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Licensee: New York Power Authority (NYPA)
P. O. Box 41
Lycoming, New York 13093

Facility Name: James A. FitzPatrick Nuclear Power Plant (JAF)

Inspection At: James A. FitzPatrick Nuclear Power Plant, Lycoming, New York

Inspection Conducted: March 19-28, 1991

Inspectors:

David J. Chawaga, Radiation Specialist — 5-1-91 date

James J. Kottan, Laboratory Specialist — 4-26-91 date

Nancy P. McNamara, Physical Science Technician — 5-2-91 date

Richard A. Plasse, Resident Inspector, James A. FitzPatrick — 4/26/91 date

Robert R. Temps, Resident Inspector, Nine Mile Point — 4-26-91 date

Robert J. Bores, Team Leader, Chief, Effluents Radiation Protection Section — 5/02/91 date

Approved By: Malcolm R. Knapp, Director, Division of Radiation Safety and Safeguards — 5/2/91 date

Inspection Summary: An Augmented Inspection Team (AIT) inspection was conducted March 19-28, 1991, to review the circumstances relative to the unmonitored release on March 18 of radioactive materials from the radwaste concentrator through the auxiliary boiler system to the environment through the auxiliary boiler vent. An Executive Summary can be found in Report Section 2.0. Potential enforcement issues are being considered separate from this inspection.

TABLE OF CONTENTS

TABLE OF CONTENTS

Page

TABLE OF CONTENTS

DETAILS

1.0 Introduction

1.1 Scope of Inspection

On March 18, 1991, radioactive concentrates from the radwaste concentrator at the James A. FitzPatrick Nuclear Power Plant (JAF) were drawn into the auxiliary boiler system which was being vented to the environment. In response to the event, the Regional Administrator sent an Augmented Inspection Team (AIT) to the site to document the relevant facts, determine the probable cause(s), evaluate the licensee's analyses and actions in response to this event, perform independent and confirmatory measurements of environmental contamination, determine whether the event was properly classified, and determine whether there were precursor events and any generic implications. This report describes the findings and evaluations of the AIT.

The AIT held an entrance meeting with plant management and support staff on March 19, 1991 and performed the inspection during the period March 19-28, 1991. The AIT briefed plant management on team findings on March 28 at the plant site. The AIT exit meeting was conducted on April 2, 1991 in the Region I Office. Attendees at the AIT entrance meeting are listed in Appendix A to this report. Attendees at the March 28, 1991 AIT debriefing with plant management are listed in Appendix B. Attendees at the April 2 exit meeting are listed in Appendix C to this report. Principle individuals contacted during the inspection are listed in Appendix D. Appendix E is the Memorandum of Assignment for this AIT and the AIT Charter for this event. Appendix F documents the bases of the NRC evaluations of releases to the environment.

1.2 Team Composition

The team was composed of a regional team leader, three regional specialists and two resident inspectors. The team's combined expertise included reactor operations and systems, radiological protection, radiological measurements and assessments, emergency preparedness and management controls.

2.0 Executive Summary

2.1 Event Summary

On March 18, 1991, with the James A. FitzPatrick reactor beginning to restart after an outage, the auxiliary boiler was being used, among other things, to supply steam to the waste concentrator in the processing of liquid radwaste. Because of organic material in the distillate from the waste concentrator, the licensee attempted to batch (remove the concentrates from the bottom of the waste concentrator) the system. However, the batch line was blocked. In the process of troubleshooting to unblock the batch line, the operators performed a number of valve manipulations outside of

the procedures that resulted in waste concentrator bottoms being drawn into the auxiliary boiler system. Since the auxiliary boiler has historically been operated with artificial loading (venting to atmosphere at about 9000 pounds per hour) during these operations, material drawn from the waste concentrator was driven off with the steam to the atmosphere. Substantial radioactive contamination of nearby building roof and wall areas, as well as, the ground adjacent to these buildings occurred.

2.2 **Assessment Summary**

The AIT concluded that the licensee's oversight and management of the radwaste operations were deficient.

- Procedures were lacking for some of the operations conducted.
- Procedures for operation of the concentrator were not followed.
- Operation of the waste concentrator has changed from the use and evaluation described in the FSAR.
- Modifications recommended in the past which might have prevented or mitigated the event had not been completed.
- Audits and management attention focused only on the solidification and transportation aspects of radwaste, not on the liquid processing or auxiliary boiler operations.
- Licensee response to NRC IE Bulletin 80-10 did not consider operation of the auxiliary boiler with artificial loading as a potential release pathway.

2.3 **Licensee Response to the Event**

Following detection of the event the licensee declared an Unusual Event and activated both the Technical Support Center (TSC) and Operational Support Center (OSC) to better coordinate and support the response in mitigating the consequences of the event and initiating recovery. The licensee's actions in this area were, in general, appropriate, well planned, prioritized and effective. However, the licensee's classification procedures indicate that, when it is determined that plant conditions exist which warrant precautionary activation of the TSC or OSC, an Alert should be declared. An Alert declaration was not made.

2.4 Consequences of the Event

The release to the atmosphere also resulted in a discharge of some material to Lake Ontario. The evaluation of the radiological consequences indicates that the drinking water pathway from Lake Ontario was the only pathway to man that had any potential for dose implications and even this pathway likely would have only insignificant exposure consequences.

3.0 The Event and Its Causes

3.1 Design and Operation of Waste Concentrator B

Two waste concentrators (WCs) of different design, manufacture and capacity were used at James A. FitzPatrick (JAF) plant. The WCs were used to reduce the volume of liquid radioactive waste through the evaporation process, evaporating the water and leaving behind the concentrated waste. The evaporated water was then condensed and, depending upon its purity, either returned for use in the plant or recycled back to the waste neutralizer tank for further processing. The B WC was used preferentially, since it was better instrumented and easier to operate than the A WC.

The waste concentrator consists of a cylindrical pressure vessel containing three major components, an internal heat exchanger, a vapor space and a deflector plate. The internal heat exchanger is a vertical tube and shell heat exchanger, sometimes referred to as the evaporator. Steam, provided to the shell side of the internal heat exchanger, transfers heat to the liquid radioactive waste (referred to as the liquor) in the WC, causing the liquid to evaporate and the concentration of impurities to increase as the evaporation process continues. The basic operating principles of the WC and certain design features relevant to the contamination of the auxiliary boiler are discussed below. Figure 1 provides details of the system schematic, flow paths and relevant valve numbers.

Steam for the WC could be supplied either from the nuclear reboiler system (when the reactor was operating) or by one of two oil-fired auxiliary boiler units when the nuclear reboiler was unavailable. Steam admission to the WC is controlled by valve FCV-106. FCV-106 was designed to operate automatically to secure steam to the WC if liquor level in the unit decreased to 72 inches and to reinitiate steam flow when level increased above 73 inches. Steam/condensate used to heat the WC exits the internal heat exchanger, flows past a conductivity cell and goes to a condensate receiver tank, from which the condensate is pumped to the auxiliary boiler condensate tank, which supplies feedwater to the boiler units. The conductivity cell was used to indicate increased conductivity in the condensate leaving the internal heat exchanger. Increased conductivity is indicative of poor water quality in the boiler steam or more importantly, of tube leakage in the internal heat exchanger of the WC. The

inspectors noted, however, that based on information contained in NYPA documents, the efficacy of the conductivity cell to indicate and alarm upon a high conductivity situation is questionable because, in the installed location, the conductivity cell may operate in a steam/water mixture. This concern is discussed further in Section 3.5.2 of this report.

Downstream of FCV-106 on the steam supply a line taps off which can be used to supply steam to the liquor side of the WC, either to agitate the liquor or to provide steam for flushing a refractometer, which is no longer used. Steam flow through this line is controlled by valve FCV-02. The inspectors determined that original design prints show this line tapping off the steam supply before FCV-106, but the as-built configuration is as described above. (See Figure 1.)

The liquor in the WC, heated by the steam, eventually evaporates. The distillate vapor, containing entrained droplets of liquor, impinges on a deflector and exits the WC into the separator vessel (entrainment separator). From there, the vapor exits and is condensed in a surface condenser unit. The liquid distillate is then diverted either to the waste collection tank, or back to the waste neutralizer tank. During the evaporation/concentration process, level in the WC is maintained at 92 inches (by procedure) through automatic makeup of feed from the waste neutralizer tank.

Lastly, the concentrated liquor solution in the WC is periodically batched. This process involves draining the contents of the WC, through a bottom drain line, by opening bottom drain valve AOV-812B and directing the contents to the concentrated waste tank (CWT). The inspectors determined that radwaste operators perform one of two types of batch operations; a "short batch" operation, which involves decreasing WC level by approximately 12 inches, or a "full batch", in which the WC is completely drained to the CWT. The inspectors noted that the batch process and criteria for when to batch are not reflected in Procedures OP-49A and B, which govern operation of WC A and B, respectively. These procedural deficiencies and others are discussed in Section 3.4 of this report.

3.2 Auxiliary Boiler System

The New York Power Authority (NYPA) uses one of two auxiliary boiler units to supply various in-house steam loads when the nuclear reboiler is unavailable. The units are oil-fired and designed to produce approximately 60,000 pounds of steam per hour. However, the inspectors determined that due to much lower steam demands or loads, the units are typically operated well below their design output, typically at 35% to 50% of design. In addition, operation at low steam loading has historically been difficult and as a result the auxiliary boilers have been operated with artificial loading of the boiler. The artificial loading was accomplished by manually opening a vent valve which allowed for venting steam directly from the auxiliary boiler to atmosphere. The artificial loading increased the steam demand from the auxiliary

boiler and allowed for more stable burner operation. The inspectors determined that, from the time of initial boiler operation, there were various conditions for which the operators found artificial loading desirable. One of these conditions was batching of the concentrator, since the batching evolution caused large fluctuations in steam demand relative to the total load on the boiler unit. Therefore, the vent valve was opened to artificially load the unit so that reductions in steam demand while batching the concentrator would not upset operation of the boiler and cause it to shut down. On the day of the event, March 18, 1991, the boiler was artificially loaded (venting approximately 9000 pounds per hour) in anticipation of batching the B WC.

3.3 Sequence of Events Leading to Auxiliary Boiler Contamination

The following information details the mechanism by which the condensate supply to the auxiliary boiler became contaminated as a result of misoperation of the B WC. The times listed for the following events are approximate.

3.3.1 Status of B WC Prior to 3/18/91

Prior to the event, the B WC was in operation with steam supplied to it from the auxiliary boiler and was processing water from the waste neutralizer tank (WNT). Due to a problem with organic contamination in the distillate, the distillate was being recycled back to the WNT. In this mode, even though the WC was in operation, new liquid was not being processed as the contents of the WNT were being recycled. As a result of the reactor outage and restart activities, there was a backlog of liquid radwaste of approximately 130,000 gallons. Processing of this waste was held up due to the problem with the carryover of total organic carbon (TOC) in the WC distillate. To clear up this problem, radwaste operators tried to batch the WC in an attempt to dump the organic contaminants to the CWT. As the result of an unsuccessful effort to batch the WC on 3/1/91 the batch line was known to be plugged, a situation which still existed on March 18. Further attempts to clear the plugged line during the outage were not made since the concentrator steam was being supplied by the auxiliary boiler. The Radwaste Supervisor's preference was to perform troubleshooting actions to clear the batch line over the weekend of 3/16/91, when the plant was scheduled to restart and the steam supply for the WC could be switched over to the nuclear reboiler system. Nuclear reboiler steam was preferred because changes in steam flow during batching were easier to handle than when using the auxiliary boiler to supply steam as discussed in Section 3.2 above. However, delays in the plant startup over the weekend and the large inventory of water awaiting processing led the Radwaste Supervisor to conclude that he had to take action on the morning of 3/18/91 to clear the plugged batch line while steam was still being supplied from the auxiliary boiler.

3.3.2 Events of 3/18/91 and Consequences

Approximate Times

0530 B WC taken out of recycle.

0650 Auxiliary boiler B sampled by Chemistry (routine sample). Gross beta activity <1.05 E-6 μCi/ml.

0700 Auxiliary boiler artificially loaded by approximately 7000 to 9000 pounds per hour (vent opened to atmosphere).

0730 RW operator dispatched to RW control room with instructions to try and batch the WC.

0755 RW operator attempted to batch. Auxiliary steam supplied to the bottom of the WC by opening FCV-02 to agitate contents to assist in clearing the plugged batch line. RW operator also secured feed (valve FCV-107) to the WC at the start of the batch operation.

