1989 ANNUAL REPORT

OF THE

OFFICE OF NUCLEAR SAFETY

submitted to the

MAINE LEGISLATURE

State Nuclear Safety Inspector
Department of Human Services
Division of Health Engineering

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Appropriation Number 014-10A-2440

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EXECUTIVE SUMMARY

In 1987, the executive department introduced a bill in the State Legislature to create a State Nuclear Safety Inspector position at Maine Yankee. The thrust of the State Inspector's role was fourfold:

a - to reside full time at Maine Yankee
b - to monitor Maine Yankee's activities
c - to observe U.S. Nuclear Regulatory Commission inspections and
d - to operate and maintain the new continuous remote radiation monitoring system around Maine Yankee.

In 1989 Maine Yankee undertook three major projects. The first involved the upgrading of its reactor power output from 2630 to 2700 megawatts thermal (MW(th)) so as to increase Maine Yankee's net electrical output. The second dealt with the consolidation of spent fuel rods into a more dense configuration to allow for additional storage in the spent fuel pool. Finally, Maine Yankee instituted an improvement plan to enhance its radiological control practices.

The first project resulted in a successful power upgrade to 2650 MW(th) with no problems. The remaining 50 MW(th) upgrade will take place after the 1990 refueling outage when the new high pressure turbine is installed. The outcome of the spent fuel project was not as fruitful. The project was beset by a multitude of problems until it was finally cancelled. Maine Yankee was hoping for a successful demonstration because it would have given them assurance of an adequate storage capacity for its spent fuel for the remainder of its license, which expires in 2008. Finally, the Radiological Controls Improvement Plan was instituted in the fall of '89. The preliminary indications are encouraging. However, its true test will come during the 1990 refueling outage.

In 1989 Maine Yankee experienced six shutdowns. Of these six, only three lasted more than seven days. They were the Environmental Qualifications Penetration discrepancies, which lasted seven days, and the Reactor Coolant Pump seal failures in October and November. The first seal shutdown lasted seven days and the second one lasted eleven days. The remaining three shutdowns averaged a day or two in length.

From a radiological standpoint, Maine Yankee discharged approximately 23 curies in gases and 422 curies in liquids. The 23 curies represents the lowest gaseous release total since 1984, whereas the 422 liquid curies represented the highest liquid releases since 1984. The public health significance for both types of releases is extremely minuscule as the calculated doses amount to fractions of a millirem. In the low level radioactive waste category, Maine Yankee generated only 4928.7 ft^3 in 1989 of which 4324 was dry wastes with the remainder being processed liquid wastes.

During the year the State Inspector activities revolved around four major endeavors:

1 - Nuclear Regulatory Commission Audits
2 - Plant Manager Meetings
3 - Legislative Document 1060 Initiative
4 - Facility Tours

The State Inspector identified problems in each area that were eventually resolved by Maine Yankee and the Nuclear Regulatory Commission (NRC). Overall the working relationships between the State Inspector and both Maine Yankee and the NRC were generally very good.

The State Inspector was also responsible for the oversight of the State's remote radiation monitoring system. This system involves 17 pole-mounted monitors which were installed within a 1 mile radius from the Maine Yankee plant. The system is sensitive enough to detect radon surges in background radiation levels from advancing weather fronts. The system also has access to 13 plant monitors, 11 of which are used by the State in assessing the public health impact from a plant emergency.

1.0 INTRODUCTION

In 1987 the executive department introduced a bill in the State Legislature to create a State Nuclear Safety Inspector at Maine Yankee. The final version of that bill became a law in 1988. The main thrust of the legislation was to have a state inspector reside at Maine Yankee to monitor their activities, such as storage and transportation of low level nuclear waste, to observe the Nuclear Regulatory Commission's (NRC) inspections and to oversee the State's newly acquired and installed remote radiation monitoring system around Maine Yankee.

As for observing NRC inspections a formal agreement between the State and the NRC had to be drawn up. This agreement, which outlined the protocol for the State Inspector to observe NRC audits, was manifested in a Memorandum of Understanding (MOU) between the two parties.

The State Inspector commenced his duties on February 6, 1989, by spending a week at the State offices of the Division of Health Engineering for orientation and moved to the site on February 13, 1989, and has been there full-time ever since.

2.0 MAJOR PLANT ACTIVITIES

2.1 PROJECTS

In 1989 Maine Yankee undertook three major projects. They were the "2700 Megawatt Thermal (MW(th)) Upgrade", the "Spent Fuel Pin Consolidation Project" and the "Radiological Controls Improvement Plan."

2.1.1 2700 MW(th) UPGRADE

In the 2700 MW(th) upgrade a Technical Specification change to Maine Yankee's operating limit was required to increase the reactor's power output from 2630 MW(th) to 2700 MW(th). Maine Yankee proposed the change to increase its net electrical output and to prepare for the new high pressure turbine installation during the 1990 refueling.

In July, 1989, Maine Yankee received permission from the NRC to perform the upgrade. Soon thereafter, Maine Yankee initiated the increased loading in 10 MW(th) increments to ensure no other operating limits would be exceeded. Maine Yankee only made it to 2650 MW(th) because of the steam flow restrictors (installed since plant start-up in 1972 to throttle down the steam entering the high pressure turbine). With the installation of the new high pressure turbine in 1990 this final obstacle will be overcome as the new turbine is rated for 2710 MW(th). After the new turbine installation Maine Yankee envisions no further problems in attaining its allowed thermal power limit. The final upgrade will be monitored by the State Inspector.

2.1.2 SPENT FUEL PIN CONSOLIDATION

The purpose for the Spent Fuel Pin Consolidation Project was to demonstrate Maine Yankee's ability to consolidate eight spent fuel assemblies into 5 consolidated spent fuel racks, thereby achieving a reduction factor of 1.6. This was being performed as part of a licensing overture to the NRC in 1992 to ensure adequate capacity exists in the spent fuel pool to store all of Maine Yankee's spent fuel until its license expires in the year 2008. Maine Yankee has storage for only 1476 spent fuel assemblies in its spent fuel pool. Currently, Maine Yankee has 986 assemblies in the pool. At its present rate Maine Yankee will lose its full core discharge capability in 1996. This means that Maine Yankee would not be able to unload all the 217 fuel assemblies in the reactor core should a problem arise.

This project was an extension of an earlier 1983 pilot project. At that time, Maine Yankee successfully demonstrated that it could consolidate one spent fuel assembly into a specially designed fuel rack which accommodated only fuel rods. Further work on this earlier project was terminated when the State's Attorney General, along with Sensible Maine Power, intervened on Maine Yankee's proposed license amendment to the NRC on pin compaction. After much debate an agreement was struck between Maine Yankee and the State. It essentially allowed Maine Yankee to consolidate only up to 20 spent fuel assemblies provided Maine Yankee did not pursue pin compaction for about 10 years.

In the 1989 project, Maine Yankee was hoping to demonstrate its capabilities for pin compaction by consolidating eight spent fuel assemblies into five. Maine Yankee chose eight assemblies that were ten years or older to minimize the radiation and thermal impacts. However, from the very beginning, Maine Yankee was plagued with various problems that in the end, only additional financial and manpower resources could overcome. Consequently, rather than spend more time, money and effort Maine Yankee decided to defer the project for the time being and revisit its spent fuel storage options.

Besides pin consolidation, other storage options are available to Maine Yankee. They include double tiering of spent fuel racks, dry cask storage or building a second spent fuel pool. As of yet, Maine Yankee has not committed itself to any options. It is expected that by 1993 Maine Yankee will make a decision on which storage option is best suitable for its needs. Whatever their decision, their efforts will be closely monitored by State officials.

