PDR

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

CHAIRMAN

March 24, 1989

The Honorable Paul S. Sarbanes
United States Senate
Washington, D. C. 20510

Dear Senator Sarbanes:

I am responding to your letter of February 7, 1989, regarding the low-level radiological release from the National Institute of Standards and Technology (NIST) during the period August-October, 1987. Our Region I Office has completed a review of the event and its technical significance. A copy of the Region I follow-up report, which describes the event and subsequent licensee and Nuclear Regulatory Commission (NRC) actions, is enclosed for your information.

As the February 2, 1989 Inspection Report No. 50-184/89-01 (Enclosure 2 to the Region I Report) makes clear, the NIST incident involved two separate but related events, neither of which posed a threat to public health or safety. Initially, the licensee observed a leak of radioactive primary coolant water into the secondary side of the heat exchanger. Although the immediate telephone reporting requirements were met by notifying NRC Region I of the leak, the licensee has been cited for failing to submit a two week written report as specified in the Technical Specifications to its license. This event did not involve a radiological release to the environment. Subsequently, the licensee decided to dispose of this radioactive water by evaporation through the cooling tower. NRC regulations permit licensees to dispose of radioactive material into the environment without advance notice to the NRC provided that the released radioactivity concentration is within the limits specified in 10 CFR Part 20. Because the NIST release remained within these limits, it posed no undue risk to public health and safety.

With respect to your concern about notifications to State and local officials, it is our understanding that the NIST is in contact with the Montgomery County Executive, representatives of the Montgomery County Council, and other local officials to discuss arrangements concerning notifications following specified events and plans similar discussions with Maryland

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officials. Although our regulations do not require such notifications unless 10 CFR Part 20 limits are exceeded, the Commission has no objection to any additional notification arrangements that may result from these discussions.

I hope the information provided in this letter and its enclosure will resolve your concerns regarding the 1987 NIST incident.

Sincerely,

Lando W. Zech, Jr.

Enclosure: As stated

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

FEB 02 1989

MEMORANDUM FOR: Victor Stello, Jr.
Executive Director for Operations

FROM: William T. Russell
Regional Administrator
Region I

SUBJECT: FOLLOWUP TO AN EVENT AT THE NATIONAL BUREAU OF STANDARDS RESEARCH REACTOR

This forwards a report on an event which occurred over the August to October 1987 timeframe at the National Bureau of Standards (NBS) research reactor facility in Gaithersburg, Maryland. This report discusses the event itself, licensee reporting of the event and NRC followup actions.

Enclosure 1 is a synopsis of the event and NRC Region I activities associated with the NBS reactor. Enclosure 2 is the inspection report issued examining the technical and licensee management aspects of the 1987 event and Enclosure 3 lists future NRC actions as a result of the event.

If you have any questions, please call me.

W T Russell

William T. Russell
Regional Administrator

Enclosures:
As stated

cc w/encls:
T. Murley, NRR

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ENCLOSURE 1

Review of Event

A. Background

The National Bureau of Standards Reactor (NBSR) is a reactor-laboratory complex for providing the means of performing research and standards on materials and nuclear processes.

The reactor is a heavy water moderated and cooled Argonne CP-5 class tank-type reactor using enriched (93%) fuel. The reactor is licensed for operation up to 20 MWt. The reactor is housed in a confinement building designed and tested to withstand the maximum anticipated internal pressure of 8 inches of water. Potentially contaminated drains from the confinement building and laboratory sinks are routed to a sump tank and then pumped to a radioactive waste system in an adjacent building.

The reactor operates at a pressure of four inches of water maintained by a helium blanket. Primary outlet temperature is 112°F. The volume of primary coolant is approximately 13,000 gallons. The primary coolant is cooled by means of one of two heat exchangers. The secondary water flowing through the shell side of the heat exchanger is cooled by means of a mechanical draft cooling tower. The volume of the secondary coolant system is approximately 100,000 gallons of treated potable water forced through the main and other heat exchangers by a combination of six pumps. Blowdown from the cooling tower basin goes to the sewage system which provides a dilution flow rate of about 300,000-400,000 gallons per day.

Secondary coolant is monitored by an N-16 detector to provide indication of primary-to-secondary leaks at 100% power. Analysis of the secondary water for tritium contamination provides a back-up leak detection method.