0800 to 0900 WC did not batch; no flow to CWT observed. However, with steam flow still cut in to WC (FCV-106 open) and no makeup feed, WC level steadily decreased due to boil off of contents. RW Supervisor arrived in RW control room to assist in troubleshooting evolution around 0830 hours.

0900 WC level decreased to low level setpoint, causing steam admission valve FCV-106 to close automatically. (Shutoff of the steam causes an alarm, which requires acknowledgement. However, RW operators interviewed do not remember this occurring nor acknowledging the attendant alarms.) A caution in OP-49B requires that the condensate receiver tank drain lines be rerouted to the floor whenever steam flow is reduced or stopped. The RW operators failed to observe this caution and reroute the drains.

0900 to 1000 Following automatic shutoff of steam, level in the WC dropped promptly from 62 inches to 40 inches (as indicated on WC level recorder strip trace). (Operators interviewed stated they didn't understand what was happening with the level decrease since they knew from other indications that the WC was not batching to the CWT.) The decision was made to cut in WC shell wash water by opening valve FCV-03 to raise the WC level (not a normal WC fill source). At 1000 hours, level increased high enough to cause steam admission valve FCV-106 to automatically reopen.

The consequence of the actions taken in this time period was the contamination of the condensate supply to the auxiliary boiler. During the time that FCV-106 was shut, (approximately one hour) the steam agitation valve, FCV-02, was left open. This created a direct pathway between the contaminated WC contents at the bottom of the WC and the steam side of the internal heat exchanger. As the steam in the internal heat exchanger condensed, likely aided by the addition of wash water via FCV-03, a vacuum formed in the steam supply line and in the internal heat exchanger, which allowed an unknown quantity of highly contaminated liquor to be drawn into the shell (steam side) of the internal heat exchanger. When the liquor level in the WC reached 73 inches from the addition of shell wash water, steam flow was automatically reinitiated to the internal heat exchanger at 1000 hours. The contamination was swept out of the internal heat exchanger with the steam/condensate and, due to the failure of personnel to redirect the condensate receiver tank drain lines, the contaminated condensate ended up in the auxiliary boiler's condensate supply tank. (From interviews, it could not be determined if the conductivity alarm on the condensate return line actuated or not. In any event, actions were not taken to redirect the condensate receiver tank drain lines.)

1000 to 1145 After level was restored to the WC and steam was readmitted to the WC, numerous other troubleshooting actions were undertaken by the RW operators in an attempt to clear the clogged batch line. Some of these actions, occurring at various time intervals, included the following.

- Shutting valve 74 (between the entrainment separator and the vapor condenser - see Figure 1) to "bottle up" the concentrator and raise the internal pressure of the WC to help clear the plug. WC internal pressure was increased approximately 1.5 psi through this action.

- Shutting an inlet valve to the CWT (downstream of AOV-812B) and attempting to backflush the drain line by applying condensate water through a fitting, by use of a connecting hose, and opening of valve 62. In parallel with the condensate supply, valve 241 was also opened to admit steam to also assist in backflushing the line. Several other valve manipulations were also made to align the backflush sources to the B WC.

In parallel with the previous evolution, the contaminated contents of the auxiliary boiler's condensate supply were fed into the boiler. From review of auxiliary boiler log traces, it appears that the contaminated water, which contained chemical wastes as well, likely caused frothing and agitation to occur within the boiler unit. This action along with the artificial loading evolution allowed for the carry over and release of contamination through the unmonitored atmospheric vent line.

1044 A reactor control room ventilation alarm (responding to radiation levels) was received. (Response to this alarm is discussed in Section 4.1 of this report.)

1145 Operators received indication that the plug in the batch line cleared as indicated by rapid level increase in WC from 80 inches to 110 inches due to backflushing the batch line. Condensate and steam backflush lineup was secured.

1150 to 1330 With WC still bottled up (valve 74 closed), operators proceeded to full batch the concentrator twice (from 110 inches to 0 inches and back up to 110 inches). As designed, during each evolution, steam flow to the internal heat exchanger secured and reinitiated as level decreased and then increased.

Agitation valve FCV-02 remained open at this time allowing for possible additional cross-contamination of the condensate return to occur twice more through the previously discussed mechanism.

1315 Auxiliary boiler vent to atmosphere shut since batching operation was completed and additional steam load changes were not anticipated.

1330 Following the second batch of B WC, the WC was lined up for return to normal service. FCV-02 was shut. Sometime later (time not established), the condensate receiver tank drains were realigned to the floor drains.

1445 Unusual Event declared because of contamination discovered outside buildings.

1700 In response to the Unusual Event, B WC was taken out of service and its contents were drained.

3.4 Management Oversight of Radwaste Operations and Procedural Adherence Issues

As part of the inspection, the inspectors interviewed numerous site personnel, from Radwaste Auxiliary Operators to the Operations Superintendent. The interviews were conducted to gain an understanding of the sequence of events which led to the auxiliary boiler contamination, to determine whether operator actions with respect to procedural adherence issues during the event were representative of normal operational practices, and to determine the extent of management awareness and oversight of radwaste operational practices.

As a result of these interviews the inspectors concluded the following.

1) The contamination of the auxiliary boiler and release of contaminated material were the direct results of individuals failing to follow procedures.

2) Radwaste operators had deviated from procedures in the past and Procedures OP-49A and OP-49B have been inadequate since at least 1983.

3) A lack of sufficient management oversight of radwaste operations allowed the procedural noncompliances to occur and the procedures to remain unrevised and not reflective of actual operating practice.

The basis and supporting facts for these conclusions are discussed below.

3.4.1 Procedural Deviations on 3/18/91

As described in the sequence of events, Section 3.3.2, the actions taken on March 18, 1991 to clear the plugged concentrator batch line were beyond the scope of approved procedures and, in addition, were not performed in accordance with any sort of troubleshooting procedure. The following specific actions were taken outside of approved procedures.

a) Backflush of the concentrator batch line with condensate water and steam and the valve manipulations required to line up these sources.

b) Refilling the concentrator using shell flush valve FCV-03.

c) "Bottling up" the concentrator by shutting valve 74.

d) Failure to redirect condensate receiver tank drains to the floor each of the three times that steam was secured to the concentrator.

e) Opening and then leaving open valve FCV-02 for steam agitation of the contents of the concentrator.

f) Successive batching of the concentrator (twice) once the batch line was unplugged.

g) Failure to take timely actions in response to the condensate return conductivity alarm.

The inspectors interviewed the Radwaste (RW) Supervisor in order to understand why he directed the above actions. He stated that he felt that the troubleshooting activities did not need to be proceduralized and that it was within his authority to undertake the actions he did to clear the plugged line. He based this statement on the following. First, the batch line has a history of becoming blocked, and actions taken in the past (also outside of approved procedures) were successful in clearing the line. Second, recent revisions to radwaste procedures have an added Note at the beginning of those procedures which states that steps in the procedure may be "resequenced" with the concurrence of the Radwaste Supervisor and/or the Shift Supervisor. However, based on interviews, the RW Supervisor has misinterpreted this Note. He stated that, in the past, the Note has been used to allow alternate valve manipulations, such as during transfer of liquid wastes, to compensate for inoperable equipment, and that on such occasions he had conferred with and obtained concurrence of the Shift Supervisor. Although the procedures for operation of the concentrators, OP-49A and B, have yet to be revised (and therefore do not contain this Note), the RW Supervisor felt that the Note could be used to allow him to take the actions he directed on March 18 to unplug the batch line. In any event, the Note only allows for "resequencing of steps" within a procedure, not for the picking and choosing of certain steps, nor for creation of new steps to compensate for inoperable system components. The inspectors also determined that the previous Waste Management General Supervisor (WMGS) was aware of this Note and was concerned that it might be misinterpreted. Although the WMGS's preference was to have the Note deleted from procedures which contained it, no action was taken to actually delete it.

3.4.2 Past Procedural Deviations and Inadequate Procedures

The inspectors identified several instances in which past operations of the WCs were conducted either outside of approved procedures or without procedures at all, as discussed below.

Until 1983, the WCs were used for concentrating sodium sulfate solutions produced by the resin regeneration process. Procedures OP-49A and B were specifically written for operation of the concentrators for the processing of sodium sulfate solutions. Then, in 1983, resins were no longer regenerated and the WCs were no longer used to concentrate sodium sulfate solutions, but were used to concentrate radioactive material in the process of recycling water from the floor drain system. Many of the steps in these two operating procedures are no longer applicable to the manner in which the WCs have been operated since at least 1983, when the procedures were last revised. Examples include the following.

a) The process of batching and short batching described earlier cannot be performed in compliance with the existing procedures, yet these two operations routinely have been performed.

b) The criteria for determining when to batch the WCs no longer apply, since they were written for the processing of sodium sulfate solutions. In current practice, batching of the WCs has been performed based on changes in operating parameters, length of time in service, or operational problems, such as organic carryover in the distillate. However, none of these criteria are proceduralized.

c) The B WC routinely was operated with the liquor level at 110 inches, versus 92 inches as specified in OP-49B.

d) On March 1, 1991, a RW operator attempted to batch the WC, but noted that Procedure OP-49B did not provide specific instructions for this evolution. He then called the RW Supervisor at home, obtained instructions on how to batch, and proceeded to attempt the evolution without obtaining a procedure change.

e) Actions have been taken in the past to clear plugged batch lines, although neither OP-49A or B provide instructions for this, nor do any other existing procedures.

The inspectors also identified several other concerns with respect to operator actions and the adequacy of procedures and training as discussed below.

a) The auxiliary boilers have not been operated in accordance with Operating Procedure, OP-35, in that the process of artificial loading by opening of the boiler's steam vent valve is not included in the procedure.

b) The alarm response procedure on hi-lo WC level is inadequate in that it does not direct that the condensate receiver tank drains be aligned to the floor upon actuation on a low level condition, even though this causes the steam supply to be automatically terminated.

c) The inspectors compared OP-49B with the technical manual for the WC and identified numerous differences in operating instructions. JAF engineering personnel were questioned as to the requirements, if any, for justifying deviations from vendor technical manuals, but an answer was not provided during the inspection. The inspectors requested JAF management to review this issue and insure that a similar concern does not exist for safety-related equipment.

d) The inspectors determined, as noted in Section 3.1, that the liquor agitation/refractometer steam wash line was not installed as shown in the design drawings, in that the installed line taps off downstream of the steam admission valve, FCV-106, rather than upstream as shown in the design drawings.

e) A training plan developed in January 1990 on the WCs, and used in training auxiliary operators on operation of radwaste systems, was reviewed. While the lesson plan appeared to be well written and contained useful information and diagrams concerning the design and operation of WCs, the material was all based on operation of the WCs for the processing of sodium sulfate solutions. During questioning, the instructor who taught this lesson plan indicated that he was aware of the fact that the WCs were no longer used for processing sodium sulfate solutions, but stated that the material taught described the most severe use of the equipment. The basis for this statement could not be determined. Additionally, the lesson plan for operation of the WCs was based on the outdated OP-49A and B. When asked about the batch process described in the lesson plan, the instructor stated that he thought that the "shutdown section" of OP-49B covered this process. However, while this section of OP-49B does contain some steps which would be used in batching the WC, from a compliance standpoint it does not support the process of batching.

