously damaged by fire or electrical shock, the plant would have faced an extended repair outage, probably lasting several months. Steps were taken to document the damage which included a photographic history.

By week's end, the investigation results indicated that although the transformer would have to be replaced, the main generator had not been seriously damaged by either the fire or electrical shocks. Required repair parts were ordered for delivery as soon as possible, and work began to replace the failed transformer with a spare transformer located on-site at the plant.

Following lengthy investigation by Maine Yankee, expert consultants and the company's insurance carriers, it was determined that the transformer failure was responsible for the April 29th incident. It remains unknown what precisely caused the transformer to fail. Given the internal damage sustained by the transformer, it may never be possible to determine the exact cause.

However, given the determination that the transformer was the cause of the April 29th incident, Maine Yankee believes that its property insurance will cover costs associated with the fire, costs which are as yet undetermined but will be in the several

million dollar range. Therefore, Maine Yankee believes its only cost should be a relatively small deductible payment.

E. Return to Service

On June lst, approximately one month after the transformer failure and fire, Maine Yankee was returned to full service.

III. Discussion of Issues Raised In Connection With the Transformer Failure and Fire

A. U.S. Nuclear Regulatory Commission Investigation

Following the April 29th unusual event, the Nuclear Regulatory Commission (NRC) conducted a comprehensive review of Maine Yankee's handling of the incident. The NRC inspection team, at a public meeting on May 10, gave Maine Yankee a favorable review. The NRC stated that the decisions made by Maine Yankee during the incident were sound and followed plant procedures, that all safety equipment responded exactly as it was designed and that security during the incident was superior. Further, the NRC team stated that proper fire fighting techniques were used, additional Maine Yankee personnel quickly arrived at the plant to provide assistance during the incident and Maine Yankee followed proper procedures for contacting state officials.

The review also confirmed that there had been no radiation release or environmental impact, nor was there ever any threat to public safety from the incident. The NRC team issued its final report on June 11 which confirmed the findings presented at the earlier public hearing.

B. Plant Aging Concerns

Subsequent to the incident, there were suggestions that the transformer failure was caused by the aging of the Maine Yankee plant. There is no foundation for such suggestions. First, the incident took place on the non-nuclear side of the plant and was caused by a transformer that was completely rebuilt at the factory in 1989 and, therefore, was essentially new equipment. Second, similar incidents have occurred at other manufacturing and electric generating plants that are newer than Maine Yankee. (Transformer failures, while rare, are well documented. Between 1984 and 1989 there

have been 506 transformer failures reported at electric generating stations nationwide.) Third, all safety systems at Maine Yankee worked exactly as designed. Following its investigation, the NRC stated there was no evidence to support the allegation that age of the plant was a factor in the incident.

C. Plant Operating Capacity Concerns

Following the incident, there were also allegations that the transformer failure was caused by Maine Yankee operating at a "too-high" capacity. In recent years, the electrical production of the Maine Yankee plant has increased due to upgrading and replacement of major mechanical components, including both the low-pressure turbines and the high-pressure turbine. However, even with this increased output, the load on the main transformers was still substantially less than full capacity and well within design specifications. In fact, the failed transformer was designed to operate for eighty years at the load experienced on April 29th. The NRC, following its independent inspection, concluded that the capacity issue was not a factor in the incident.

D. Media and Public Notification Issues

The evening of the fire, a Maine Yankee spokesperson reported to the plant and released a statement to the media which reported that a fire had occurred and further indicated that the incident was non-nuclear, was under control and posed no public safety threat. The spokesperson also committed to provide a more in-depth account as accurate details became known.

By noon on Tuesday, Maine Yankee issued a press release detailing the events of the transformer failure and fire and at 2 p.m. held a press conference at the plant. However, shortly before Maine Yankee's detailed statement was released, a national newswire story characterized the event as "an explosion" at Maine Yankee which had

"crippled" the plant; this dramatic characterization created intense national and state media interest.

As soon as possible and starting Wednesday morning, May 1st, Maine Yankee opened the plant to inspection by interested parties. Governor McKernan, Congresswoman Snowe, Congressman Andrews, representatives from the Maine Public Utilities Commission, the State Planning Office, the State Department of Human Services, Maine legislators, officials from communities surrounding the plant, and many members of the national and Maine media were guided through the Maine Yankee plant to view the fire damage. In addition, Maine Yankee provided daily updates to the media as to the plant's status.