It should be noted that, based on the design of the reactor, there is no credible accident which poses a significant risk to the health and safety of the public beyond the site boundary. The licensee's Emergency Plan, therefore, does not include a General Emergency.

Organization

The reactor is operated by employees of the Department of Commerce, National Institute of Standards and Technology (formerly, the National Bureau of Standards). At the facility, the Chief, Reactor Radiation Division, and the Chief Nuclear Engineer, Reactor Operations, have line responsibility for direction and operation of the reactor facility, including safeguarding the general public and facility personnel from radiation exposure and adhering to all requirements of the Operating License and Technical Specifications.

The Safety Evaluation Committee and the Safety Audit Committee provide oversight of the facility's operations.

Current Management Personnel include:

Chief, Reactor Radiation Division	-	Dr. Robert S. Carter
Deputy Chief, Reactor Radiation Division and Chief, Reactor Operations Section	-	Tawfik M. Raby
Deputy Chief, Reactor Radiation Division and Chief, Technical Support Section	-	James Torrence

B. Recent Regulatory History

- Routine inspection history since 1986:

Report No.	Dates	Area Inspected
50-184/86-01	6/25-26/86	Radiation Protection
50-184/86-02	10/1-2/86	Operator Licensing Exam
70-398/86-01	2/13/86	Nuclear Material Control
70-398/86-02	4/14-17/86	Nuclear Material Control
70-398/86-03	6/25-26/86	Radiation Protection
50-184/87-01	7/7/87	Safeguards
50-184/87-02	7/6-9/87	Radiation Protection
50-184/87-03	11/5/87	Emergency Preparedness
70-398/87-01	3/12/87	Nuclear Material Control
70-398/87-02	3/16-18/87	Nuclear Material Control
70-398/87-03	5/11-14/87	Nuclear Material Control
70-398/87-04	12/7-9/87	Nuclear Material Control
50-184/88-01	6/6-7/88	Operator Licensing Exam
50-184/88-02	8/9-11/88	Radiation Protection

- IR 70-398/87-04 identified one Level IV violation for failure to properly post an area containing radioactive material.

- Reports submitted - The following reports were submitted since 1986 pursuant to license requirements:

  -- Event Reports

  9/23/87 - Reported 9/11/87 - failure of shim arm No. 1 to move out/in.

-- Annual Reports

3/20/86 - Operations Report No. 38 for CY 85
3/20/87 - Operations Report No. 39 for CY 86
3/28/88 - Operations Report No. 40 for CY 87
(Resubmitted 4/21/88 to correct typo errors)

Note: The above reports were all correctly addressed.

C. Chronology of Events

A series of events occurred in the August-October 1987 timeframe that has recently received substantial interest. An event chronology follows:

1987

5/17 Reactor shutdown for anticipated three-month shutdown for installation of experiment and major maintenance.

7/7 Plugged 7 tubes in heat exchanger HE-1A.

7/15 HE-1A passed leak rate test.

8/20 Refilled primary system

8/26-27 Loaded core

8/27 Refilled secondary system

8/28 AM - Licensee logs show that the cooling systems were started and a loss of "several hundred gallons of heavy water" was noted. Analyzed spent fuel pool, liquid waste system, and secondary coolant system; tritium found in secondary system.

8/28 12:00 - Telephone notification to Region I reporting:

- Loss of "several hundred gallons" of primary coolant
- Tritium detected only in secondary system
- No release to surroundings
- No Technical Specification limit exceeded

Isolated and drained the two main heat exchangers and drained secondary sides. (HE-1A showed higher tritium concentration).

Tested HE-1B and HE-2 (purification HX) satisfactorily.

Drained primary side of HE-1A, pressure tested secondary side with results indicative of leaks.

1987 (Continued)

8/31 Plugged 15 tubes in HE-1A following numerous leak checks.

Licensee operated cooling tower fans "... to aid in evaporation."

9/3 Established 70 gpm dilution flow from potable water to sanitary sewers.

9/4 10:30 - Telephone followup notification to Region I reporting:

- Detection of leaks in 15 tubes in heat exchanger and plugging of affected tubes.
- Having restored secondary flow on 9/3 to check for vibration.
- Estimated loss of 300 gallons (within factor of 2) of heavy water (late calculations indicated 400 gallons).
- No indication of tritium releases provided.

9/5 Detected and plugged additional leaking tube in HE-1A.

9/10 Re-routed secondary N-16 sample return to pump suction header to minimize liquid discharge to storm sewers.