2.1.3 RADIOLOGICAL CONTROL IMPROVEMENT PLAN

Another significant undertaking in 1989 was management's commitment to improving its radiological control practices. This was done in light of NRC's 1988 Systematic Assessment of Licensee Performance (SALP) Report rating Maine Yankee's radiation protection program as a category "3 with a trend of improving". The NRC uses three category levels to assess a licensee's performance. They are categories 1,2 and 3, with 1 being the best, and 3 being the lowest. A category 3 denotes that a licensee's performance does not significantly exceed that needed to meet minimal regulatory requirements, that a licensee's resources in this area appear to be strained or not effectively used or that management's attention to and involvement in the performance of nuclear safety or safeguards activities are not sufficient. A trend of "improving" denotes to the NRC that the licensee's performance towards the close of the assessment period was significant enough to warrant an "improving" trend rating.

In August of 1989 management instituted the Radiological Controls Improvement Plan as a means of bettering its performance in this area. The plan is continuously revised and updated to address and resolve problems. Maine Yankee believes this is the first step in improving its NRC SALP rating in Rad Controls (RC) to a 2 and even a 1 in due time. Since the plan's inception new state-of-the-art equipment has been purchased and installed, such as the security gatehouse portal monitor, an additional portal monitor at the RC checkpoint and a new respirator washer and drier system to name a few. The entire RC organization has also been revamped along with promoting an entirely new work ethic for work in the radiation areas of the plant.

As Low As Reasonable Achievable (ALARA) efforts are more significant than in the past. People appear to be more in tune to reducing their exposures and their efforts are bearing fruit. Although 1989 was a non-refueling year, Maine Yankee did experience two shutdowns to repair seals on the reactor coolant pumps. These repairs amounted to 30 man-rem. Yet, Maine Yankee was able to keep its man-rem for the year below its corporate objective of 100 man-rem, with a year end total of 88 man-rem. This represents the second lowest year in Maine Yankee's 17 year operating history. The lowest man-rem year was in 1976 with 71 man-rem. Maine Yankee has also instituted a hot spot reduction program to flush, if feasible, localized hot spots in piping to further reduce general area dose rates. Preliminary results are very encouraging.

In the coming year, Maine Yankee has also undertaken an ambitious task which should challenge its Radiological Controls Improvement Plan. It has set itself a goal of 450 man-rem for the outage and 500 for the entire year. Maine Yankee has been unable to achieve this since the late 1970's. Time will tell how successful their planning efforts were.

As part of the Radiological Controls Improvement Plan, Maine Yankee is also attempting to minimize the 248 personnel contaminations they experienced in 1989 by embarking on an ambitious project to clean up the radioactive side of the plant. Maine Yankee's decontamination efforts now focus beyond walkways to the walls and piping overhead. Maine Yankee still has a way to go especially with the refueling just around the corner.

As part of its improvement program Maine Yankee also undertook another venture to clean up the yard area, known as the outside Radiological Controls Area (RCA). This involved the dismantling of the infamous Wiscasset Wall, which has been considered a permanent fixture here since the 1970's. This walled-in area was principally used as a high radiation storage area for radioactive materials or radwaste. It also served as a staging area for radioactive shipments because of its location directly beneath the yard crane. This ten foot high wall which enclosed an area of roughly 30 feet by 50 feet was composed of several hundred, high density, concrete blocks. Each block had to be surveyed and hand frisked with two separate radiation detection devices prior to its unconditional release. This was no small feat as it took several months for the wall to be finally removed.

2.2 OTHER ACTIVITIES

There were four other issues of significance in 1989. They were the security gatehouse repairs, the #2 main feedwater regulating valve problem, the loose parts monitoring system alarm indications and the annual Emergency Plan exercise.

2.2.1 SECURITY GATEHOUSE REPAIRS

In 1989 Maine Yankee also instituted major changes on how it processed people into the plant via the security gatehouse. The changes were prompted by several NRC violations cited in the security area during the 1988 fall refueling outage for which Maine Yankee was later fined $75,000. To accomplish the NRC objectives Maine Yankee had to physically expand and remodel the entire security gatehouse in addition to purchasing new state-of-the-art equipment. The repairs in conjunction with security procedural improvements has resulted in the more orderly processing of incoming personnel.

2.2.2 #2 MAIN FEEDWATER REGULATING VALVE PROBLEM

On September 1, the vibrations in the #2 Main Feedwater Regulating Valve indicated some serious problems which, if it went uncorrected, could lead to an unplanned plant trip and shutdown. The problem was a complex one in that Maine Yankee had to set up an elaborate scheme to check the signals going to the valve to see if they could discern whether it was an electrical or mechanical problem.

The testing was done at power and Maine Yankee had to be careful because the instrumentation attached to the system could perturb the already precarious oscillations the valve was experiencing. From this set up Maine Yankee was able to detect that the valve did not respond appropriately to certain signals. Maine Yankee reduced power down to about 13% to affect repairs. The problem turned out to be a small tear in a rubber diaphragm which prevented the valve from responding to appropriate signals. The erratic behavior was rectified and since then the valve has experienced no further problems.

2.2.3 LOOSE PARTS MONITORING SYSTEM ALARM INDICATIONS

In the August/September time frame, Maine Yankee experienced a lot of alarms on the Loose Parts Monitoring System (LPMS). This system is used to listen internally to the reactor to see if there are any sounds which may indicate that some part is loose and/or moving in the reactor coolant system (RCS). If a part is loose in the RCS, the potential exists for fuel damage.

Management responded promptly to the alarm indications. It immediately called in an outside expert and a representative of Combustion Engineering, the reactor manufacturer. The noise was finally located and identified to be coming from RC-M-11, the loop #1 isolation valve. Based on the frequency of the sound the experts were able to determine the impact energy of the object (1/2 ft-lb) and its approximate weight (4-10 lbs.) However, they were not able to discern whether the noise was external or internal to the valve. A containment entry was performed to determine if something external was causing the noise on the valve - none was found. A concern was raised that the noise could be from the valve's disc being loose enough to cause the tapping sounds. If it was the valve disc and it disengaged and fell into the reactor coolant system (RCS), it would reduce the flow in the RCS which would force an automatic plant trip and shutdown. Since the impact energy was very small, it was felt that the energy would not be enough to cause any fatigue in the valve parts or produce any other failure mechanism.

Maine Yankee had a chance to explore the noise in October when the plant was shutdown to repair the #2 reactor coolant pump (RCP) seal. With the plant down the valve was externally inspected and nothing was found except for a packing leak. The operators decided to take all the play off the valve

disc by backseating it a turn or two. When Maine Yankee returned to power the noise was gone. During the upcoming 1990 refueling outage Maine Yankee plans to disassemble and fix the valve. They hope this will remedy the situation once and for all. Until then the cause of the LPMS alarms remains uncertain, although, the packing leak is highly suspect.

2.2.4 ANNUAL EMERGENCY PLAN EXERCISE

On November 15, Maine Yankee conducted its annual emergency plan exercise. The State Inspector not only observed the activities but also participated as the State representative to Maine Yankee's drill.

The make-believe scenario for the imaginary event started with a leak in containment with some safety equipment, namely two of the three high pressure safety injection (HPSI) pumps, being out of service for repairs. Later on, the remaining HPSI pump would fail further deteriorating the situation. In addition the two low pressure safety injection (LPSI) pumps would not be available to cool the core as the water level in the Refueling Water Storage Tank (RWST) was nearing the 100,000 gallon mark. This meant that the LPSI pumps would be automatically shut off and the containment spray (CS) and HPSI pumps would come on under long term recirculation of the containment sump contents. However, with all three HPSI pumps out long term cooling of the core would not be possible. At this time a General Emergency was declared.

During the event radioactivity was being released up the primary vent stack (PVS) via the Spray Building. The highest, 1/2 mile dose rate projection was 1580 mR/hr for the people directly east of the plant on Westport Island. The prevailing winds for the drill were due east with a 24 hour shift towards Boothbay Harbor.

The exercise went well and lasted about 4 hours. The State Inspector did not observe any major problems and did sit in on the licensee's self-critique.