3.4.3 Management Awareness and Oversight of Radwaste Operations

Several concerns were identified with respect to management awareness and oversight of radwaste operations.

a) In 1983, an external audit identified that, in the area of RW operations, there were undocumented modifications to RW systems, procedures needed to be upgraded, and some operations were not reflected in procedures. As a result, internal commitments were made to identify procedures needing revision, to list and prioritize needed modifications, and to complete these actions by September of 1984. The inspectors reviewed a prioritization document prepared by the RW Supervisor in 1984 to track the procedure revisions and modifications. Although OP-49A and B were included on this list, they remain unrevised eight years later. The RW Supervisor indicated that he had been assigned the responsibility of revising these documents, but due to the lack of personnel resources and the press of getting the waste processed, he had not been able to revise these two procedures. The inspectors also determined that the WMGS in 1983, presently the Operations Superintendent, was aware of the changeover in use of the concentrators, but did not feel that Procedures OP-49A and B needed revision.

b) Administrative procedures require that a biennial review of certain procedures, including OP-49A and B, be performed. The biennial reviews for OP-49A and B in 1987 and 1990 were performed by the RW Supervisor. He indicated on the review forms that the procedures did not work as written. The inspectors were unable to identify if the completed review forms received a higher level supervisory review. However, under the administrative controls in effect at the time, a supervisory review of the completed review forms was not required. The review forms were filed upon completion and revisions were not effected.

c) The QA/QC reviews and audits required by Technical Specifications for RW processing focused only on the Process Control Program (PCP), which deals with the solidification of radwaste and its transportation. No auditing of the liquid processing area was required.

d) Oversight of radwaste operations appears to have been left solely to the RW Supervisor for several years. Although he reports to the WMGS, the inspectors determined that the WMGS's priorities were generally devoted to other things, such as maintaining his Senior Reactor Operator's License current, operations management responsibilities in the control room, and primary emphasis in RW operations on the PCP. The inspectors also determined that there had been several instances in which the WMGS position was either unfilled or the individual performing the job had dual duties while transitioning to the WMGS job. Therefore, it appears that, at best, only modest management oversight of the RW Supervisor was available and that the RW Supervisor was relied upon heavily to run radwaste operations independently. This appears to be one of the key reasons why operations in radwaste were performed outside of approved procedures. The practice was either not identified by management or was condoned by management.

e) The inspectors determined that auxiliary operators (AOs) were assigned to RW operations about once a year for twelve-week assignments as RW operators. These same individuals, when not assigned to RW operations, performed operations in the plant on safety-related and balance-of-plant equipment. The inspectors found no evidence during this inspection which indicated that the AOs did not follow procedures in operating equipment outside the radwaste area. This apparent discrepancy in the AOs' attitude toward procedural adherence in the radwaste area vice the rest of the plant could not be reconciled with management statements and directions relative to procedure adherence.

f) The JAF Final Safety Analysis Report (FSAR) states clearly that the concentrators were installed for concentration of sodium sulfate solutions generated during the resin regeneration process. However, as stated previously, resin regeneration and, therefore, processing of sodium sulfate solution was terminated in 1983. The decision was made at that time to use the concentrators for the processing of water from the floor drain system, a purpose not described in the FSAR. The inspectors could not locate any licensee evaluation dealing with the changeover in use of the concentrators.

3.5 Past Actions Taken by NYPA in Response to NRC IE Bulletin 80-10 and Previous Boiler Contaminations

3.5.1 Precursor Events that Provided the Opportunity to Predict the Event

The inspectors reviewed the FSAR for evaluations identifying the potential contamination of the auxiliary boiler and noted the following.

NYPA's response to NRC Question 9.7 of the FSAR, dated February 9, 1972, identified the potential source of radioactivity to the auxiliary boiler system from the radwaste concentrators. NYPA's response stated that conductivity monitors are highly sensitive for concentrator leaks, and that the boiler water is checked weekly for radioactivity. If activity is detected, condensate discharge would be rerouted to radwaste neutralizer tank.

NRC Question 11.3 of the FSAR requested NYPA to identify all pathways by which liquid or gaseous effluents which contain or could potentially contain radioactivity can be released from the plant to unrestricted areas and, in addition, to identify which of these pathways were monitored with radiation detection instruments. NYPA's response, dated June 28, 1972, stated that there are no known pathways for radioactivity release from the plant which are not monitored by appropriate radiation detection instruments.

3.5.2 NYPA Identification of Potential for Unmonitored Pathway

On April 14, 1975, FitzPatrick's architect engineer (A/E) identified the possibility that contamination from the concentrator to the auxiliary boiler system could result in an unmonitored, undetected release to atmosphere via the storm drains, condensate receiver vents, and the auxiliary boiler blow off vents (same vents as used for artificial loading of the boilers). To address this concern, the A/E initiated change record CR #317 and assigned it a "priority one" in November 1975. Plant modifications necessary to address resolution were planned for completion under modification F1-75-175. Various correspondence between NYPA and the A/E between November 1975 and May 1977 identified the following modifications.

a) Automatic switching of supply steam/condensate exiting the concentrator to radwaste on high conductivity.

b) Installation of gamma detectors rather than conductivity cell on the condensate line from the concentrator.

c) Installation of a third conductivity cell on the discharge of the condensate receiver tank and a radiation monitor on the auxiliary boiler system.

d) Automatic switching of the condensate concentrator to radwaste on high conductivity. Installation of a bypass line prior to the steam traps upstream of the existing conductivity cells as well as a sample cooler in the bypass line to cool the condensate. Installation of an additional conductivity cell to provide reliable conductivity measurements. (This latter modification was proposed because the existing conductivity cell arrangement downstream of the steam trap was considered unreliable because the pressure drop across the trap results in a steam/water mixture at the conductivity cell.)

The A/E provided a final modification package to NYPA on August 22, 1977 (as described in item d) above). NYPA approved the proposed modification on September 2, 1977. Portions of the modification were made by the A/E during November 1977, but the work was then placed on hold due to radwaste operational needs at the time, which prevented system isolation in order to allow modification completion. The modification remained on a radwaste list of needed modifications from 1977 until 1991. A subsequent modification, F1-83-019 superseded F1-75-175, but some of the planned modifications were not incorporated in the new modification request. This resulted in NYPA closing modification F1-75-175 on February 5, 1991, without having completed some of the work.

3.5.3 Previous Contamination Events of the Auxiliary Boiler

The inspector reviewed NYPA engineering correspondence, plant occurrence reports, and Licensee Event Reports (LERs) and identified several previous contamination events for the auxiliary boilers. Specific occurrences identified included:

a) A leak from B WC caused contamination of the B auxiliary boiler on November 7, 1975; and

b) Contamination of the A auxiliary boiler, which occurred on July 15, 1980; August 24, 1980; October 14, 1980; August 27, 1981; and July 13, 1982.

NYPA determined these occurrences were not reportable by LER because the level of radioactive materials contained within the boilers was less than the maximum concentration that could exceed the technical

specification releases. NYPA determined the boilers could be operated contaminated, however, NYPA did not formally address in these evaluations the unmonitored release pathway via the auxiliary boiler vent, when artificially loading the boilers.

3.5.4 NYPA Response to NRC IE Bulletin 80-10

NRC IE Bulletin 80-10 (Bulletin 80-10), dated May 6, 1980, identified the potential for contamination of non-radioactive systems resulting in an unmonitored, uncontrolled release of radioactivity to the environment. The specific event identified in the Bulletin concerned an event caused by the use of a temporary heating hose from the auxiliary boiler to a radioactive waste evaporator concentrator tank. Upon condensation of the steam in the temporary hose, contaminated water was siphoned from the concentrator tank back to the auxiliary boiler through this hose. A tube leak in the fire box of the oil-fired auxiliary boiler resulted in an unmonitored, uncontrolled release of radioactivity to the environment in the form of steam via the auxiliary boiler fire box and smoke stack.

The inspectors reviewed NYPA's response to Bulletin 80-10 and concluded the following.

a) The response appeared adequate assuming closed operation of the system, however, NYPA routinely operated the auxiliary boilers by venting to atmosphere (artificial loading). Based on previous boiler contaminations, the 1975 A/E identification of the potential release pathway, and the identified concern in Bulletin 80-10, the inspectors determined NYPA's response to Bulletin 80-10 was inadequate.

b) NYPA's response to Bulletin 80-10 Item No. 3 states that possible contamination of the auxiliary boiler was considered in the FSAR, and that no 10 CFR 50.59 determination was required for the auxiliary system. Inspector reviews could not find this evaluation in the FSAR. NYPA did perform a 10 CFR 50.59 analysis for the contamination events subsequent to the bulletin response.

c) The inspector reviewed the 10 CFR 50.59 evaluation performed by NYPA for the contamination events which occurred after NYPA's bulletin response. The NYPA evaluation determined for the above events that it was acceptable to operate the contaminated auxiliary boilers while decontamination was in progress. This evaluation was

based on a potential release pathway via an auxiliary boiler tube failure. The inspector determined this evaluation failed to identify and analyze the release pathway during artificial loading of the boiler.

3.5.4.1 **NYPA Surveillance of Non-Radioactive Plant Systems**

In response to NRC IE Bulletin 80-10, the licensee had established a program for sampling non-radioactive systems and normally non-radioactive release pathways which potentially could result in an unmonitored and uncontrolled release of radioactivity to the environment. The auxiliary boiler is included in this surveillance program and had been sampled prior to 0800 hours on the morning of the release incident, March 18, 1991, and found to have no detectable contamination. The auxiliary boiler water sampling frequency is defined in Station Procedure PSP-10. PSP-10 requires weekly boiler water sampling during wet lay-up (shutdown) and daily sampling during boiler operation. In addition, the boilers are to be sampled after boiler blowdowns, chemical additions, and whenever boiler status has changed. A review of selected sampling records for the auxiliary boiler and other typically non-radioactive systems indicated that samples were being taken at the frequencies specified in the station procedures and no contamination had been identified in any of these systems until after the release on March 18. The inspector also reviewed the records of the weekly analyses of the storm drain systems and the sanitary sewage system. No indication of contamination in these areas was identified. The inspectors concluded that NYPA was performing excellent surveillance of these systems to identify any radioactive contamination and potential releases through these normally non-radioactive systems.

3.6 **Overall Assessment**

The results of this inspection indicate that the immediate causes of the event were personnel actions, resulting in concentrated radioactivity in the waste concentrator being drawn into the auxiliary boiler system, and the mode of operation of the boiler, specifically the routine venting of steam to the atmosphere. The proximate cause of these actions include the failure to have procedures or procedures appropriate to the equipment and mode of operation of the equipment, and several examples of failure to follow procedures. In addition, the design capacity of the auxiliary boiler and its poor burner operation at low loading, the installation of the steam line for agitation/refractometer wash downstream of the

steam shutoff valve, FCV-106, rather than upstream as per the design drawings, the failure to complete the identified modifications to the concentrator, the management inattention to this area, and the lack of adequate resources in this area, all were identified as contributing factors.

JAF management stated during the inspection and by previous written directives that all personnel are responsible for following written procedures and for notifying appropriate personnel when procedures cannot be followed as written. All the personnel interviewed during this inspection had a clear understanding of the meaning of procedural adherence, yet their actions, past and present, indicated otherwise. The concentrators were operated outside of approved procedures for at least the last eight years and troubleshooting evolutions were performed without procedures. Plant management remained unaware of this or had not acted on this information, even though the need for procedural revisions was apparently identified by AOs and the Radwaste Supervisor on several occasions.

4.0 Licensee Response to the Incident

4.1 Identification of the Release of Radioactivity to the Environment

At 1044 hours on March 18 the control room ventilation monitor alarmed. The control room personnel responded to the alarm as per procedure and requested Radiation Protection to verify the radiological conditions in the control room. Control Room Annunciator Response Procedure 09-75-1-20 indicates that the cause of an alarm is "high airborne radioactivity outside at the control room ventilation intake" and requires that the control room personnel contact Radiation Protection for air samples and surveys. The Radiation Protection Technician (RP) who responded was unaware of the detector location in the control room ventilation room and, according to survey documentation, apparently misinterpreted or was misinformed about the monitor reading. The notes on the back of the survey record indicated that the monitor was measuring an exposure rate of 3000 Roentgens per hour (R/hr). The actual reading was 3000 counts per minute (cpm). The technician stated that he was sent to the control room to perform a habitability survey, which meant to him that he was to look for exposure rates in excess of 5 milliRoentgens per hour (mR/hr) and to collect a general area air sample. Exposure rates in control room ventilation room are approximately 10 - 20 microRoentgens per hour (μR/hr) during normal operations. The RP measured 300 μR/hr (0.3 mR/hr) in the ventilation room in responding to the request to perform the survey and noted this on a survey map. The technician did not recognize at that time that 300 μR/hr was abnormal for this area. As a result of the surveys, the alarm was determined to be "spurious" when the RP did not recognize as abnormal the more than a factor of 10 increase in the dose rates.

The monitor had actually measured the release of contaminated steam from the auxiliary boiler during the time that it was being vented while the waste concentrator was being batched. The administration and control building ventilation was switched to the recirculation mode as a precaution.