E. Public Safety Concerns

As the NRC found in its investigation, at no time during the incident was there a threat to off-site public health and safety. The fire was contained completely within the non-nuclear side of the plant and extinguished without injury to Maine Yankee workers or any other personnel. No radiation release related to the fire occurred and no long-term environmental damage was sustained.

APPENDIX V

NRC SUMMARY ON THE APRIL 29, 1990 FIRE AT MAINE YANKEE

From U.S. Nuclear Regulatory Commission
Region 1, Report No. 50-309/91-80,
May 16,1991

OVERVIEW OF ON-SITE FINDINGS

General. This non-nuclear event began with failure of Main Transformer X-1A and a main generator hydrogen fire. Failure of the main generator field excitation breaker to trip when the transformer output breakers opened was an apparent contributor to the arcing hypothesized to be the cause of hydrogen leakage and ignition.

Operations. The on-shift staff appropriately followed procedures and assured that the nuclear reactor was stable in hot shutdown.

Fire Protection. The fire brigade quickly assessed the lack of significant potential for other fires being ignited by the burning hydrogen. Hydrogen make-up to the generator was verified to be secured. A proper decision was made to limit the hydrogen hazard by allowing the fire to burn itself out. That decision was sustained over a Technical Support Center recommendation that the fire be extinguished. The Wiscasset Fire Department responded to the site 14 minutes after the plant trip, was promptly admitted to the plant, concurred with allowing the fire to burn, and coordinated well with the Maine Yankee Fire Brigade. A minor communications obstacle was caused by fire fighter face shield interference with walkie-talkie use. Overall, fire fighting measures were proper, timely, and effective.

Emergency Preparedness. The fire was properly classified and reported as an Unusual Event, and the on-site response was appropriate. In the report to the State Police, however, the fire was described as small. That description was determined, by interview of the reporting individual, to be consistent with his knowledge at the time. No inadequacy in on-site response to the fire resulted. (Off-site emergency response evaluation by FEMA will be documented in an Appendix to this report.) Also, the prescribed key emergency response personnel notifications by pager were not made for the Unusual Event, but parallel communications produced an ample response to the site. Overall, on-site response to the low level emergency caused by the generator hydrogen fire was appropriate and sufficient.

Engineering/Technical Support (Electrical). No main transformer sizing inadequacy or geomagnetic disturbance involvement has been identified. The main generator field excitation breaker's failure to open on the trip was a potential contributor to this event. Increased hydrogen usage for the main generator following the last refueling outage was attributed by the licensee to generator vent valve leakage to the roof vent. Licensee and NRC review of these matters is continuing.

Security. Security processing and support of the fire protection response was timely and proficient. No inadequacies were identified.

Radiological. This event caused no radiological consequences.

Environmental Protection. Prompt response to the oil spill resulted in its containment and collection with minimal environmental impact.

APPENDIX VI

FEMA RECOMMENDATIONS ON THE APRIL 29, 1990 FIRE AT MAINE YANKEE

From the Federal Emergency Management Agency
Region I
June 6, 1991

F. **RECOMMENDATIONS:**

1. Maine State Police:

a. Train all dispatchers to ensure that they fully understand the procedures to be followed with any messages related to a nuclear power plant incident that is transmitted to other response agencies, and to REPEAT the messages word for word.

b. Whoever receives the call from Maine Yankee should immediately obtain a second person to assist with the notification, and this assistance should be formally incorporated into the existing procedures.

c. Eliminate the "courtesy" procedures which cause confusion.

d. Dispatchers should notify the Maine Emergency Management Agency personnel first, then the Department of Health Engineering, and then the Governor's Office and other appropriate officials.

2. Lincoln County Dispatch:

a. Provide additional training for all dispatchers so that they do not make any assumptions and are required to listen to an entire message before responding.

b. Provide additional training for all dispatchers to re-emphasize the importance of the emergency classification levels and the procedures to be followed in the event of any nuclear plant incident. Ask questions to ensure that all the information being received is completely understood prior to retransmitting it.