Originally, this was a scheduled two day event. The first day would have involved the usual plume exposure pathway with the second day concentrating on the ingestion (food) pathway (such as milk, vegetables, meats, fruits, etc.). However, the two day drill was postponed and the scenario shortened to one day. The postponement was a direct result of Federal Emergency Management Agency representatives being diverted to the San Francisco Earthquake. The two day exercise planned for in 1989 will be rescheduled for 1990.

3.0 PLANT SHUTDOWNS

In 1989 Maine Yankee experienced a total of six plant shutdowns and they are chronologically listed below:

a - Electrohydraulic Control Power Supply Failure
b - Inadequate Qualification of Environmentally Qualified Penetrations
c - #3 Main Feedwater Regulating Valve - Valve Stem Failure
d - Inadvertent Actuation of the Generator Protective Relaying
e - #2 Reactor Coolant Pump Seal Failure
f - #1 Reactor Coolant Pump Seal Failure

3.1 ELECTROHYDRAULIC CONTROL POWER SUPPLY FAILURE

On January 10, 1989, the plant tripped due to a loss of the electrohydraulic control (EHC) power supply. The EHC system is an electronic system which controls the position of the turbine control valves. The system controls both the turbine speed and the electric load on the generator. Loss of EHC power means you lose control over the turbine control valves which governs how much steam flows to the high pressure turbine. The power supply was repaired and the plant was brought back on line on January 11.

3.2 INADEQUATE QUALIFICATION OF ENVIRONMENTALLY QUALIFIED PENETRATIONS

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

3.3 #3 MAIN FEEDWATER REGULATING VALVE - VALVE STEM FAILURE

The third shutdown occurred when coming back up in power on February 22. The control room operators noted that the Steam Generator #3 level was dropping rapidly. An operator was dispatched to the mezzanine level of the turbine building to check the #3 Main Feedwater Regulating Valve (MFRV) because the valve was recording a 100% open signal. Upon arrival the operator immediately observed that the valve stem on the #3 MFRV was sheared off. To prevent a potential heat up of the reactor coolant and subsequent fuel cladding deterioration, the plant was shutdown to repair the valve. At the same time the other two main feedwater regulating valves were inspected and both stems were found cracked. Seeing that this was a common mode failure, Maine Yankee ensured that all three feedwater

regulating valves were repaired prior to plant start-up. An autopsy of the sheared stem indicated that it failed due to stress fatigue.

3.4 INADVERTENT ACTUATION OF THE GENERATOR PROTECTION RELAYING

The fourth shutdown resulted from a plant trip due to a loss of load condition caused by an inadvertent actuation of the generator protective relaying. The cause of the trip was attributed to a CMP inspector who had been working on restoring a 345 kV breaker relay back to service. Apparently, the CMP inspector did not ensure that the output or trip switches were closed last when he restored the relay to service. His actions caused the tie breakers to isolate the plant from the grid resulting in a loss of load condition. The plant was returned to power that same day.

3.5 #2 REACTOR COOLANT PUMP SEAL FAILURE

The #2 Reactor Coolant Pump seal slowly began deteriorating a month prior to the shutdown on October 10. Maine Yankee opted for an orderly shutdown rather then wait for the seal to fail. However, in preparation for their orderly transition to shutdown, two containment ventilation/purge valves failed their leak test. Maine Yankee was then compelled by their Technical Specifications to shutdown 12 hours earlier than originally scheduled.

An autopsy on the seal revealed that it failed because of a lock ring which came apart inside the seal cartridge and was slowly grinding the face of the third stage of the seal. The failure mode is rare in that the seal failure had only occurred once before in the industry. It was a very unsuspected failure mode and surprised Maine Yankee officials. Maine Yankee opted to replace only the #2 RCP seal with the same design and leave the others undisturbed in order to get back up in power on October 17.

3.6 #1 REACTOR COOLANT PUMP SEAL FAILURE

Less than a month later, on November 7, Maine Yankee was faced with another shutdown, precipitated by the rapid failure of the #1 Reactor Coolant Pump (RCP) seal. It totally failed just after the plant was shutdown resulting in about 2800 gallons being spilled into the containment building. The 2800 gallons was collected and processed through the plant's liquid radwaste treatment system.

Again, the failure mode was just like the #2 RCP seal failure in October. It appears the #1 RCP seal was of the same lot as the previous #2 RCP seal. Maine Yankee could not justify not replacing the seal in the #3 RCP because it was also of the same lot as the #1 RCP seal. Hence, Maine Yankee had to change out the seals in both #1 and #3 RCPs. They did so this time with a brand new type of seal called the N-9000 whose reliability is expected to be better than the old standard S-U seal. Maine Yankee came back on-line on November 18.

4.0 PLANT RADIOACTIVE INDICATORS

On the amount of radioactivity released to the environment, the gaseous releases were the lowest in the last six years whereas the liquid releases were the highest in the last six years. As for low level radioactive waste, the amount generated was the second lowest in Maine Yankee's operating history.

4.1 GASEOUS RELEASES

In 1989 Maine Yankee had 44 gaseous releases which totaled 23.47 curies. During the extended shutdowns in October and November for the RCP seal repairs the containment was purged and vented both times. This resulted in about 13.44 curies released for both purges or about 57% of the total activity for the year.

During the years 1984 through 1988 Maine Yankee released from a low of 78.33 curies in 1988 to a high of 1079.08 curies in 1986. Based on activity levels only, the 23.47 curies released in 1989 was very low in comparison to the previous five year history. This is a good example of tight fuel which means that there are essentially no leaky fuel rods. When you have leakers, then it is possible to have high amounts of activity released like the 1000+ curies in 1986, when Maine Yankee did have leaky fuel rods.

As for the public health consequences from the 1989 releases, they were insignificant because the dose amounted from hundredths to thousandths of a millirem for a whole year. Normally a person would receive in the neighborhood of 10 to 100 times this dose just from one day's exposure to background radiation.

4.2 LIQUID RELEASES

On the liquid side, Maine Yankee had 132 releases during 1989 totalling 422.48 curies with tritium being the predominant nuclide. In fact tritium encompassed nearly 100% of the total activity released. During the previous five years (1984-1988) Maine Yankee released anywhere from 120.09 to 351.22 curies via the liquid pathway. Again, the public health impact is insignificant as the calculated doses amount to the thousandths of a millirem.

4.3 LOW LEVEL RADIOACTIVE WASTE

On the radwaste front Maine Yankee generated 4928.7 ft^3 of radwaste in 1989 of which 4324 ft^3 was dry active waste (DAW) with the remaining 604.7 ft^3 being processed liquid waste such as resins, filters, and evaporated bottoms. The 4928.7 ft^3 represents the lowest amount of radwaste generated over the last 16 years. The lowest year ever was achieved in Maine Yankee's first full year of operation, 1973, when about 2400 ft^3 of radwaste was reported.

As for radioactive waste shipments, Maine Yankee had a total of 24 radwaste shipments in 1989. That means a total of 13,078.9 ft^3 of 1988 and 1989 low level radioactive waste was shipped across the Maine roads. Of that total, 10 shipments or 10,377.6 ft^3 went to Scientific Ecology Group (SEG), a supercompacting firm, which further reduced this waste volume by a factor of 2.4 prior to its being disposed at the Barnwell facility in South Carolina.

Of the waste it generated plus its backlog, Maine Yankee was able to bury 6997.6 ft^3 in 1989 of which 871.5 ft^3 was liquid waste with the remainder being 6106.1 ft^3 of dry waste. The total activity buried amounted to 267.25 curies of which 242.21 curies were from liquid wastes and 25.04 were from dry wastes.

The following table depicts the backlog of radwaste at the end of 1989:

a) DAW = 1725.8 ft^3
b) Soil, Rocks, Asphalt = 3105 ft^3
c) Liquid Waste = 328.7 ft^3

In the soil, rock asphalt category 1290 ft^3 is considered very low radioactive waste which Maine Yankee will be applying for a 10 CFR 20.302 variance from the NRC for on-site burial.