Instrument and Control (I&C) personnel were requested to check the operation of the control room ventilation monitor during the afternoon of March 18 and found that it was operating properly. (This was after contamination had already been found exterior to the buildings.)

Interviews with radiation protection personnel revealed that Radiation Protection did not have a specific alarm response procedure. Consequently, the RP who responded did not have specific instructions as to what measurements/evaluations were to be performed, other than to assure control room habitability for the operating personnel.

The release to the environment was discovered subsequent to 1315 hours on March 18, 1991, when an auxiliary operator exiting the auxiliary boiler area, after closing the auxiliary boiler vent, found that his clothing had become contaminated. Surveys confirmed at 1400 hours that material had been released outside the plant. Two workers who had moved some empty drums stored on the east side of the turbine building had become contaminated earlier in the day (at about 1130 hours), but the source to the contamination (release from the auxiliary boiler vent) had not yet been recognized.

4.2 Emergency Response

Following the discovery of radioactive contamination outside the plant, the licensee declared an Unusual Event at 1445 hours on March 18, 1991, on the basis of plant conditions "that warrant increased awareness" on the part of plant operating staff (Emergency Action Level, Event No. 15, "Other Events"). The licensee decided to staff and activate two of the emergency response centers. The Technical Support Center (TSC) was staffed and ready at 1505 hours, and activated at approximately 1515 hours. The Operations Support Center (OSC) was activated at 1600 hours. The licensee stated that the TSC and OSC were activated in order to improve communications among the licensee staff and with outside agencies; to be better able to coordinate the plant response due to the larger assembly areas and communications equipment available within the centers; and to relieve the operating staff of most of the event-related activities. (The inspector noted that the Event Category No. 15, "Other Events", Emergency Action Level for Alert, indicates that when the Shift Supervisor determines that plant conditions exist which warrant precautionary activation of the TSC or OSC, an Alert should be declared. The inspector also noted that, prior to the March 18, 1991, event, the licensee had submitted for NRC approval a change to Emergency Action Level Criteria which would require declaration of an Alert when the TSC and the Emergency Operations Facility (vice

OSC) are activated. That request had not been approved by NRC at the time of the event.) The licensee remained in the Unusual Event status until 1045 hours on March 20. The licensee staffed all major activities and major emergency functions continuously on a 12-hour shift schedule. The licensee made emergency notifications consistent with that of an Unusual Event emergency classification. The licensee effectively used the TSC to coordinate and control the response activities. Representatives from the major licensee groups, including plant engineering, maintenance, warehouse and purchasing, radiological controls, chemistry, planning, radwaste, I&C and public affairs, participated in the response and priorities were appropriately set and carried out.

4.3 Assessment of the Radiological Conditions

Following the discovery of contamination in the auxiliary boiler area, radiation surveys were made of numerous inplant areas, confirming the contamination of the auxiliary boiler. Chemistry began sampling various components of the radwaste concentrator and auxiliary boiler systems to determine the extent of the contamination problem. By about 1400 hours, the presence of contamination outside the buildings was discovered and both radiation protection and chemistry personnel were heavily involved with trying to determine the nuclides, quantities, and extent of the spread of contamination outside as well as inside the facility. Following discovery of the outdoor contamination, radiological surveys were conducted of increasingly greater areas to determine the quantities and spread of contamination. Assistance was requested and received from Nine Mile Point personnel in this area. As areas of contamination were identified, ropes and signs were utilized on ground areas to restrict personnel from entering these areas unless they were tasked with activities in those areas.

Since it had rained lightly earlier during the day of March 18, and began to rain again after 1400 hours, chemistry personnel were directed to sample the storm drain systems. The west storm drain outfall was sampled at 1620 hours. (See Attachment 1 to Table IV for location.) This sample was analyzed in the one-liter bottle in which it was collected. Before the analysis was completed, chemistry personnel noted the unexpectedly high count rates and immediately requested a second sample from the west storm drain outfall. Chemistry had noted the high turbidity of the sample and suspected that the sample may not have been representative of the outfall and may have included sediment as a result of the sampling technique. The second sample was collected at 1700 hours by the same technician, who also measured the flow rate through the west storm drain at that time. The measured rate was 18 gallons per minute (gpm) and, according to the technician, appeared to be about the same as during the 1620 hour sample. The initial analysis of the 1620 hour sample indicated that the storm drain effluent contained in excess of 100 times the Maximum Permissible Concentrations (MPCs) for water (10 CFR 20, Appendix B, Table II, Col. 2). Reanalysis of the 1620 hour sample by both the licensee and the NRC, after

filtering the sample, indicated that the activity was approximately 65 times MPC, with most of the activity (more than 90%) in the filtered material (See Section 6.1). Based on interviews with the technician involved relative to the sampling methods and his observations, it appears that the 1620 hour sample was likely to have been representative of the storm drain outfall at the time. The sample collected at 1700 hours (the second sample) indicated that the concentration had dropped to approximately 2.7 times the MPCs. (The evaluation of the releases are discussed in Section 5.2 of this report.)

It was noted by the inspectors that the east storm drain was also sampled and was determined to have little flow and no detectable activity when sampled on the evening of March 18. The licensee took action to secure the flow from the west and east storm drains to prevent additional releases to Lake Ontario. By 1939 hours on March 18, 1991, an inflatable rubber plug had been installed in the west storm drain, terminating that release. Additional actions were taken by the licensee to pump the water from this storm drain system to tanks for treatment and prevent the plug from being forced out; to analyze the incoming water into the storm drain system to identify the source(s) of contamination (most was coming from the roof drains of the administrative and control building); to isolate non-contaminated portions of the storm drain system to minimize the amount of water that needed treatment prior to release; to begin work on isolating and collecting the contaminated water entering the storm drain system from contaminated roof drains; and to secure and install a portable water treatment system to process the contaminated water.

During the NRC review of the above activities, several actions were noted in which radiological protection aspects could have been improved from a lessons-learned perspective.

a. Relative to the collection of the west storm drain samples on March 18 at 1620 and 1700 hours, the chemistry technicians did not coordinate their activities with Radiation Protection. At 1700 hours the technicians were aware that the first sample at the outfall was highly contaminated, but the area had not yet been surveyed.

    1) The sampling team, rather than radiation protection, determined what protective clothing requirements would be used.

    2) Survey instruments were not taken to the sampling point to evaluate dose rates in the area (later found to be 5 to 10 mR/hr at 18 inches from the ground/rocks below the outfall).

3) The technicians' dosimetry was removed with their security badges when the technicians exited the security fence to collect the samples from the outfall. Because of the brief sampling times involved, the exposure to these individuals was not significant.

Due to the technicians' care, planning, experience and perhaps good fortune, no personnel contaminations resulted from this sampling activity and no significant personnel exposures were encountered.

b. Several areas in which elevated radiation levels and/or contamination were identified were not posted as thoroughly as they might have been. Considering, however, the rapid onset of events, the number of areas involved, and the thoroughness of the later postings, the licensee's posting efforts during this early phase of the response were adequate.

4.4 **Stabilization and Decontamination of Outdoor Contamination**

In addition to the actions described above in Section 4.3 of this report to control or eliminate any additional liquid releases from the site, the licensee initiated prompt and effective actions to limit the spread of contamination both on site and potentially to off site areas.

Plastic sheeting was utilized on horizontal, flat surfaces to prevent the spread of contamination by runoff or wind action and the penetration into the soil as a result of the rains. These efforts were excellent in view of the strong, swirling wind conditions and rain that ensued on March 18 and following. By March 19, 1991, the major outdoor radiological characterization had been completed. Very little radioactivity had been identified as having left the site area, aside from the releases through the west storm drain to the lake. Cleanup activities included moving contaminated equipment and components that had been outside to the interim radwaste storage building for subsequent cleanup; isolation of contaminated roof drain segments to allow separate collection and processing of contaminated water; and initiation of building roof, wall and ground area cleanup.

Building vertical surfaces that were contaminated were painted with a strippable coating to temporarily fix the radioactive material on the surfaces. The strippable coating will be removed and handled as solid radwaste. Test results by the licensee indicated good decontamination was being achieved with the strippable coatings. Roofs and ground surfaces were being scraped to remove contaminated materials, which will then be stored for ultimate characterization and removal as solid radwaste. The licensee established cleanup criteria for unrestricted release of contaminated areas. The licensee's criteria are consistent with those in NRC Regulatory Guide 1.86 for removable and fixed surface contamination. The ground areas will be decontaminated to levels such that the dose implications from the residual

radioactivity will not exceed 10 mrem per year from all environmental pathways. The licensee will also ensure that any residual activity has been stabilized such that further radionuclide migration will be limited. Licensee actions in the above areas have been prioritized appropriately, with good planning and review, and were effective as observed through the dates of the inspection.

4.5 **Surveys of Offsite Contamination**

Following discovery of the outside contamination, the licensee identified a number of vehicles that had been parked in onsite areas that may have become contaminated from the auxiliary boiler vent release. The licensee prevented vehicles from leaving the site until they had been surveyed and determined to be free from contamination. Between five and ten NYPA vehicles were found to be contaminated and were segregated on site until they could be decontaminated. Four trucks from offsite commercial businesses were on site at or near the time of the venting. Two were surveyed and were found free of contamination before leaving the site, however, two trucks had exited the site prior to the discovery of the contaminated release. Both of the latter vehicles were subsequently found and surveyed by the licensee on March 19, 1991. Neither had detectable activity on them.

The licensee's ground surveys and environmental sampling confirmed that the contamination was limited to within a short distance from the heater bay, turbine building and administration and control buildings. General area air samples collected in the contaminated area did not show a resuspension problem.

4.6 **Personnel Contamination Surveys and Actions**

The licensee's actions and performance in regard to personnel protection were excellent. The licensee took actions to put the guard house portal monitors into operation and to provide radiation protection technician coverage at the guard house to frisk the shoes of each individual as they exited the restricted area. On March 18 and during the days following the event, no personnel or shoe contamination was detected, other than the three individuals who were known to have been contaminated by mid-afternoon on March 18, 1991, prior to the identification of the source of the contamination.

To ensure that personnel did not receive internal contamination as a result of the contaminated venting, the licensee whole body counted any workers who had been working in the general area when the venting occurred. Subsequently, the licensee whole body counted more than 25 individuals. No internal contamination attributable to this event was identified.

External exposures to radiological protection and decontamination personnel were well controlled. Maximum individual exposures were well below regulatory limits.

The air compressor intakes located on the outside of the east wall of the administration and control building were highly contaminated on the outside. Analysis of breathing air, based on 24-hour samples, indicated no detectable radioactive contamination. Nonetheless, the licensee took conservative actions to restrict breathing air use from this source until the decontamination of the air compressor intakes could be completed.

4.7 Affected Inplant Components

Licensee surveys of plant components, both by direct radiation surveys and by sampling and analysis of liquid in components, indicated that the inplant contamination was primarily restricted to the radwaste concentrator and to portions of the auxiliary boiler and steam supply system that were not isolated prior to the initiation of the event. The licensee took the auxiliary boiler out-of-service. (Testing of the concentrator on March 24, 1991, indicated no component leakage, inferring that the contamination of the auxiliary boiler had resulted from the improper valve lineup during the troubleshooting activity on March 18.) With the auxiliary boiler out-of-service, the licensee lacked plant heating when the nuclear reboiler was not available. Likewise, steam for the nitrogen vaporizer was not available, nor was domestic hot water for plant use. The licensee procured a portable boiler unit to satisfy the plant heating and other steam demand needs for the short-term. A large hot water heater was procured to provide for domestic hot water needs. (While the hot water heat exchangers (steam side) was contaminated, the domestic water systems had no detectable activity in them.)

With regard to the radwaste reprocessing, the licensee brought in a commercial demineralization/filtration unit to process the liquid floor drain wastes to replace the function of the waste concentrators for the near term.

All of the above systems were fully reviewed by the licensee, from the design changes, modifications, testing, procedures and training aspects, prior to their use. These units will be used until the licensee completes the cleanup of the contaminated systems and decides the future use of those systems or their ultimate replacement.