9/? Licensee believes a telephone report was made to NRC to discuss method of tritium disposal. No NRC records exist of this phone call.

9/12-13 Operated reactor at 5 MWt to release tritium via evaporation.

9/14 Operated reactor at 5 MWt (approximately 2 hours) to release tritium via evaporation.

9/25-30 Operated reactor at 5 MWt to release tritium via evaporation.

Secured 70 gpm sanitary system dilution flow and established normal 20 gpm cooling tower blowdown.

10/? Telephone report from licensee informing Region I that written report was about to be sent. Licensee believes the call involved a discussion of report content details. No record exists of this call.

1988

12/? A reporter from the Montgomery County Sentinel toured the reactor facility with the licensee. The reporter is told of an event involving a radiological release which is said to have occurred "last August".

1989

1/5 Region I Public Affairs Officer receives an inquiry from the Montgomery County Sentinel reporter regarding the leak. Region I determines an event occurred in August 1988, which involved leakage from a cooling system for the biological shield wall. No records of a primary system leak occurring in August 1988 were located.

1/18 Based on phone conversations with the licensee, Region I determined that an event consistent with that described to the reporter occurred in the summer of 1987 and that the licensee submitted an informal event report in a letter dated October 26, 1987; however, no record exists that this letter was received in Region I.

1/23
- Region I received a copy of the licensee's October 26, 1987 letter.
- Press inquiries are received about the event from the Washington Post indicating the Post was developing this story.
- PNO-I-89-005 was issued around 4:45 p.m.
- The Commissioners' Assistants were briefed at about 8:15 p.m.

1/24 Region I Public Affairs Officer provided copies of the October 26, 1987 letter to the two reporters he had been dealing with on this event.

1/26 Region dispatched two man team to investigate the event.

D. NRC Followup to the Event

NRC Region I was notified of the degradation of the tubes in one of two primary-to-secondary system heat exchangers in phone calls made by the NBS licensee on August 28 and September 4, 1987. No mention of radiological releases were made during either of these calls. The licensee did not indicate that either call was being made pursuant to Technical Specification reporting requirements. In January 1989, when Region I became aware of the tritium releases which occurred, a two-man team was dispatched to the site to review the event and its technical significance and to determine if the licensee properly reported the event. The results of this review are provided in Inspection Report No. 50-184/89-01.

In addition, Region I reviewed its records and practices to determine how the original phone reports were handled and to attempt to determine the disposition of the licensee's October 26, 1987 letter.

E. Conclusions

1. Region I concluded that the event discussed by the NBS licensee in its August 28 and September 4, 1987, phone calls and in its October 26, 1987, letter occurred as it was described.

2. Region I verified that the event involved a degradation of the primary-to-secondary heat exchanger tubes which resulted in a leak rate substantially in excess of that allowed by Technical Specification.

3. Region I verified that the radiological releases associated with the event were within Technical Specification and 10 CFR 20 limits and were not reportable based upon the quantities released. The radiological significance of these releases was minimal.

4. The licensee failed to formally report the event pursuant to Technical Specification requirements associated with degradation of primary system barriers. Consequently, a Notice of Violation is being issued.

5. Region I did not fully recognize the Technical Specification implication of the leak rate when it was informed of the event in 1987. The Region did not promptly followup the initial phone call with the licensee. As a result, although the licensee claims to have made two additional phone notifications regarding the event, with the release plans discussed during at least one of them, the NRC has no records of receiving these subsequent calls or the licensee's October 26, 1987 letter.

Enclosure 2

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

FEB 02 1989

Docket No. 50-184

U. S. Department of Commerce
National Institute for Standards and Technology
ATTN: Dr. R. S. Carter, Chief
Reactor Radiation Division
Gaithersburg, Maryland 20899

Gentlemen:

Subject: Inspection Report No. 50-184/89-01

An announced, reactive inspection was conducted on January 26, 1989 at the research reactor facility in Gaithersburg, Maryland. The purpose of the inspection was to review the circumstances connected with a controlled but non-routine release of tritium in September, 1987. This release occurred via the mechanical draft cooling tower associated with the reactor secondary cooling system, as well as via a storm drain at the facility. The tritium released in this manner originated from a primary to secondary leak in the reactor cooling system, in one of the two main reactor heat exchangers. Some water contaminated with tritium was also released into the sanitary sewer system during this period.