5.0 STATE ENVIRONMENTAL RADIATION NETWORK

5.1 BACKGROUND

As part of the legislation creating the State Nuclear Safety Inspector position, the law also required the State to establish and maintain a continuous remote radiation monitoring system to record the radioactive levels of gaseous discharges from Maine Yankee.

This is the first system of its kind to be installed in the United States around a nuclear power plant. It is not the first remotely operated continuous monitoring system installed in the USA, as the State of Illinois had installed some monitors not too long after Three Mile Island incident. However, those employ high pressure ionization chambers and their reliability can be finicky at times. The Eberline system is the first to use a Geiger-Muller tube. Their first system was installed in Great Britain. Their second and first in the United States was here at Maine Yankee.

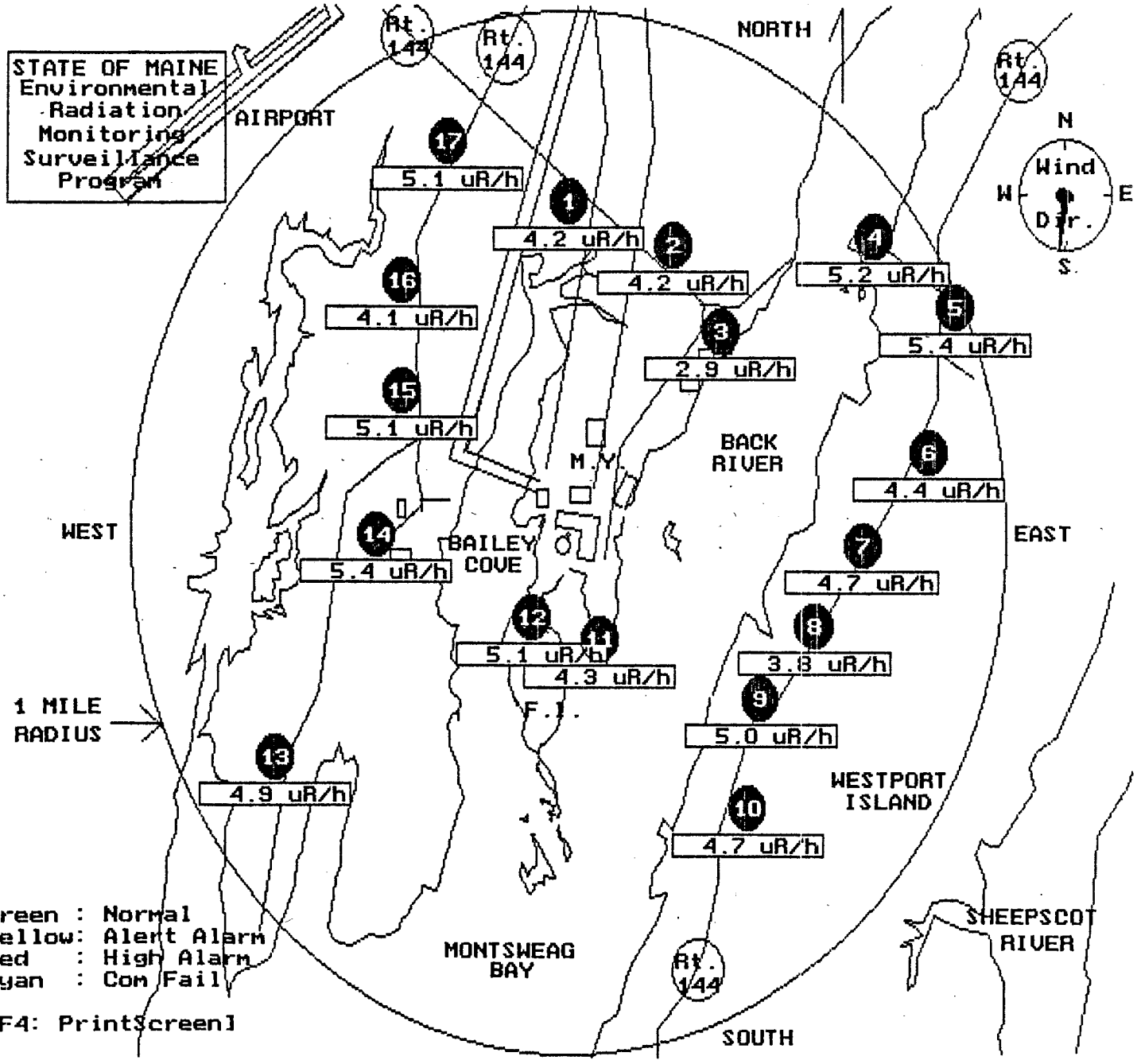
Since its installation the States of Virginia and Massachusetts have visited the State facility at Maine Yankee to ascertain its benefits and capabilities. At last note, it appeared at least that Massachusetts will be installing a system around the Pilgrim nuclear power station. In addition, a demonstration of the system's capabilities was given to a NRC commissioner, Mr. Kenneth Rogers. Commissioner Rogers was also very interested in the State Inspector's working relationship with Maine Yankee.

5.2 DESCRIPTION

The State purchased 20 environmental radiation monitors from Eberline corporation and installed 17 monitors within a 1 mile radius from the plant. The remainder have been used as spares to replace malfunctioning equipment and for performing some quick background studies. Seven of the monitors are located on Westport Island. Figure 1 portrays a typical data plot map on the State's computer of what the background radiation levels are around Maine Yankee. Over the past year the 17 monitors have averaged 4.5 uR/hr. The distribution over time is demonstrated in figure 2. The 4.5 uR/hr exposure rate is unusually low as this translates to a background dose of about 39 millirem per year. The reason for the low average is explained later in section 5.5.

The 17 monitors are all pole mounted and are approximately 10 to 12 feet above the ground surface. Each pole has an antenna, a radiation monitor, a circuit breaker box, a radio transmitter, and a 20 amp circuit box. Figure 3 shows the key portion of a pole mounted monitor with its radio transmitter at the top, the circuit breaker box in the center and the radiation monitor on the bottom. The radiation monitor is housed in a white steel container along with a heater for cold weather protection and a voltage surge protector.

FIGURE 1


STATE OF MAINE
Environmental
Radiation
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Surveillance
Program
AIRPORT
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S
17
5.1 uR/h
1
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5
5.4 uR/h
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4.1 uR/h
3
2.9 uR/h
15
5.1 uR/h
M.Y.
BACK
RIVER
6
4.4 uR/h
WEST
EAST
14
5.4 uR/h
BAILEY
COVE
7
4.7 uR/h
12
5.1 uR/h
11
4.3 uR/h
8
3.8 uR/h
F.I.
1 MILE
RADIUS
9
5.0 uR/h
13
4.9 uR/h
WESTPORT
ISLAND
10
4.7 uR/h
Green : Normal
Yellow: Alert Alarm
Red : High Alarm
Cyan : Com Fail
[F4: PrintScreen]
MONTSWEAG
BAY
Rt. 144
SOUTH
SHEEPSCOT
RIVER

The detector is an Eberline ERM2 with an HP-270 (hot dog) probe. The counting on the detector has been set for a fairly high precision - 95% confidence level. This means that it takes 1500 individual events before the detector generates an exposure rate in micro Roentgen per hour (uR/hr). The advantage with this precision mode is that instead of having a preset counting time, the counting time varies according to the intensity of the radiation field - the higher the exposure rate the lower the counting time to collect the 1500 counts, which means the faster the numbers on the computer color monitor would be updated.