4.8 Assessment of Licensee's Response

The licensee's overall response to the event, once identified was, in general, commendable. The actions to identify those areas outside which were heavily contaminated and the subsequent covering of the horizontal flat surfaces (roof areas and ground) with large sheets of plastic were timely and likely prevented additional spread of contamination. The efforts to limit the amount of contaminated water

leaving the site and the quick action to analyze and process contaminated water from the storm drain system were excellent. The maintenance of the above activities during the adverse weather conditions that followed was also excellent.

5.0 Release Assessments

5.1 Auxiliary Boiler

The amount of radioactive material released from the auxiliary boiler is estimated by the NRC to be in the range of 400 to 1500 millicuries (mCi). These bounding values are based upon two independent methods used by the licensee to assess the amount of radioactivity released from the auxiliary boiler. The first method was based upon the amount of radioactive material remaining on and about the JAF site. This includes contaminated ground areas, contaminated external building surfaces and contaminated storm drains. The second method was based upon the amount of radioactive material estimated to have been present in the waste evaporator at the time of the incident and in the auxiliary boiler system after the release. The difference between the amount of radioactive material transferred to the auxiliary boiler system and the amount of material remaining in the auxiliary boiler system after the release is the amount of radioactive material released.

The first method was based on a combination of soil samples, direct radiation measurements, and wipe survey results. The second method was based on the analysis of samples taken from the auxiliary boiler system, with the condensate receiving tank sample representing the radioactivity in the evaporator that was transferred to the auxiliary boiler and the boiler water sample itself representing the radioactivity remaining in the system. The latter method assumes that the samples collected from the auxiliary boiler and waste concentrator system were representative of those concentrations during the release. It is likely, however, that because of the duration of the release (about three hours following the contamination of the auxiliary boiler) and the rate of venting (about 18 gpm), the sampled concentrations could have been less than that representative of the concentrations during the release.

The licensee's data and calculations for both of the above methods were reviewed by the inspector. Although both methods have shortcomings, they provide a reasonable estimate of the amount of radioactive material released during the incident. The NRC's release estimate of 400 to 1500 mCi was based on the licensee's measurements and assessments, in addition to the evaluation of additional assumptions. Appendix F to this report provides additional details relative to these estimates.

5.2 **Site Releases**

The amount of radioactive material released from the site was estimated by the NRC to be in the range of 30 to 50 mCi. The primary release pathway from the site was a liquid pathway through the west storm drain. Radioactive material was released from the auxiliary boiler vent, deposited on the ground and building surfaces (walls and roofs), and then was washed into the site storm drain system by the subsequent rains. The rain began at approximately 1400 hours on March 18, 1991. At 1939 hours on March 18, 1991 the licensee plugged the west storm drain to prevent further releases from this pathway. Samples of the west storm drain were taken at 1620, 1700, and 1910 hours on March 18, 1991, and these sample analysis results were used to quantify the release via this pathway. Since the first sample was taken at 1620 hours, approximately two hours after the rain began, this sample result was extrapolated back to 1400 hours in order to estimate the total amount of radioactivity released via the west storm drain. This extrapolation provided the results of 30 - 50 mCi released from the pathway. It is quite likely, however, that the amount of steam released (about 9000 pounds per hour) through the auxiliary boiler vent during the artificial loading (venting) was of sufficient quantity to cause roof runoff to begin even before the rains started. If this was the case, the release would have been higher than estimated here and, in fact, may nearly double the above estimate. (The licensee's estimation that approximately 60 mCi remained in the west storm drain system (Table to Appendix F) tends to support the higher release estimate.) The lack of flow measurements from the west storm drain earlier in the day and a lack of historical flow data on the west storm drain as a result of auxiliary boiler ventings leave gaps in the data needed to more closely refine the above estimates.

The inspector noted that the JAF Technical Specifications limit releases to the water concentrations not exceeding the MPCs listed in 10 CFR 20, Appendix B, and further require composite or continuous sampling of discharges from the plant. Other potential release pathways included the east storm drain, the discharge canal, and direct deposition into Lake Ontario. Releases via these pathways appeared to be only a small fraction of that via the west storm drain. Samples of the east storm drain contained measurable concentrations of radioactivity, but these concentrations were well below the maximum permissible concentrations for liquid effluents released to unrestricted areas (10 CFR 20, Appendix B, Table II, Column 2). Additionally, very little flow had been observed in the east storm drain. This storm drain was also plugged by the licensee on March 18 as a precaution to prevent additional discharges to the lake.

Several of the turbine building roof drains empty directly into the discharge canal, which is the normal release path for monitored radioactive liquid effluents. Small amounts of radioactivity were detected on the roof of the turbine building. However, it appeared that only a small fraction of the total release from the auxiliary boiler vent deposited on the roof of the turbine building. This was because the turbine

building is approximately 50 feet higher than the release point from the auxiliary boiler. This is further indicated by the relatively large amount of radioactivity deposited on the south and east walls of the turbine building and the relatively larger amount of material on the roof of the administration and control building.

Lastly, direct deposition into Lake Ontario from the vented steam plume was also believed to be a small fraction of the release through the west storm drain. The amounts of radioactivity deposited from the steam plume on the ground outside the site perimeter fence adjacent to the lake were calculated from samples measured independently by the NRC. These values, which are presented in Table IV and discussed in Section 6 of this report, indicated that the deposition was of the same order of magnitude as that seen for nuclear test fallout radionuclides. The area of this deposition was not widespread, and was limited to that in the prevailing wind direction as modified by the turbine building wake effects.

5.3 **Dose Implications**

Review by the inspection team of the survey data, including air sample data, indicates that the only pathway of reasonable exposure to potential members of the public is that from the discharge to Lake Ontario through the west storm drain and subsequently in drinking water. The short duration of the discharge from the storm drain system and its rapid dilution would minimize the opportunity for fish life or other human food pathway media to concentrate the released material. The licensee used a factor of 12 as an estimate of the dilution factor from the FSAR to calculate the dilution in the lake to the City of Oswego water intake, some eight miles away. The application of this factor of 12 to the discharge from the west storm drain is extremely conservative, since the volume of the total discharge was very small in comparison to the normal diffuser discharge from the circulating water system (the water system used to cool the turbine condensers) even in one minute (on the order of 1% of the diffuser discharge volume in one minute). Therefore, the actual dilution factor from the west storm drain discharge to the City of Oswego is likely to be orders of magnitude greater than 12. (The licensee has engaged a consultant to better refine the dilution factor and dose implications. This area will be reviewed during a subsequent environmental inspection by Region I.)

The licensee and the State of New York have sampled the water at the City of Oswego water intake. The licensee has a routine monitoring program for this water intake. No activity attributable to this event was identified in the analyzed samples. One other factor impacts significantly on the potential dose to water users from this event. Most of the activity (greater than 90%) was associated with the filterable material in the samples collected. This was also seen in terms of deposited material in the sediment traps in the storm drain system and in the rocks at the outfall area. The radioactivity was primarily associated with material that tended to settle out. Consequently, little of the material, regardless of dilution, is expected to travel very

far before settling out. If any material reached the city water intake, nearly all of it would be expected to be removed by the filter beds and settling tanks at the water plant.

The overall assessment indicates that any potential exposure to members of the public as a result of this release is negligible. This area will be reexamined, however, when the licensee's consultant provides a more appropriate estimate of the dilution factor to the City of Oswego from discharges from the west storm drain.

6.0 Measurements Verification

6.1 Sample Radioanalyses

As part of this inspection, actual samples were split between the licensee and the NRC for the purpose of intercomparison. The samples included soil samples, water samples, and particulate filters from filtered water samples. The samples were actual split samples with the exception of one of the particulate filter samples. In this case the sample could not be split, and the same sample was analyzed by the licensee and the NRC. The soil samples were actual environmental or onsite samples, the liquid samples were actual effluent samples, as was the above referenced particulate filter. These samples were obtained by the licensee using routine procedures and were analyzed using routine methods and equipment. The licensee's analyses of liquid effluent samples and onsite soil samples were performed by the onsite chemistry laboratory, and the environmental samples were analyzed at the licensee's environmental laboratory (located off site). The NRC analyses were performed on site using the NRC I Mobile Radiological Measurements Laboratory except for those in Table II, in which case the NRC I analyses were performed in the Region I Laboratory. The joint analyses of actual samples were used to verify the licensee's capability to perform radiological assessments as a result of this incident.

The results of the above sample measurements comparisons, which are presented in Table I, indicated that all of the measurements were in agreement under the criteria used for comparing results, with one exception (See Attachment 1 to Table I).

The one exception was the manganese-54 (Mn-54) result on the west storm drain sample taken at 1530 hours on March 19, 1991. The disagreement is believed due to particulate material in the sample settling while the sample was being counted. The licensee's normal procedure for samples of this type involved filtering the sample (so that particulate material would be removed) and then analyzing the filter and filtrate separately. However, because the sample was being split with an independent offsite laboratory, the sample was first acidified and then split without filtering. It was noted that the licensee's result was higher than the NRC result and, therefore, biased in a conservative direction.

The onsite samples which contained measurable amounts of radioactivity consisted primarily of Cobalt-60 (Co-60), Zinc-65 (Zn-65), Mn-54, and Cesium-137 (Cs-137). The Co-60 and Zn-65 concentrations in the samples were approximately an order of magnitude higher than the Mn-54 and Cs-137 concentrations. The Zn-65 concentrations were approximately twice the Co-60 concentrations. These ratios were present in most of the samples analyzed by the licensee or the NRC and were, therefore, useful as "tracers" to indicate the measured radioactive material that had been released from the auxiliary boiler during this event.

A selected number of the split samples were returned to the NRC regional laboratory where the samples could be counted for a longer period of time in a lower background environment. These results are presented in Table II.

Soil sample RS #2 collected in the directly downwind direction indicated that some of the radioactive materials from the March 18 auxiliary boiler release had blown outside of the perimeter fence in the northwestern direction from the turbine building. The other three soil samples, RS #1, RS #3 and RS #4 showed little or no contamination and without the "tracer" radionuclide ratios.

The four bottom sediment samples reported in Table II were collected off shore in the near vicinity of the west storm drain outfall. None of these samples showed the "tracer" radionuclide ratios seen from contamination from this event. The NRC concluded that little material traceable to this event could be found off site.

6.2 Independent Data - NRC TLDs

The NRC maintains a direct radiation monitoring network around the FitzPatrick/Nine Mile Point sites. This network is operated by the NRC in cooperation with the State of New York and provides continuous measurement of the ambient radiation levels around the FitzPatrick/Nine Mile Point sites. The purpose of this network is to measure radiation levels during facility operations and to establish background radiation levels to assess the radiological impact of an unusual condition or incident.

The radiation measurements are made using passive, integrating detectors called thermoluminescent dosimeters (TLDs). These detectors provide a measurement of the radiation levels in the area in which they are located. At the FitzPatrick/Nine Mile Point sites 26 TLDs are placed in two concentric rings extending to about five miles from the facilities. All of the TLDs are outside the site boundary of the FitzPatrick/Nine Mile Point facilities. The TLDs are placed in the field for three-month periods. At the end of the three month period the TLDs are exchanged. The TLDs which had been in the field are then analyzed at the NRC Region I Dosimetry Laboratory.

On March 21, 1991 the TLDs around the FitzPatrick/Nine Mile Point site were exchanged and the retrieved TLDs were returned to the NRC Region I Dosimetry Laboratory. The TLDs were analyzed, and the results indicated that radiation levels were not above the ambient radiation levels present during routine operation of the site facilities. That is, no increase in radiation levels was detected off site as a result of the release of radioactivity on March 18, 1991. The data from these TLD measurements are presented in Table III.