The findings of this inspection indicate that the corrective actions following discovery of the primary to secondary leak in the heat exchanger were timely and well executed. The release of the tritium contaminant in the secondary coolant via the cooling tower also appears to have been carefully reviewed for safety and compliance prior to the release. The monitoring program that was implemented during the release appears to have been adequate to support the release calculations, and showed that the concentrations of tritium at the site boundary were well below the applicable NRC limits for the general public.

Although you met the immediate telephone reporting requirements of your Technical Specifications by notifying NRC Region I of the occurrence of the leak, you failed to submit the required two week written report. This failure to submit a written report to the U. S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555, as required by Section 7.8 of your Technical Specifications and 10 CFR 50.4 constitutes an apparent violation of the Technical Specifications reporting requirements. Details are provided in the enclosed Appendix A and the enclosed report. You are required to respond to the violation in accordance with the instructions contained in the enclosed Appendix A.

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Your cooperation with us is appreciated.

Sincerely,

Ronald R. Bellamy

Ronald R. Bellamy, Chief
Facilities Radiological Safety
and Safeguards
Division of Radiation Safety and
Safeguards

Enclosures:
1. Appendix A, Notice of Violation
2. Inspection Report No. 50-184/89-01

cc w/encls:
J. Torrence, Deputy Chief, Reactor Operations
T. Raby, Reactor Supervisor
Public Document Room (PDR)
Local Public Document Room (LPDR)
Nuclear Safety Information Center (NSIC)
State of Maryland (2)

APPENDIX A

NOTICE OF VIOLATION

National Bureau of Standards
Gaithersburg, Maryland

Docket No. 50-184

As a result of the inspection conducted on January 26, 1989, and in accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," 10 CFR Part 2, Appendix C (Enforcement Policy, 1986), the following violation was identified:

> Technical Specification Section 7.7 requires, in part, that a major degradation of one of the several boundaries which are designed to contain radioactive materials resulting from the fission process, shall be reported to the NRC in accordance with Section 7.8(1). Technical Specification Section 7.8(1) requires, in part, that the reports required by Section 7.7 be submitted, in writing, within 2 weeks to the U. S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555, as required by 10 CFR 50.4.
>
> Contrary to the above, on or about August 28, 1987, a major degradation of the primary coolant boundary, was not reported, in writing, to the NRC as required.
>
> This is a Severity Level V violation (Supplement IV).

Pursuant to the provisions of 10 CFR 2.201, the National Bureau of Standards, is hereby required to submit to this office within thirty days of the date of the letter which transmitted this Notice, a written statement or explanation in reply, including: (1) the corrective steps which have been taken and the results achieved; (2) corrective steps which will be taken to avoid further violations; and (3) the date when full compliance will be achieved. Where good cause is shown, consideration will be given to extending this response time.

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U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-184/89-01

Docket No. 50-184

License No. TR5

Licensee: U. S. Department of Commerce
National Bureau of Standards
Gaithersburg, Maryland 20899

Facility Name: National Bureau of Standards

Inspection At: Gaithersburg, Maryland

Inspection Conducted: January 26, 1989

Inspector: _____ 2/2/89
D. Limroth, Project Engineer, Section 3A date
Branch 3, Division of Reactor Projects

_____ 2/2/89
S. Sherbini, Senior Radiation Specialist date
Facilities Radiation Protection Section

Approved by: _____ 2/2/89
M. Shanbaky, Chief, Facilities Radiation date
Protection Section

Inspection Summary: Inspection on January 26, 1989 (Report No. 50-184/89-01)

Areas Inspected: Announced, reactive inspection to review the circumstances connected with the release of tritium to the atmosphere, to a storm drain, and to the sanitary sewer, in September 1987.

Results: One apparent violation was identified: failure to submit a written report of the primary to secondary leak within two weeks of the event to the U. S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555, as required by Section 7.8 of the Technical Specifications and 10 CFR 50.4.

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DETAILS

1.0 Personnel Contacted

* R. Carter, Chief, Reactor Radiation Division
  T. Hobbs, Chief, Health Physics
* T. Michaels, NRC, NRR
* T. Raby, Deputy Chief, Reactor Radiation Division
* L. Slaback, Supervisory Health Physicist

* denotes attendance at the exit interview.