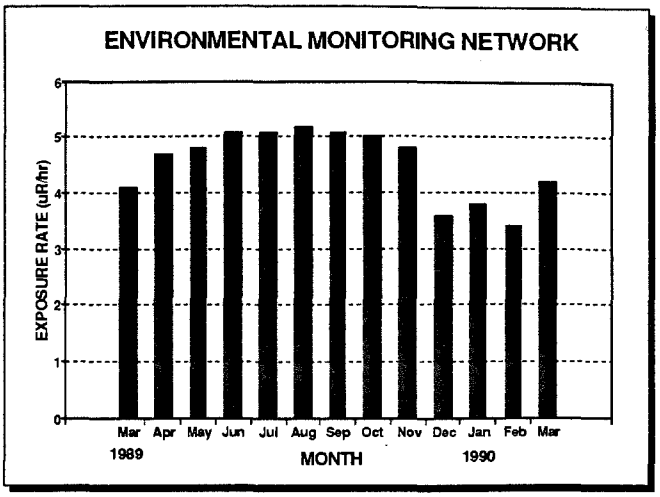


Figure 2 ***Monthly average exposure rate for all 17 environmental monitors.***

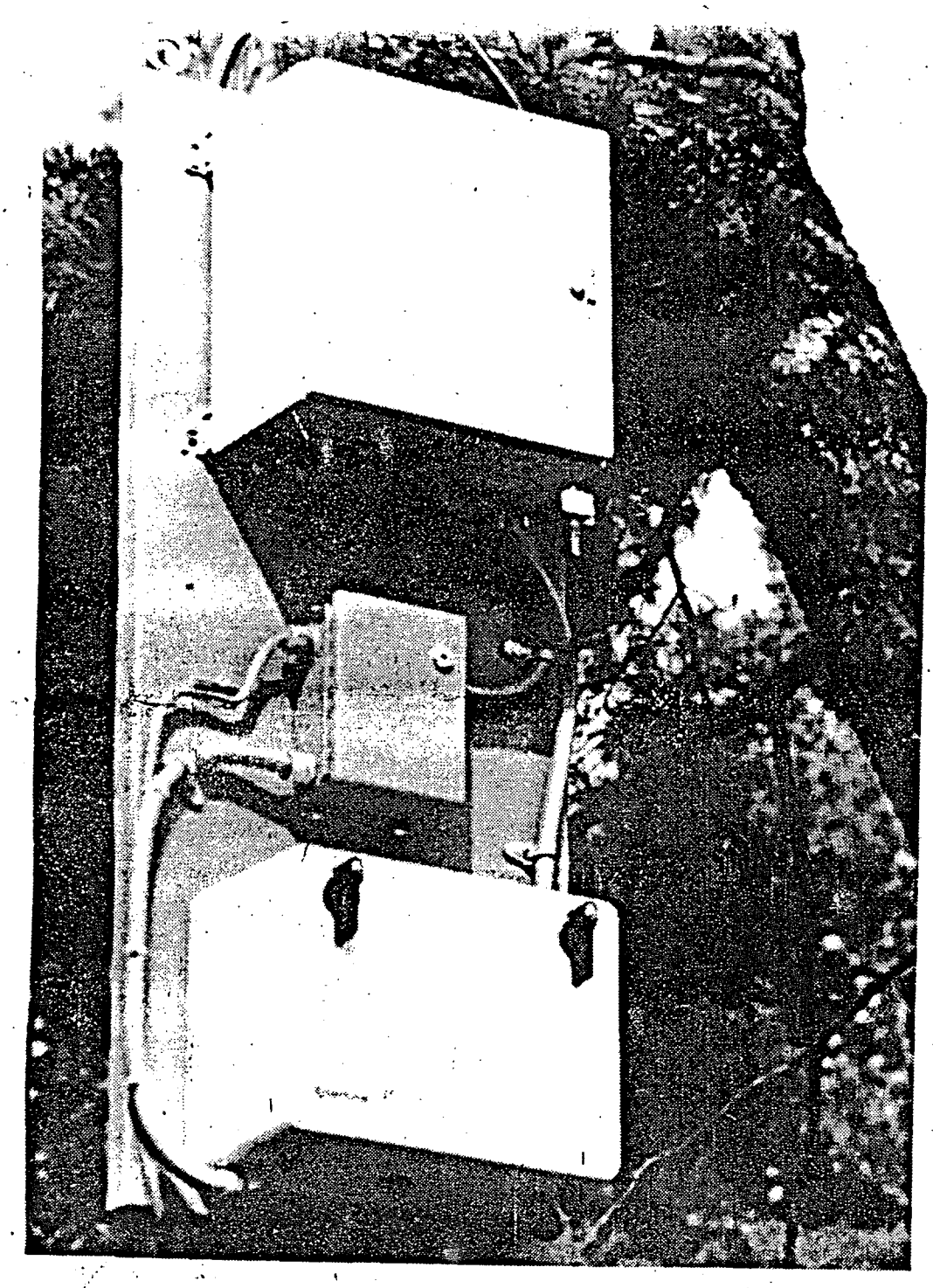
The base station for the radio telemetry is in the State Inspector's office in the basement at the South end of the Staff Building. The master radio sends a signal out every 2 minutes to each monitor starting with Monitor #1 and then in succession ending with monitor #17, after which it receives the plant data via the modem hook-up. The total polling time for the field and plant data takes on the average about 30 seconds.

In addition to the 17 environmental monitors the computer system is also connected to Maine Yankee's computer. There it accesses another 13 data points, 11 of which are used for evaluating the plant's emergency parameters. This information is fed to the State computer via a modem link up from the plant's emergency support system, which also supports Maine Yankee's Safety Parameter Display System (SPDS). As with the environmental monitors, this information is stored and plotted.

5.3 PRIMARY VEST STACK

The Primary Vent Stack monitor (low range) is the key plant indicator that the State Inspector uses most often. Not only does it give the actual readings of the continuous gaseous releases in counts per minute (cpm) but it can also detect certain plant operations, such as the taking of daily radioactive samples of the reactor coolant, the daily testing of the Radiation Monitoring System (RMS), observed the eructation of the Volume Control Tank (VCT), observed the pressurizer (PZR) gas space sample being purged

FIGURE 3



longer than allowed and observed the containment purge during the last RCP seal shutdown. Figure 4 illustrates a typical daily spectrum on the primary vent stack (PVS) with a reactor coolant sample being taken at about 8:00 A.M. At the present, based on preliminary evaluations, we cannot see any affect from the PVS effluents on the State's environmental monitors.

5.4 RADON EVENTS

The detectors' sensitivity is very high in that radon events from advancing weather fronts have been observed. The minimum number of discernable events in 1989 was 7 with the first one observed on June 6, 1989. The largest radon excursion took place on November 21, 1989, just before Thanksgiving. All the background monitor readings were between 2 and 3 times higher than normal as exemplified by Figure 5. These radon excursions which have affected the monitors appear to come from weatherfronts that are fast moving, over land and accompanied by heavy precipitation over a short time. The radon events are distinguishable from a Maine Yankee event in that a plume released from the primary vent stack would be governed by the prevailing winds and affect only a few monitors at the most, at the same time. Whereas a radon plume from a weatherfront affects virtually all the monitors at the same time.

The radon theory was tested on one of the fronts last October. During a downpour, a precipitation sample was collected from the Bailey House. With Maine Yankee's assistance the sample was brought to their chemistry lab where it was analyzed. The analysis showed the presence of the radon daughters, Lead-214 and Bismuth-214. This meant that the monitors were seeing the wash out of the radon daughter particles and their associated gamma activity.

It was also observed that the weather seemed to affect the monitors. During the summer, high temperature and humidity appeared to increase the communication problems between the field monitors and the base station. In addition, it caused the detectors to read higher than normal as if to increase the electronic background.

5.5 COMPARISONS WITH TLDs

Another observation that surprised both the State and Eberline, was that the monitors were consistently reporting doses below what the State's thermoluminescent dosimeters (TLD) would report. At first it was speculated that the containers the monitors were in affectively shielded it from the background radiation. It was also postulated that there was a height effect since the monitors were nearly twice as high above ground as the TLDs were.