3. Governors Personal Staff:

Provide additional training to the Governor's personal staff in order to emphasize the urgency of notifying the Governor immediately when any incident occurs at a nuclear power plant.

4. Maine Emergency Management Agency:

a. Provide additional training for all personnel assigned to Duty Officer responsibilities. Duty Officers should be proactive, questioning and obtaining details of all calls received concerning the nuclear plant.

b. Develop a Duty Officer message log that can be passed from person to person. After each week/month, the Director should review the logs and check for trends.

c. Make Plan changes, where applicable, to the Unusual Event portion of procedures/checklists to add Sagadahoc County to the notification process at the State Police 24 hour warning point.

d. Add a procedure for both the Director, Maine Emergency Management Agency, and the Director, Health Engineering to ensure that they call one another when either one becomes aware of a classification level or incident at any nuclear power plant that affects their jurisdiction.

APPENDIX VII

SUMMARY OF UP-COMING REFUELING OUTAGE PROJECTS AT MAINE YANKEE

Provided by Maine Yankee

REFUELING OUTAGE PROJECTS

MAINTENANCE:

Repair UGS Lift Rig
Reactor Disassembly & Reassembly
ICI Replacement
CEDM Fan Replacement
E-3B Head Leak Repair
MOV Program (Approx. 90 valves)
Valve Inspection & Repair
Pipe Insulation Project
Circ House Project
Reinsulate 3T5
Replace #3 RCP SEAL, Rotating Assembly and Motor

REACTOR ENGINEERING:

ICI Measurement
Fuel Inspection & Repair
CEA Inspection
Refueling Equipment Maintenance

OPERATIONS:

RCS Clean Up
Full Core Off Load
HP Drain Cooler Chemical Flush
Hot Spot Flush Program
Tag & Drain Plant Systems

REFUELING OUTAGE PROJECTS

ENGINEERING:

- Main Generator Renewal
- Inverter/Charger Renewal
- S/G Water Level Control
- ECCS Light Box Modification
- ATWS Pressure Response Modification
- 480 Volt Transformers Replacement
- 7T8 Interlock Modification
- S/G Pressure Recorder Installation
- On-Line Secondary Chemistry Monitors
- Containment Class A Test
- Appendix J Testing
- System Hydro Exams
- Equipment Hatch Cribbing Upgrade
- SW HX Outlet Valve Replacement
- SW Overboard Elbow Replacement
- S/G ECT (all S/G's)
- S/G Sludge Lancing (all S/G's)
- S/G Work Platform Improvements
- → CSB Thermal Shield Inspection/Repair
- MOV Diagnostic Testing
- LD-M-2 Replacement

APPENDIX VIII [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.

---

[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 IX

MAINE YANKEE
ENVIRONMENTAL MONITORING PROGRAM SUMMARY

From Table 2.1 of the Annual Radiological Environmental Monitoring Report
January - December 1990
Prepared by the Yankee Atomic Electric Company
Bolton, Massachusetts
April 1991

TABLE 2.1

Radiological Environmental Surveillance Program
Maine Yankee Atomic Power Station

Media	Sampling Frequency	Required Analyses
Air Particulate (AP)	- Weekly - Quarterly Composite	Gross-beta Gamma spectroscopy
Charcoal Filter (CF)	- Weekly	I-131
Milk (TM)	- Monthly	Gamma spectroscopy, I-131
Food Crop (TF)*	- Annually (Harvest)	Gamma spectroscopy, I-131
Groundwater (WG)**	- Quarterly	H-3, gamma spectroscopy
Estuary Water (WE)	- Monthly Composite - Quarterly Composite	Gamma spectroscopy. H-3
Sediment (SE)	- Semiannually	Gamma spectroscopy
Fish and Invertebrates (FH, MU, CA, HA)	- Semiannually or in Season	Gamma spectroscopy
Direct Radiation (TL)	- Quarterly	Integrated gamma dose

---

* Performed only if milk sampling is not done.

** Groundwater samples shall be taken when this source is tapped for drinking or irrigation purposes in areas where hydraulic gradient or recharge properties are suitable for contamination.