2.0 Event Description

The reactor was shut down on May 17, 1987 and the core unloaded for a period that was expected to last about three months. The purpose of the shutdown was to install an experiment at the reactor. The shutdown period was also to be used for major maintenance on the reactor systems. One of these maintenance items was to locate and repair a small leak in heat exchanger HE-1A, one of the two main reactor system heat exchangers. The leak had been identified on the basis of sampling of the secondary system for tritium content.

Following shutdown, both the primary and secondary systems were drained. The primary system contained approximately 13,000 gallons of heavy water (deuterium oxide), and was drained to a storage tank. The secondary system contained a total of about 100,000 gallons of water, and was drained to the cooling tower basin or to holdup tanks and then to the sanitary sewer. The basin normally contains most of the secondary water, the balance being in the secondary system piping. The cooling tower is a mechanical draft cooling tower equipped with three fans. Water is pumped to the top of the tower and then allowed to cascade down a series of louvers while cooling air flows past the water. The top of the cooling tower is about 21' above ground level. The licensee stated that at full reactor power (20 MW thermal) the heat output from the reactor will evaporate approximately 100,000 gallons of water to the atmosphere in a 24 hour period. The evaporated water is replaced by fresh makeup water, either continuously or intermittently. The cooling tower basin is located directly below the tower and is open to the atmosphere. During repair of the small leak following shutdown, several tubes in the heat exchanger were identified as possibly contributing to the leak, and seven tubes were plugged. The system was successfully pressure tested on July 15, 1987, using high pressure air.

On August 20, 1987, after completion of the maintenance work, the heavy water was returned to the primary system, and by August 27 the core was loaded into the reactor. It was found necessary to add 55 gallons of heavy

water to bring the water in the system to the desired level. The licensee stated that this is normal and expected as a result of minor leaks and evaporation during the lengthy shutdown period. The secondary system was then filled on August 27, and the primary system pumps were operated for testing purposes. A second 55 gallons of heavy water were added to maintain the desired level. The licensee stated that this addition was still not unusual. On the morning of August 28, it was discovered after operating the system pumps that the level of the heavy water in the primary system had dropped overnight. Visual inspection of all systems did not reveal any leaks. The licensee, however, did not check the tritium concentrations in the secondary side for possible primary to secondary leaks. A third 55 gallon quantity of heavy water was then added to the primary system, but the water level could not be maintained. The licensee then decided to analyze samples of water taken from several locations in the system for tritium content. The locations were chosen as being likely points of contamination in case of a primary system leak. Elevated tritium concentrations were found in the samples taken from the secondary cooling system, indicating a heat exchanger leak. The heat exchangers were then isolated and drained and the water from each was analyzed. In this way, it was found that the leak was in main heat exchanger HE-1A, the same heat exchanger that was repaired earlier. The primary system was then drained and repairs started. Sixteen tubes in HE-1A were plugged before repairs were completed. The licensee believes that the leak probably occurred after the primary pumps were started on August 27. The reactor was operated for the first time following the May shutdown on September 12, 1987.

Following discovery of the primary to secondary leak in the heat exchanger, the licensee analyzed the secondary water for radioactivity content and found a tritium concentration of slightly over 2 uCi/ml, which is about four orders of magnitude higher than normal operating levels. Using a total secondary volume of 100,000 gallons, the licensee estimated that the tritium leak was approximately 800 curies (Ci). The secondary water also contained about 2-3 millicuries (mCi) of nongaseous radioactive material, mostly cobalt (Co-60). An analysis of the primary coolant at that time showed a tritium activity of 0.53 mCi/ml. Based on this value and the total activity calculated to be in the secondary system, the licensee estimated the magnitude of the leak to be approximately 400 gallons of heavy water.

3.0 Review of the Events Connected With The Release of Radioactivity

On September 9, 1987, the licensee had approximately 100,000 gallons of secondary water contaminated with about 800 Ci of tritium and about 3 mCi of Co-60. About 690 Ci of the tritium were in the cooling tower basin, and the remaining 110 Ci were in holdup tanks containing secondary water drained from the heat exchangers. The licensee stated that they evaluated the various possibilities available to them at the time for disposing of this contaminated water. Based on their evaluations, it was decided that evaporation into the atmosphere via the cooling tower would have the least

environmental impact and that the released radioactivity concentrations would be well below allowable limits. The licensee's records indicated that the options were discussed by the Reactor Health Physics Supervisor and the Chief of Health Physics at the National Bureau of Standards (NBS, now NIST). According to these records, the timing of the release, the most favorable meteorological conditions, and environmental monitoring were discussed on August 31 and again on September 3. The record also shows that the matter was discussed during the September 9, 1987 meeting of the Safety Evaluation Committee. According to the minutes of the September 9 meeting, the Reactor Health Physicist stated that his calculations showed that it was not likely for the tritium concentration in the atmosphere to exceed the concentration limits for air specified by NRC regulations (10 CFR Part 20.106).