In September, 1989 it was decided to test this shielding and height affect by placing at two stations (#1 and #2) an environmental TLD inside the Environmental Radiation Monitor container. The TLDs were left out for 97

FIGURE 4

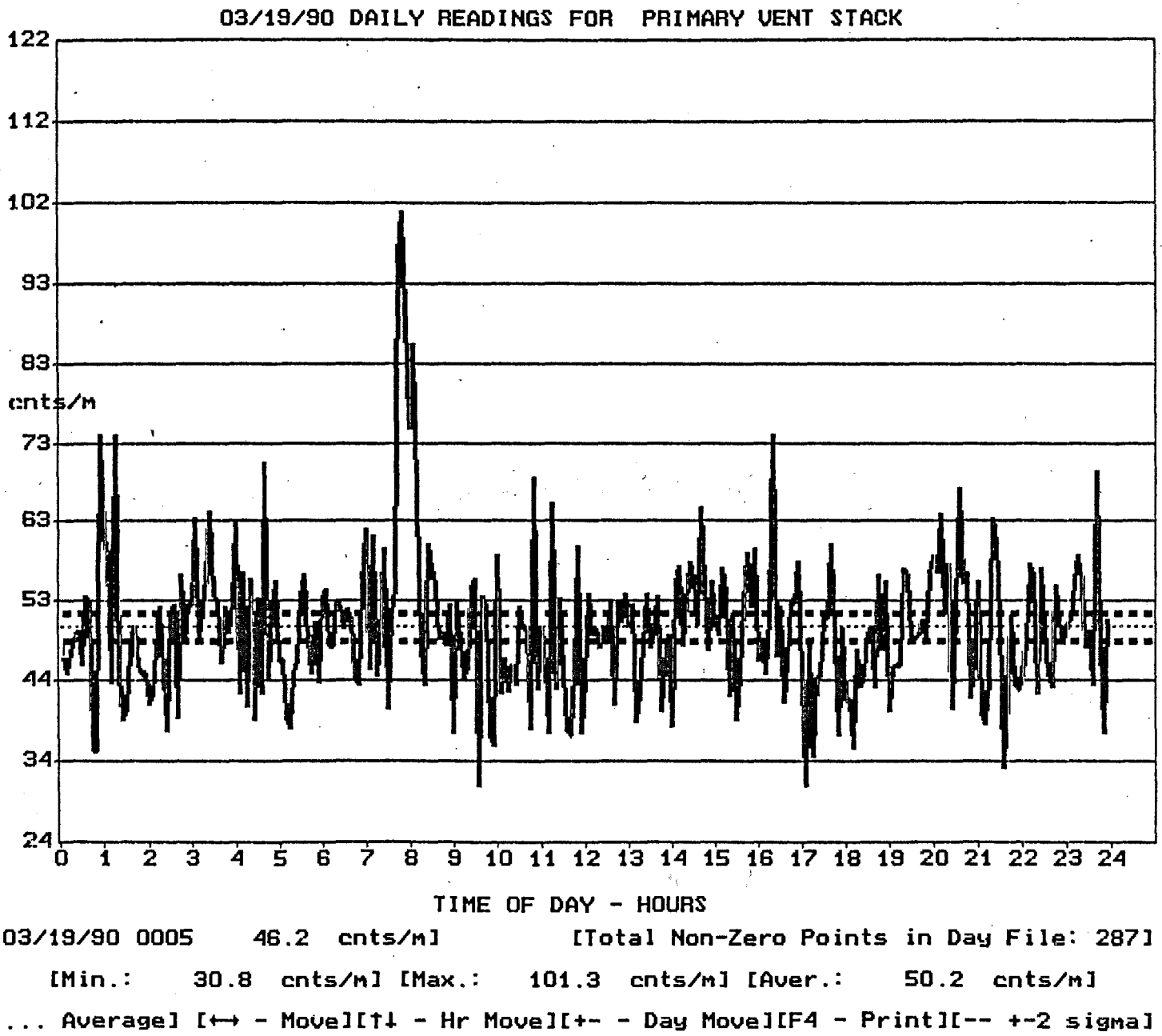
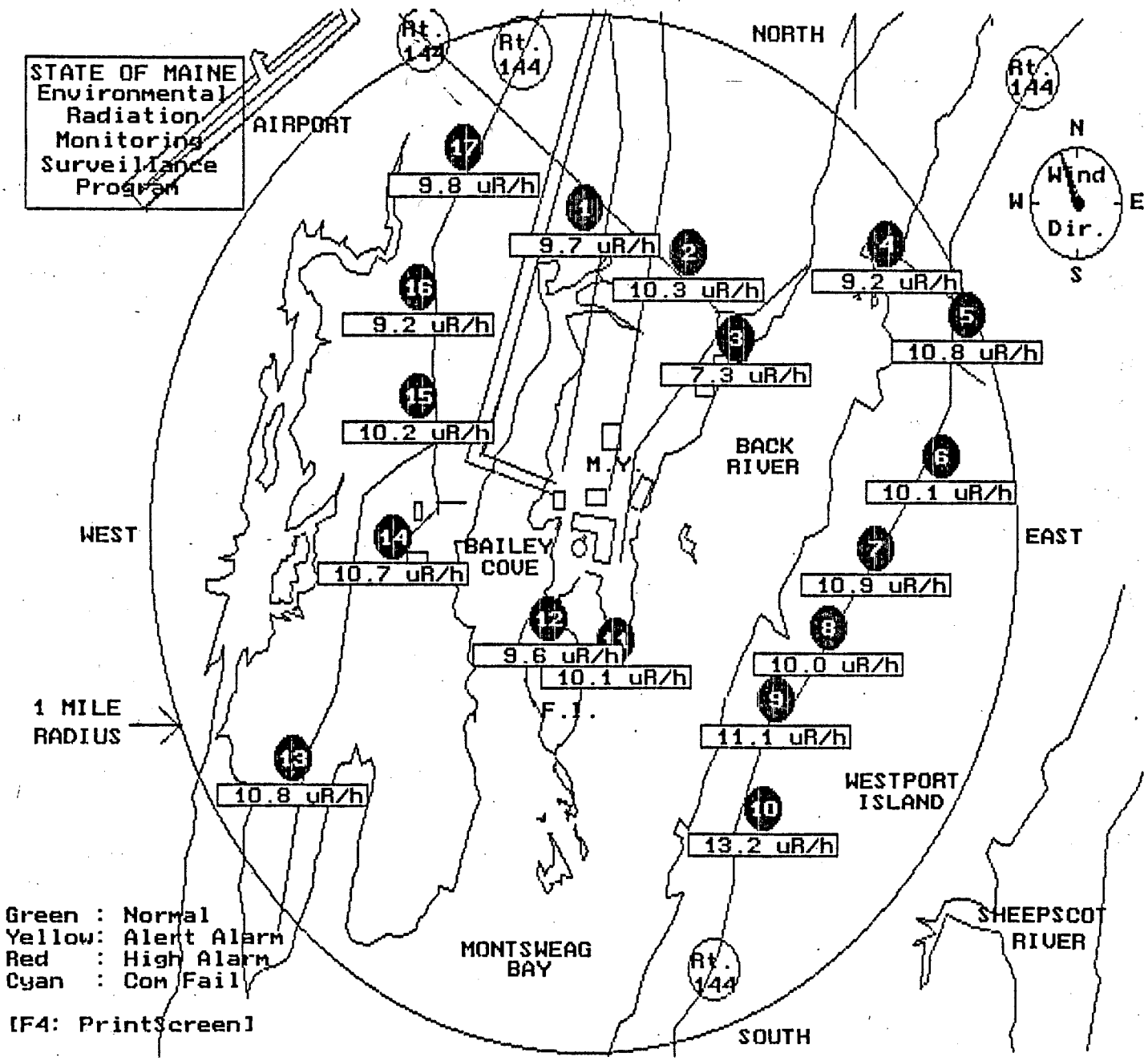