TABLE I

FitzPatrick Verification Test Results

SAMPLE	ISOTOPE	NRC VALUE***	LICENSEE VALUE	COMPARISON**
		RESULTS IN PICOCURIES PER GRAM		
Soil RS #1* 1420 hrs 03/19/91	Cs-137	0.17 ± 0.03	0.125 ± 0.015	Agreement
	Zn-65	0.35 ± 0.10	0.26 ± 0.05	Agreement
	Co-60	0.18 ± 0.06	0.26 ± 0.16	No comparison
	Mn-54	0.03 ± 0.03	0.1 ± 1.5	No comparison
Soil RS #2* 1425 hrs 03/19/91	Cs-137	0.42 ± 0.05	0.38 ± 0.02	Agreement
	Zn-65	1.20 ± 0.14	0.99 ± 0.06	Agreement
	Co-60	0.56 ± 0.09	0.60 ± 0.02	Agreement
	Mn-54	0.18 ± 0.03	0.16 ± 0.02	Agreement
Soil RS #3* 1439 hrs 03/19/91	Cs-137	0.20 ± 0.03	0.13 ± 0.10	No comparison
	Zn-65	0.10 ± 0.10	0.21 ± 0.06	No comparison
	Co-60	0.13 ± 0.06	0.140 ± 0.015	No comparison
Soil RS #4* 1500 hrs 03/19/91	Cs-137	0.12 ± 0.04	0.09 ± 0.02	No comparison
	Mn-54	0.08 ± 0.04	< 0.08	No comparison
Bottom Sediment* #1 1300 hrs 03/20/91	Co-60	0.07 ± 0.04	0.063 ± 0.011	No comparison
	Zn-65	0.02 ± 0.06	< 0.1	No comparison
	Cs-137	0.33 ± 0.03	0.28 ± 0.02	Agreement
Bottom Sediment* #2 1300 hrs 03/20/91	Zn-65	0.02 ± 0.08	< 0.2	No comparison
	Cs-137	0.56 ± 0.04	0.41 ± 0.03	Agreement
Bottom Sediment* #3 1300 hrs 03/20/91	Zn-65	0.00 ± 0.09	< 0.2	No comparison
	Cs-137	0.49 ± 0.03	0.49 ± 0.03	Agreement
Bottom Sediment* #4 1300 hrs 03/10/91	Mn-54	0.05 ± 0.03	< 0.04	No comparison
	Co-60	0.19 ± 0.05	0.057 ± 0.012	No comparison
	Zn-65	0.14 ± 0.07	< 0.05	No comparison
	Cs-137	0.47 ± 0.04	0.38 ± 0.02	Agreement
Shore Oaks Road (Shoreline Sediment) 1115 hrs 03/20/91	Co-60	0.04 ± 0.04	< 0.06	No comparison
	Zn-65	0.01 ± 0.08	< 0.02	No comparison
	Cs-137	0.15 ± 0.02	0.22 ± 0.02	Agreement
Rainbow Shores (Shoreline Sediment) 1252 hrs 03/20/91	Zn-65	0.07 ± 0.07	< 0.3	No comparison
	Cs-137	0.06 ± 0.02	< 0.07	No comparison

*See Attachment 1 to Table IV for locations sampled
**See Attachment 1 to Table I
***Uncertainties reported for NRC values are ± 1 standard deviation counting uncertainties

TABLE I - CONTINUED

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
RESULTS IN PICOCURIES PER GRAM				
Dempster (Shoreline Sediment) 1130 hrs 03/20/91	Mn-54	0.07 ± 0.03	< 0.06	No comparison
	Zn-65	0.06 ± 0.08	< 0.2	No comparison
Lakeview Road (Shoreline Sediment) 1052 hrs 03/20/91	Mn-54	0.03 ± 0.02	< 0.06	No comparison
	Zn-65	0.09 ± 0.07	< 0.2	No comparison
	Cs-137	0.13 ± 0.03	0.13 ± 0.02	Agreement

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
RESULTS IN MICROCURIES PER MILLIMETER				
West Storm Drain 1530 hrs 03/19/91	Mn-54	(4.11 ± [illegible])E-6	(5.3 ± 0.4)E-6	Disagreement
	Co-58	(7.0 ± 0.4)[illegible]	< 8E-7	No comparison
	Co-60	([illegible]274 ± [illegible])E-5	(1.49 ± 0.06)E-5	Agreement
	Zn-65	(2.[illegible]8 ± 0.02)E-[illegible]	(2.71 ± 0.13)E-5	Agreement
	Cs-137	(5.[illegible] ± [illegible])	(8 ± 3)E-7	No comparison
West Storm Drain Particulate Filter 1620 hrs 03/18/91	Co-60	(1.305 ± 0.005)E-3	(1.37 ± 0.004)E-3	Agreement
	Zn-65	(2.561 ± 0.010)E-3	(2.78 ± 0.007)E-3	Agreement
	Co-58	(2.6 ± 0.2)E-5	(2.74 ± 0.15)E-5	Agreement
	Mn-54	(3.77 ± 0.04)E-4	(3.87 ± 0.02)E-4	Agreement
	Cr-51	(8.6 ± 0.9)E-5	(8.6 ± 0.5)E-5	Agreement
	Fe-59	(2.0 ± 0.4)E-5	(1.4 ± 0.3)E-5	Agreement
Demineralizer Inlet from West Storm Drain 1400 hrs 03/20/91	Co-60	(9.5 ± 0.8)E-7	(1.1 ± 0.3)E-6	Agreement
	Zn-65	(2.64 ± 0.15)E-6	(3.3 ± 0.6)E-6	Agreement
	Cs-137	(5.1 ± 0.5)E-7	< 6E-7	No comparison
Discharge from Demineralizer System (LT004) 1100 hrs 03/20/91 Filtrate	Zn-65	(6 ± 8)E-8		This sample was not split for comparison but for independent NRC verification of demineralization system operation
Discharge from Demineralizer System (LT004) 1100 hrs 03/20/91 Filter	Zn-65	(4 ± 3)E-7		This sample was not split for comparison but for independent NRC verification of demineralization system operation
	Co-60	(4 ± 2)E-7		
	Cs-137	(1.7 ± 0.7)E-7		

TABLE I - CONTINUED

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		RESULTS IN MICROCURIES PER GRAM		
Onsite Soil	Mn-54	(4.6 ± 0.6)E-7	(2.1 ± 1.3)E-7	No comparison
S-119	Co-60	(2.37 ± 0.10)E-6	(2.5 ± 0.2)E-6	Agreement
DZA #4	Zn-65	(3.2 ± 0.2)E-6	(4.2 ± 0.5)E-6	Agreement
1330 hrs	Cs-137	(4.5 ± 0.5)E-7	(3.9 ± 1.3)E-7	No comparison
03/27/91				
Onsite Soil	Mn-54	(1.06 ± 0.07)E-6	(1.00 ± 0.15)E-6	Agreement
S-120	Co-58	(1.2 ± 0.4)E-7	< 3E-7	No comparison
B-3A	Co-60	(2.92 ± 0.10)E-6	(3.2 ± 0.2)E-6	Agreement
1330 hrs	Zn-65	(5.8 ± 0.2)E-6	(6.4 ± 0.5)E-6	Agreement
03/27/91	Cs-137	(2.4 ± 0.5)E-7	< 4E-7	No comparison

ATTACHMENT 1 TO TABLE 1

Criteria for Comparing Analytical Measurements

This attachment provides criteria for comparing results of capability tests and verification measurements. The criteria are based on an empirical relationship which combines prior experience and the accuracy needs of this program.

In these criteria, the judgement limits are variable in relation to the comparison of the NRC Reference Laboratory's value to its associated uncertainty. As the ratio, referred to in this program as "Resolution", increases the acceptability of a licensee's measurement should be more selective. Conversely, poorer agreement must be considered acceptable as the resolution decreases.

Resolution[1]	Ratio for Agreement[2]
<4	No comparison
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
>200	0.85 - 1.18

[1]Resolution = (NRC Reference Value/Reference Value Uncertainty)

[2]Ratio = (License Value/NRC Reference Value)

TABLE II

NRC Region I Analysis of Selected FitzPatrick Samples

Sample Description	Isotope	Results
		Results in picocuries per gram (wet weight)
RS #1 Soil*	Cs-137	0.144 ± 0.005
1420 hrs	Zn-65	0.332 ± 0.012
03/19/91	Co-60	0.21 ± 0.07
	Mn-54	0.038 ± 0.004
RS #2 Soil*	Cs-137	0.337 ± 0.009
1425 hrs	Zn-65	1.16 ± 0.02
03/19/91	Co-60	0.637 ± 0.012
	Mn-54	0.187 ± 0.008
	Cs-134	0.028 ± 0.007
RS #3 Soil*	Cs-137	0.095 ± 0.006
1439 hrs	Zn-65	0.033 ± 0.007
03/19/91	Co-60	0.129 ± 0.007
RS #4 Soil*	Cs-137	0.086 ± 0.005
1500 hrs	Mn-54	0.09 ± 0.07
03/19/91	Co-60	0.024 ± 0.006
Bottom Sediment	Co-60	0.071 ± 0.004
#1 1300 hrs	Zn-65	0.028 ± 0.007
03/20/91	Cs-137	0.319 ± 0.005
Bottom Sediment	Co-60	0.113 ± 0.006
#2 1300 hrs	Zn-65	0.055 ± 0.008
03/20/91	Cs-137	0.493 ± 0.007
Bottom Sediment	Co-60	0.094 ± 0.006
#3 1300 hrs	Zn-65	0.020 ± 0.007
03/20/91	Cs-137	0.515 ± 0.007
	Mn-54	0.008 ± 0.003

TABLE II - CONTINUED

Sample Description	Isotope	Results
		Results in picocuries per gram (wet weight)
Bottom Sediment #4 1300 hrs 03/20/91	Co-60	0.103 ± 0.005
	Zn-65	0.030 ± 0.008
	Cs-137	0.442 ± 0.006
	Mn-54	0.005 ± 0.003

*For locations sampled, see Attachment I to Table IV. The bottom sediment samples were taken near the west storm drain outfall.

NOTE:
The reported uncertainties are ± 1 standard deviation counting uncertainties. An additional systematic uncertainty of ± 20% is not included in the above results.

TABLE III

NRC TLD Data for the FitzPatrick/Nine Mile Point Site

NRC Sta	Location Azimuth/Dist (Deg)/(Mi)		Gross Exposure (mR) ± Rdm; Tot.	Net Exposure Rate (mR/Std. Qtr.) ± Rdm; Tot.	Hist. Range Net Exp Rate ± 1 Std Dev
1	230	6.9	14.4 ± 0.4; 2.2	13.8 ± 0.6; 4.0	15.0 ± 1.4
2	184	14.0	14.9 ± 0.4; 2.2	14.5 ± 0.6; 4.0	16.1 ± 1.5
3	122	8.4	13.6 ± 0.4; 2.0	12.8 ± 0.6; 3.9	14.8 ± 1.7
4	76	11.0	14.8 ± 0.4; 2.2	14.3 ± 0.6; 4.0	15.1 ± 1.0
5	91	6.8	14.6 ± 0.4; 2.2	14.1 ± 0.6; 4.0	15.6 ± 1.8
6	112	4.3	14.8 ± 0.4; 2.2	14.3 ± 0.6; 4.0	15.3 ± 1.2
7	138	4.3	14.9 ± 0.4; 2.2	14.5 ± 0.6; 4.0	15.3 ± 1.3
8	152	3.6	14.4 ± 0.4; 2.2	13.9 ± 0.6; 4.0	15.4 ± 1.3
9	183	3.9	14.9 ± 0.4; 2.2	14.4 ± 0.6; 4.0	15.5 ± 1.1
10	205	4.5	14.3 ± 0.4; 2.1	13.7 ± 0.6; 3.9	14.6 ± 1.6
11	220	4.4	14.8 ± 0.4; 2.2	14.3 ± 0.6; 4.0	15.5 ± 1.4
12	230	6.1	Damaged Dosimeter	No Net Data	15.7 ± 1.3
13	245	1.8	15.1 ± 0.5; 2.3	14.7 ± 0.7; 4.0	15.5 ± 1.3
14	223	1.8	14.3 ± 0.4; 2.1	13.7 ± 0.6; 3.9	15.2 ± 1.2
15	204	2.0	14.5 ± 0.4; 2.2	13.9 ± 0.6; 4.0	15.0 ± 1.6
16	181	1.8	14.2 ± 0.4; 2.1	13.6 ± 0.6; 3.9	15.2 ± 1.2
17	157	1.9	14.8 ± 0.4; 2.2	14.3 ± 0.6; 4.0	15.3 ± 1.1
18	137	1.6	14.1 ± 0.4; 2.1	13.4 ± 0.6; 3.9	14.9 ± 1.2
19	115	1.2	14.5 ± 0.4; 2.2	13.9 ± 0.6; 4.0	15.1 ± 1.7
20	92	1.1	14.4 ± 0.4; 2.2	13.8 ± 0.6; 4.0	15.9 ± 1.2
21	229	20.0	14.7 ± 0.4; 2.2	14.1 ± 0.6; 4.0	15.0 ± 1.5
22	229	20.0	14.3 ± 0.4; 2.1	13.7 ± 0.6; 3.9	14.7 ± 1.3
23	229	20.0	14.2 ± 0.4; 2.1	13.6 ± 0.6; 3.9	14.9 ± 1.3
24	196	8.0	13.0 ± 0.4; 2.0	12.1 ± 0.6; 3.8	14.8 ± 1.5
25	168	7.2	14.4 ± 0.4; 2.2	13.8 ± 0.6; 4.0	14.4 ± 1.3
26	152	0.6	15.8 ± 0.5; 2.4	15.5 ± 0.7; 4.1	16.3 ± 1.3

Transit Dose = 3.2 ± 0.3; 2.4 mR

NOTES:
Historical Range Net Exposure Rate in units of mR/Std. Qtr.
These TLD data are for the period 12/14/90 to 03/26/91, Field Time = 73 days.