03/19/90 DAILY READINGS FOR PRIMARY VENT STACK
122
112
102
93
83
cnts/m
73
63
53
44
34
24
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
TIME OF DAY - HOURS
[03/19/90 0005 46.2 cnts/m] [Total Non-Zero Points in Day File: 287]
[Min.: 30.8 cnts/m] [Max.: 101.3 cnts/m] [Aver.: 50.2 cnts/m]
[... Average] [↔ - Move][↑↓ - Hr Move][+- - Day Move][F4 - Print][-- +-2 sigma]

FIGURE 5


STATE OF MAINE
Environmental
Radiation
Monitoring
Surveillance
Program
AIRPORT
Rt. 144
Rt. 144
NORTH
Rt. 144
N
Wind
Dir.
W
E
S
17
9.8 uR/h
1
9.7 uR/h
2
10.3 uR/h
4
9.2 uR/h
16
9.2 uR/h
3
7.3 uR/h
5
10.8 uR/h
15
10.2 uR/h
M.Y.
BACK
RIVER
6
10.1 uR/h
WEST
14
10.7 uR/h
BAILEY
COVE
EAST
7
10.9 uR/h
12
9.6 uR/h
11
10.1 uR/h
8
10.0 uR/h
1 MILE
RADIUS
F.I.
9
11.1 uR/h
13
10.8 uR/h
WESTPORT
ISLAND
10
13.2 uR/h
Green : Normal
Yellow: Alert Alarm
Red : High Alarm
Cyan : Com Fail
[F4: PrintScreen]
MONTSWEAG
BAY
SHEEPSCOT
RIVER
Rt. 144
SOUTH

days. Upon processing it was evident there was a distinct difference between the TLD and monitor results. The TLDs were about 50% higher than the monitors. It also became apparent that there seemed to be a consistent 2.2 uR/hr difference between the TLD and the monitor. In discussions with Eberline, it appeared that the fixed background value for each detector could have been questionable, because the lead that Eberline used to shield, external radiation may have screened out the cosmic component. Apparently, Eberline correctly traced their exposure rate calibrations to the National Bureau of Standards but they never performed any comparisons with TLDs.

In 1990 a more extensive evaluation of the fixed background of the detectors will be undertaken to assess the cosmic component and to incorporate the adjustment into the fixed background to ensure that the TLDs and the monitors are in agreement.

6.0 STATE INSPECTOR ACTIVITIES

The State Inspector activities revolved around four major endeavors:

A. NRC Audits/Inspections
B. Plant Manager Meetings
C. Legislative Document 1060 Initiative
D. Facility Tours

6.1 NRC AUDITS/INSPECTIONS

During the year it became apparent that communications between the NRC and the State Inspector required some improvements. There were two issues which caused some problems. The first one dealt with the State Inspector learning of NRC inspections through Maine Yankee, as opposed to the NRC and his belief that a written request was necessary to seek approval for observations of upcoming NRC inspections. The State Inspector's concern was that with the lack of advance notice, he would be unable to provide a request to NRC Region I and acquire approval of that request in a timely manner. The second issue involved regional inspectors being unaware of the standing agreement (Memorandum of Understanding (MOU)) between the NRC and the State of Maine. Because of this lack of awareness, some regional inspectors were hesitant to allow the State Inspector to observe portions of their inspections.

In September 1989, representatives from NRC Region 1 and the State Division of Health Engineering met to discuss ways to improve on their communication issues. During the meeting the NRC corrected the misperception that written requests were required in advance to observe NRC audits. By virtue of the MOU the State was guaranteed observer status at all

inspections and that the MOU already acted as the instrument of prior written request and authorization.

Two resolutions resulted from the September meeting. First, the Regional State Liaison Officer was to provide the State Inspector with the NRC inspection schedule as dictated by the SALP process and then distribute a memo to regional inspectors alerting them of Maine's MOU situation. Second, weekly meetings with the NRC residents and the State Inspector were instituted. These meetings later evolved into informal briefings whereby each side would present the major issues that they were addressing with Maine Yankee management. A third issue surfaced during the meeting. It involved the particular type of inspections performed by the State Inspector. When the NRC found out that the State Inspector was conducting NRC type inspections, the NRC expressed concern that this went beyond the MOU and should be discontinued unless the State Inspector received NRC state resident engineer status. The State opted to discontinue the inspections and focus on monitoring NRC and Maine Yankee activities.

During 1989 the NRC generated 27 inspection reports on Maine Yankee. Of the 27 reports 10 were produced by the two NRC resident inspectors. Two of the 27 were composed by NRC headquarters in Washington. Fifteen of the remainder dealt with NRC inspectors out of NRC Region I, King of Prussia, Pennsylvania. The audits covered such areas as operator requalification examinations, emergency preparedness, security, In Service Inspection Program, fire protection, radiological controls, engineering design changes, procurement, safety safeguards functional inspection and the emergency operating procedures to name a few. A total of seven violations were cited in the 27 reports. The findings of the 1989 audit reports are summarized in Appendix A.

Overall, the working relationship with the NRC residents has been very good.

6.2 PLANT MANAGER MEETINGS

These meetings were established early on in 1989 to facilitate communications between Maine Yankee management and the State Inspector. The meetings provided an avenue for the State Inspector to have access to Maine Yankee management and have fared very well.

During 1989 110 issues were raised. Some issues dealt with simple requests such as receiving copies of documents to raising issues that involved Maine Yankee's license, specifically the technical specifications. Of the 110 issues raised, 100 were resolved at year's end. However, by the end of the year there was one significant item that had not been resolved for over 5 months. This issue involved an apparent violation of Maine Yankee's own Quality Assurance procedures and it's plant license (Technical Specifications). At the end of the year there seemed to be some progress made by Maine Yankee to address the issue.

At one point in early September the State Inspector expressed a concern that some of the issues he was bringing forward to Maine Yankee management (via the Plant Manager's weekly meetings) were not being addressed in a timely manner. Maine Yankee promptly instituted appropriate measures to ensure State issues would receive a higher priority.

During the course of the year a few problems arose regarding the daily public information line on radioactive releases. These were resolved. However, it did point out that different interpretations of the State law existed and that these differences would have to be ironed out in 1990.

The Inspector found the weekly meetings to be informative while providing him with insight on Maine Yankee's philosophical approaches to issues.

6.3 LEGISLATIVE DOCUMENT 1060 INITIATIVE

During the 1989 legislative session a bill was proposed mandating certain requirements from Maine Yankee relative to its Radiation Monitoring System. The primary focus of the proposed legislation centered on two multi-point recorders located in the control room that provided traces for the 22 radiation detection devices scattered throughout the plant and its process systems. The Legislative Document focused on four objectives. They were:

a - Assurance that the multi-point recorders were functional at all times,
b - that the recorders were in plain view of the control room operators,
c - that the State Inspector inspect the two recorders daily to ensure they were functional and
d - that the recorder charts be kept in the Inspector's office for at least two years before being discarded.

The bill was tabled because of an agreement reached between Maine Yankee and the Legislature's Human Resources Committee. Principally, Maine Yankee would install new recorders and maintain them functional. Secondly, that Maine Yankee would work together with the State's Radiological Health Program to provide data summaries on the recorders results, since the recorder charts could not be made available to the State.

The State Inspector did perform daily (work week) inspections of the recorders to ensure they were functioning, maintained and repaired in a timely manner should they malfunction. Some problems were observed and most of these were resolved. However, there was one performance issue relative to the recorders' traces. The traces of some of the detector points were illegible and some invisible. The cause appeared to be related to the ink pads drying out over time. This issue was brought to Maine Yankee's attention. At year's end Maine Yankee was starting to address the issue.

6.4 FACILITY TOURS

The State Inspector plant tours have been limited at this point. However, more tours are expected in 1990 because of the refueling outage. Most of the tours in 1989 have focused on the control room, general housekeeping (both on the radioactive and non-radioactive segments of the plant), and radiological control practices with an emphasis on posting and contamination control. Several deficiencies were especially noted in the contamination control program. These were brought to management's attention whose response was more defensive than proactive. With the onset of the newly instituted Radiological Controls Improvement Plan, however, management's attitude in this area has changed for the better.

APPENDIX A

1989 NRC INSPECTION REPORT FINDINGS

REPORT #	PERFORMED BY	AREA OF INTEREST	FINDINGS
89-01	Region I	Operator Exam	Completion of makeup training is not being tracked.
89-02	Resident	Routine Inspection	Initiatives on Environmental Qualification repair and efforts in fire protection area were exemplary.
89-03	Region I	Procurement	Followup and verification of the 1988 violations in procurement.
89-04	Region I	Emergency Prepar.	There were 3 areas needing improvements notably related to the Emergency Plan. They were training, organization and management control.
89-05	Region I	Requal Exam	Maine Yankee has a satisfactory program and that all 12 operators (7 senior Reactor Operators and 5 Reactor Operators) passed the exam. There were no failures.
89-06	Resident	Routine Inspection	Good initiatives on critical self review of the fire protection program plus the preplanning associated with the cooling fans for the control element drive mechanism.

89-07	Region I	Security Program	Violation relevant to access control of vehicles. This was a Severity Level IV violation.
89-08	Resident	Routine Inspection	Two concerns were expressed; the first dealt with the applicable standard for the verification and validation of the microprocessor on the Primary Inventory Trend System and the second involved the uncertainties associated with the Subcooling Margin Monitor instrument inaccuracies.
89-09	Resident	Routine Inspection	No violations.
89-10	Region I	ISI Program	No findings or violations.
89-11	Resident	Routine Inspection	Radiological Control concerns were raised relative to the resin spill and contamination control practices associated with the Low Pressure Safety Injection pump overhaul.
89-12	Region I	Emergency Plan	This was a management meeting called by the NRC to discuss Maine Yankee's corrective actions for the 1987 exercise deficiencies identified by Federal Emergency Management Agency (FEMA). Representatives of the State of Maine and FEMA also attended the meeting.

89-13	Resident	Routine Inspection	Observed well developed controls for 2700MW(th) upgrade and Demineralized Water Storage Tank repairs but still had radiological concerns on hot particles.
89-14	Region I	Fire Prot.Preven.	No findings or violations.
89-15	Region I	Radiological Cont.	Four findings - a) concerns on the adequacy of the corrective actions for self-identified findings, b) water in a radwaste storage bunker c) weaknesses in the area of housekeeping and d) the hot particle exposure control program continues to need improvement.. No violations.
89-16	Region I	Environmental Qual.	No violations were observed. Two issues remain unresolved - a) strict control on electric load changes and b) electrical penetration assemblies manufactured by D.G. O'Brien.
89-17	Resident	Routine Inspection	There were no violations, but two concerns were expressed in the radiological area on work relating to the loose parts monitoring system and the low pressure safety inspection pump.

89-18	Resident	Routine Inspection	Two violations were cited -one for the repetitive overfilling of the resin storage tank and the other on improper maintenance on the Pressurizer Spray Control Valves. Both violations were Severity Level IV's.
89-19	Region I	Physical Security	No violation. However, several potential weaknesses were identified in the areas of management effectiveness, protected area assessment aids and vital area detection aids.
89-20	Region I	EDCR Program	One violation and one deviation noted. The Severity Level IV violation pertained to an inadequate functional test of the primary component cooling and secondary component cooling outlet valves to the residual heat removal heat exchangers. The deviation did not meet 3 provisions of Regulatory Guide 1.97, Rev. 3. Management has undertaken several initiatives to commit to a long term, strong performance in engineering and technical support.
89-21	Region I	Emergency Prep.	No violations. Only one area was noted as needing improvement which involved protective action recommendations altering event classification levels.

89-22	Resident	Routine Inspection	No violations were found. The NRC did cite the T-1H switching error as an open item and was concerned over a failure to initiate a procedure change request when necessary during the performance of the Emergency Feedwater Flow test. There was a minor weakness identified relative to a training inaccuracy due to updating discrepancies.
89-23	Region I	Radwaste Program	There were no violations. The inspector cited two notable improvements - one dealt with the use of the Radman computer code and the other with the radiological controls supervisor's review of all shipping papers prior to the transport vehicle leaving the site.
89-24	Region I	Security Program	Two violations were found. One involved the failure by the Operations Department to properly control emergency, spare security vital area keys. The second one involved a failure by the Operations Department to inventory security keys in accordance with the NRC approved physical security plan. Both violations were Severity Level IVs.
89-25	Resident	Routine Inspections	Three unresolved items were identified. The first involved a termination letter not being issued in a timely

			manner. The second dealt with the alignment of the containment spray building ventilation. The last one related to Maine Yankee's method of evaluating and correcting the acceptance criteria for a component cooling water valve cycle time.
89-80	Headqtrs	Emergency Proced.	NRC management's overall assessment was that Maine Yankee's program was in the top 15% of the programs reviewed to date and recommended it as a role model for industry. NRC did identify one concern relative to the direction Maine Yankee gives its operators - that the emergency procedures are to be used only as guidelines versus verbatim compliance documents.
89-81	Headqtrs	Safety System Functional Inspec.	Weaknesses identified were an inconsistent safety perspective on several longstanding problems, electrical system lineup problems that could substantially reduce the reliability of Maine Yankee's electrical power distribution, the inability to determine component cooling water system capability to perform its intended safety function and the apparent use of component replacement when the rigor of the design process is more appropriate.

APPENDIX B

PLANT REPORT INDICATORS

Maine Yankee utilizes several reporting systems to track issues to ensure resolution and to archive lessons learned to prevent future occurrences. Three of the many reporting systems that Maine Yankee utilizes to track problem issues are the mysteries report, the unusual occurrence report and the licensee event report. The first two are internal to Maine Yankee whereas the last one is a formal, 30 day report to the Nuclear Regulatory Commission.

In 1989 Maine Yankee identified 135 mysteries. Mysteries are normally identified at the morning management meeting and refer to those events that have no immediate explanation as to why or what caused them. They can be as simple and insignificant as to why a certain part was not delivered on time to something much more complex and significant as what caused the Reactor Coolant Pump seals to fail in 1989. The mysteries are tracked and discussed weekly at the Plant Operations Review Committee (PORC). The mysteries become part of Maine Yankee's database and can assist in problem resolutions as well as identifying precursors of some major events.

Besides the mysteries report Maine Yankee also employs the Unusual Occurrence Report (UOR). In 1989 133 UORs were generated. A UOR is generated whenever something out of the ordinary occurs from a plant operations perspective. The reports are compiled by the Operations Department and usually report on the circumstances surrounding the event, compare the event with prior, similar historical events, identify short term corrective actions and prescribe long term corrective actions. Each long term action is then tracked until it is successfully resolved.

During 1989 Maine Yankee issued six Licensee Event Reports (LERs). LERs usually involve issues related to public health, safety and plant technical specifications. The six events that required NRC notification are listed below:

Table: 1989 LERs

NUMBER	DESCRIPTION
89-001	Plant Trip on Loss of EHC Control Power.

89-002 Environmental Qualification Discrepancies Identified in Containment Cable Connector Seals.

89-003 Plant Trip due to Inadvertent Actuation of Generator Protective Relaying.

89-004 Plant Shutdown due to Containment Purge Valve Leakage in Excess on Technical Specification Limits.

89-005 Emergency Core Cooling System (ECCS) Valve not Fully Closed.

89-006 Emergency Battery Loads.

The first four LERs relate directly to four of the six shutdowns Maine Yankee experienced in 1989.