TABLE IV

FitzPatrick Ground Deposition Results
(Soil Samples)

Sample	Isotope	Deposition ($\mu Ci/m^2$)
RS #1 1420 hrs 03/19/91	Cs-137 Zn-65	(4.8 ± 0.8)E-3 (10 ± 3)E-3
RS #2 1425 hrs 03/19/91	Cs-137 Zn-65 Co-60 Mn-54	(2.2 ± 0.3)E-2 (6.2 ± 0.7)E-2 (2.9 ± 0.5)E-3 (9.4 ± 1.6)E-3
RS #3 1439 hrs 03/19/91	Cs-137	(5.3 ± 0.8)E-3
RS #4 1500 hrs 03/19/91	Cs-137	(3.0 ± 1.0)E-3

(See the attached sheet for sample locations)

Attachment 1 to Table IV

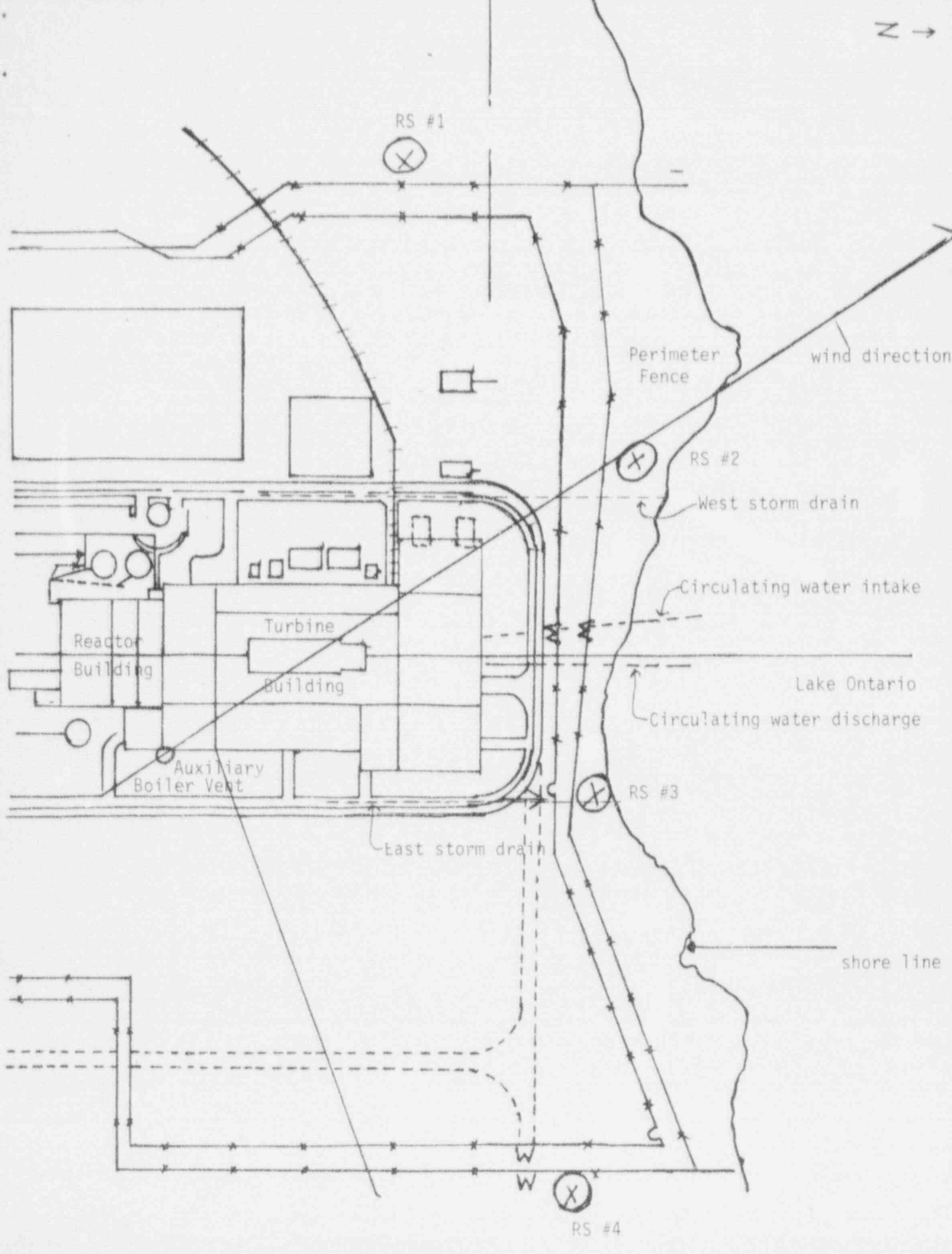
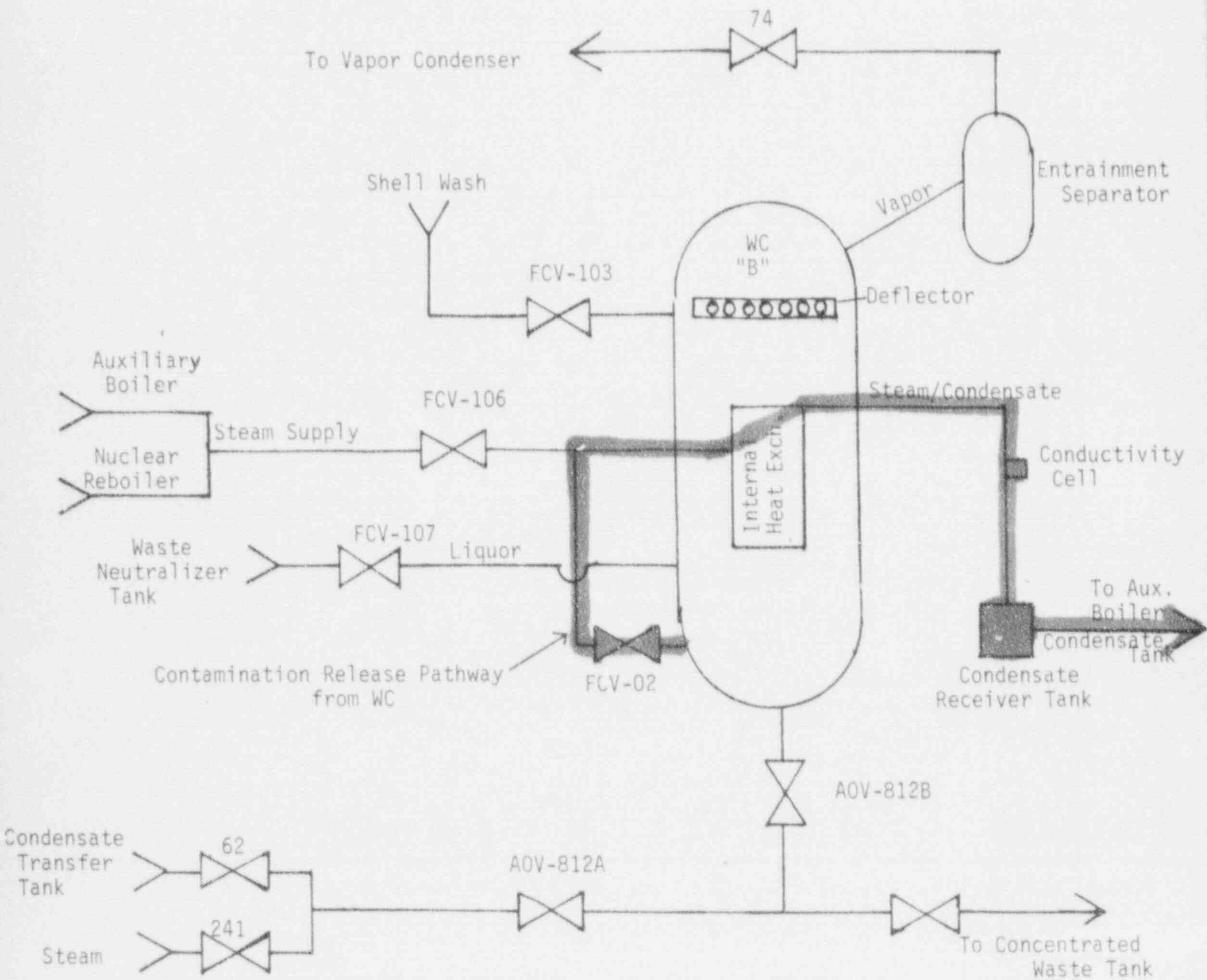


FIGURE 1

WASTE CONCENTRATOR (WC) B FLOW SCHEMATIC



APPENDIX A

Entrance Meeting Attendees (3/19/91)

New York Power Authority

W. Fernandez, Resident Manager
D. Lindsey, T.S.C. Manager
R. Liseno, Superintendent of Power
G. Vargo, RES/Superintendent
A. Zaremba, Emergency Plan Coordinator

U. S. Nuclear Regulatory Commission

R. Bores, Section, Chief, RI, DRSS, ERPS
D. Chawaga, Radiation Specialist, RI, DRSS, FRPS
W. Cook, Senior Resident Inspector, Nine Mile Point
J. Kottan, Laboratory Specialist, ERPS
N. McNamara, Physical Science Technician, ERPS
R. Plasse, Resident Inspector, FitzPatrick
W. Schmidt, Senior Resident Inspector, FitzPatrick

APPENDIX B

Debrief Attendance Sheet

Attendees at AIT Debriefing on March 28, 1991

Licensee

R. Baker, Senior Technical Advisor, NYPA
W. Fernandez, Resident Manager, NYPA
D. Lindsey, Planning Superintendent, NYPA
R. Liseno, Superintendent of Power, NYPA
R. Locy, Operations Superintendent, NYPA
D. Vandermark, Quality Assurance Supervisor, NYPA
G. Vargo, Radiation and Environmental Services Superintendent, NYPA
V. Walz, Technical Services Superintendent, NYPA
A. Zaremba, Emergency Planning Coordinator, NYPA

U. S. Nuclear Regulatory Commission

R. Bores, Chief, Effluents Radiation Protection Section, AIT Leader
D. Chawaga, Radiation Specialist, ERPS, DRSS
J. Kottan, Laboratory Specialist, ERPS, DRSS
R. Plasse, Resident Inspector, FitzPatrick
W. Schmidt, Senior Resident Inspector, FitzPatrick
R. Temps, Resident Inspector, Nine Mile Point

APPENDIX C

April 2, 1991 Exit Meeting from AIT

Licensee Personnel

R. Beedle, Executive Vice President, Nuclear Generation, NYPA
R. Dowiot, Electrical Plant Engineer, NYPA-JAF
W. Fernandez, Resident Manager
H. Fish, Assistant to Superintendent of Power, Licensing, NYPA-JAF
J. Gray, Jr., Director, Nuclear Licensing - BWR
J. Kelly, Director, Radiological Health and Chemistry, NYPA-JAF
D. Ruddy, Plant Engineering Supervisor, NYPA-JAF
G. Tasick, Quality Assurance Superintendent, NYPA-JAF
G. Vargo, Radiation and Environmental Services Superintendent, NYPA-JAF
V. Walz, JAF Technical Services Superintendent, NYPA
S. Zulla, Vice President Engineering, NYPA

U. S. Nuclear Regulatory Commission

L. Bettenhausen, Chief, Operations Branch, Division of Reactor Safety
R. Bores, Section Chief, Effluents Radiation Protection Section (ERPS), Division of Radiation Safety and Safeguards (DRSS)
R. Capra, Director, NRR/PDI-1
W. Cook, Senior Resident Inspector, NMP 1 & 2
D. Haverkamp, Chief, Reactor Projects Section 1B, Division of Reactor Projects (DRP)
J. Joyner, Chief, Facilities Radiological Safety and Safeguards Branch, DRSS
M. Knapp, Director, Division of Radiation Safety and Safeguards
J. Kottan, Laboratory Specialist, ERPS, DRSS
J. Linville, Projects Branch No. 1, DRP
B. McCabe, Project Manager, NRR
N. McNamara, Physical Science Technician, ERPS, DRSS
P. O'Connell, Radiation Specialist, Facilities Radiation Protection Section, DRSS
W. Pasciak, Section Chief, Facilities Radiation Protection Section, DRSS
R. Plasse, Resident Inspector, FitzPatrick
W. Schmidt, Senior Resident Inspector, FitzPatrick
R. Temps, Resident Inspector, Nine Mile Point 1 & 2
J. Wiggins, Deputy Director, Division of Reactor Projects

APPENDIX D

List of Principal Individuals Contacted

New York Power Authority

R. Baker, Senior Tech Advisor
P. Brozenick, OPS/Waste Management General Supervisor
J. Collins, RES
S. Chuborn, RES/Environ Offsite Lab
K. Diefendorf, Chem/Env Tech
A. Eng, Project Engineer
W. Fernandez, Resident Manager
E. Fox, Operations
J. Gnojek, Radiation Protection Tech
B. Gorman, RES/CHEM General Supervisor
W. Hamblin, RES/CHEM Lab Supervisor
A. Jarvis, RES
D. Johnson, Operations Assistant Superintendent
D. Lindsey, Planning/MGR
R. Locy, Operations Superintendent
J. Loeffort, RES
B. Maki, Operations/SS
A. McKeen, RES/CHEM/General Supervisor
M. McMahon, RES/Dosimetry Supervisor
T. Pelton, Shift Supervisor
K. Peper, Rad Engineer
D. Robert, OPS/Rad Waste Supervisor
D. Russell, Operations
R. Salcedo, Project Engineer
J. Solini, RES/Environ Supervisor
M. Sortwell, Training
J. Sowolski, RES/Environ Supervisor
M. Stell, Operations
G. Vargo, RES Superintendent
P. Walker, Training
V. Walz, RES
N. Wiley, VOLT/MEL Services

Many other individuals were contacted during this inspection who are not listed here.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406

MAR 1 9 1991

Docket No. 50-333

MEMORANDUM FOR: Robert J. Bores, Leader
James A. FitzPatrick Augmented Team Inspection

FROM: Thomas T. Martin
Regional Administrator

SUBJECT: AUGMENTED INSPECTION TEAM CHARTER - UNMONITORED RELEASE OF CONTAMINATED STEAM FROM AUXILIARY BOILER ON MARCH 18, 1991

After being briefed on the March 18, 1991, unmonitored release of contaminated steam from auxiliary boiler, Region I, NRR, and AEOD senior management determined that an Augmented Inspection Team (AIT) inspection should be conducted at FitzPatrick to verify the circumstances and evaluate the significance of the subject event.

An AIT is appropriate for this event based on criterion 05.02.h of NRC Inspection Manual 0325, as the event resulted in a significant unmonitored release of radioactivity and significant radioactive contamination outside the radiologically controlled area at the FitzPatrick facility. Notwithstanding this specific criteria, an AIT is appropriate based on the potential generic implications of this unmonitored release pathway. Despite the generic communications previously issued, events similar to the FitzPatrick event have continued to occur.

You have been designated as Team Leader. Enclosed is the charter for the AIT delineating the scope of this inspection. The inspection shall be conducted in accordance with NRC MC 0513, NRC Inspection Manual 0325, Inspection Procedure 93800, and this memorandum.

Thomas T. Martin
Regional Administrator

Enclosures:
1. AIT Charter
2. Team Membership/Schedule

cc w/encls:
J. Taylor, EDO
J. Sniezek, EDO
K. Brockman, EDO
E. Jordan, AEOD
D. Ross, AEOD
T. Murley, NRR
F. Miraglia, NRR
W. Russell, NRR
J. Partlow, NRR
M. Virgilio, NRR
E. Greenman, NRR
C. Rossi, NRR
J. Richardson, NRR
A. Thadani, NRR
B. Grimes, NRR
J. Roe, NRR
R. Capra, NRR
D. LaBarge, NRR
W. Kane, RI
C. Hehl, RI
J. Wiggins, RI
J. Linville, RI
D. Haverkamp, RI
D. Vito, RI
T. Vegel, RI
W. Schmidt, SRI - FitzPatrick

ENCLOSURE 1

AUGMENTED INSPECTION TEAM CHARTER
FITZPATRICK UNMONITORED RELEASE OF CONTAMINATED
STEAM FROM THE AUXILIARY BOILER

The Augmented Inspection Team (AIT) is to perform an inspection and accomplish the following:

1. Determine the specific circumstances and events which led up to the release of contaminated steam from the auxiliary boiler and subsequent unmonitored release from the plant. Include a sequence of events.

2. Evaluate the effectiveness of any actions the licensee had taken in regard to IE Bulletin 80-10. The team should make a recommendation regarding the need for further generic communications pursuant to this event.

3. Evaluate the licensee's actions following the event including:

   a. actions performed by the licensee to restore contaminated systems to normal operation.

   b. actions to determine the levels and extent of system, building, and environmental contamination.

   c. actions to determine the extent of personnel contamination/uptake at both FitzPatrick and Nine Mile Point.

   d. actions to stop the unmonitored release and prevent the spread of further contamination to the environment.

4. Evaluate the licensee's decontamination plan.

5. Using the Independent Measurements Van, perform sufficient environmental sampling and analysis to confirm the licensee's evaluations of environmental contamination. As considered necessary, evaluate environmental radiation exposures using TLD data from the NRC, State of New York, or licensee environmental TLD networks.

6. Determine if there were any precursor events that provided the opportunity to predict the event. Include an evaluation of operator actions and procedural compliance/adequacy relative to the event.

7. Determine whether the event was appropriately classified and reported to the NRC and other offsite agencies

8. Provide a Preliminary Notification upon initiation of the inspection and an update at the conclusion of the inspection.

9. Prepare a special inspection report documenting the results of the above activities within 30 days of the start of the inspection.

ENCLOSURE 2

Team Membership/Schedule

Team Membership:

Robert J. Bores, Chief, Effluents Radiation Protection Section, Division of Radiation Safety and Safeguards (DRSS), Team Leader
David J. Chawaga, Radiation Specialist, DRSS
James J. Kottan, Laboratory Specialist, DRSS
Nancy T. McNamara, Physical Science Technician, DRSS
Richard A. Plasse, Resident Inspector - FitzPatrick
Robert R. Temps, Resident Inspector - Nine Mile

Additional resources will be identified as necessary to supplement the team.

Tentative Schedule

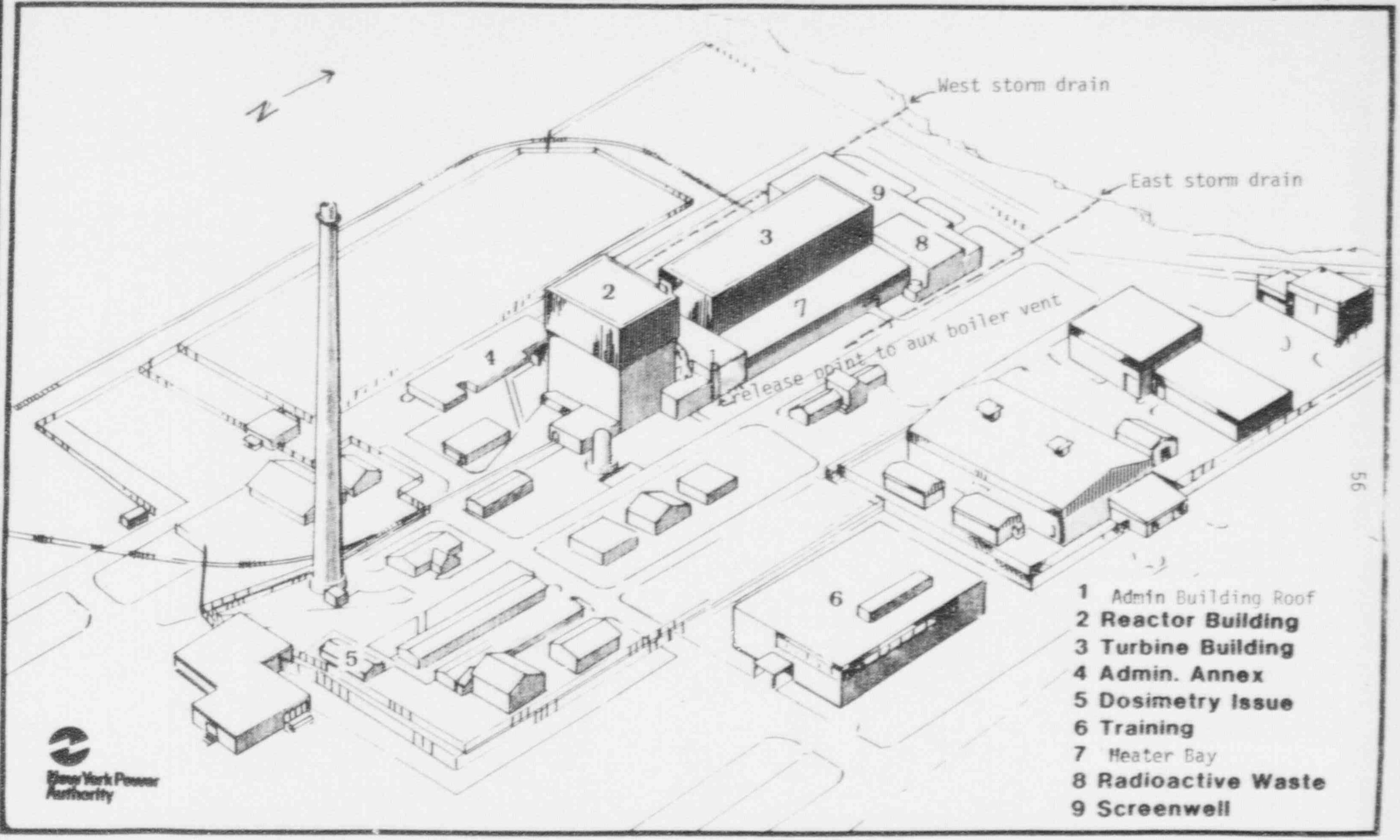
3/19/91		Arrive onsite, badging, set up interviews
3/19/91	0900	Entrance meeting at site with licensee management
3/19/91	1030	Begin inspection
3/21/91	1800	Debrief with RI Management
3/22/91	1100	Complete inspection and debrief with RI Management
3/22/91	1500	Exit with licensee management onsite
4/22/91		Issue Report

APPENDIX F

This Appendix contains the results of the evaluation performed to quantify the total amount of radioactivity deposited outside of the plant as a result of the radioactivity release which occurred on March 18, 1991. The amount of radioactivity deposited on the various surfaces such as building roofs, building walls, and the ground, was determined by using a combination of direct radiation measurements, smear sample results, and actual sample results, where possible. The total amount of radioactivity deposited outside of the plant buildings, but on the plant site, is believed to be in the range of 400 to 500 millicuries. The attached Table contains a list of the surfaces/areas with the amount of radioactive material deposited on each surface/area. (Refer to the attached diagram for the location of the surfaces.) It should be noted that during the cleanup phase, the licensee should be able to more accurately assess the total amount of material deposited on site as material is packaged and characterized for ultimate disposal. These data will be reviewed during future inspections by Region I specialists.

TABLE TO APPENDIX F

Location (Surface)	Deposited Activity (millicuries)
Administration Building Roof	240
Administration Building East Wall	36
Administration Building North Wall	0.02
Ground on East Side of Admin. and Turbine Buildings	18
Ground on West Side of Admin. and Turbine Buildings	3
Turbine Building South Wall	19
Turbine Building East Wall	1.0
Heater Bay East Wall	9
Heater Bay Roof	2
West Storm Drain System (sediment traps and piping)	60
Other Areas	33



James A. FitzPatrick Nuclear Power Plant