The licensee initially decided to evaporate the water in the basin by heating it with steam supplied directly to the basin. However, this method did not work, and evaporation was minimal. It was then decided to heat the water by operating the reactor at low power and using the normal reactor cooling system to evaporate the water. According to the reactor's log book, the reactor was operated at a power level of 5 MW from 1343 on September 12 to 1444 on September 13, 1987, a total of a little over 25 hours. The reactor was operated at 5 MW for about two hours on September 14, and again at 5 MW from 2012 on September 25 to 0700 on September 30, 1987, for a total of about four days and 11 hours. Practically all the tritium in the secondary cooling system (approximately 680 Ci) was evaporated during these periods of low power reactor operation.

The licensee's analysis of the secondary water on September 12 showed about 2 uCi/ml of tritium. The water analysis after shutdown on September 13 showed about 0.9 uCi/ml of tritium, and it dropped to 0.8 uCi/ml on September 14. The tritium level at restart on September 25 was about 0.8 uCi/ml and at shutdown on September 30 was about 0.05 uCi/ml. The reactor was subsequently operated at 10 and then 15 MW during October, and the tritium levels in the secondary system had dropped to essentially normal operating levels of 0.0002 uCi/ml by October 6, 1987.

During the period of reactor operation on September 29, 1987, the temporary piping connecting the N-16 monitor outlet to the cooling tower basin broke, allowing the secondary water flowing through the monitor to flow into a storm drain at the reactor site. The system used by the licensee to ensure the quality of temporary modifications will be reviewed during a future inspection. The N-16 monitor is an immersion type GM detector connected to the secondary system and used to detect primary to secondary leaks during reactor operation. Part of the secondary system flow is routed through this monitor (about 2-4 gallons per minute) and the discharge from the monitor is routed to a local storm drain. Following discovery of the heat exchanger leak, the licensee had temporarily re-routed the monitor outlet back to the basin. The licensee estimated that when this temporary connection broke on September 29, about 4000 gallons of secondary water went into the storm

drain. Based on a water analysis at the time of the break that showed about 0.4 uCi/ml, the licensee conservatively estimated a total release of 10 Ci of tritium. Approximately 100 uCi of Co-60 would have also been released to the storm drain. The licensee has permanently re-routed the N-16 monitor discharge to the cooling tower basin. The licensee stated that in an attempt to dilute the activity in the storm drain, a total of 2 million gallons of clean water was pumped into the storm drain over a nine-day period following the spill.

4.0 Radiological Consequences

Based on analyses of the secondary reactor cooling system water, about half of the tritium activity, approximately 400 Ci, was released to the atmosphere via the cooling tower during the 25 hour period of September 12-13. According to the minutes of the Safety Evaluation Committee meeting, the licensee calculations indicated that the tritium concentration in the atmosphere would not exceed the maximum permissible concentration in 10 CFR Part 20. The release on September 12-13 was conducted over a weekend because public access to National Institute for Standards and Technology (NIST) grounds is restricted during periods outside of normal working hours. Releases during the period from September 25 to September 30 averaged from about 100 Ci/day during the first day to about 10 Ci/day during the last day. These releases were carried out during periods that included normal working hours at NIST. The licensee stated that the extensive air sampling during the first period of release on September 12-13, had shown that the tritium concentrations in the air within the NIST facility fence were substantially below allowable 10 CFR 20.106 limits. Since the second period of release from September 25-30 involved much lower release rates than those that occurred during the first period, the licensee determined that it was not necessary to limit the September 25-30 releases to periods of restricted access to NIST facilities. Only a small quantity of tritium was released during the brief period of operation on September 14.

The inspector reviewed the licensee's records of the results of the environmental monitoring and performed independent calculations to verify the licensee's analysis predicting the expected concentrations as a result of the releases. The calculations supported the licensee's conclusions that the annual average concentration of tritium was not likely to exceed the allowable concentrations for the general public as specified in 10 CFR Part 20.106.

The reactor Technical Specifications place limits on the allowable concentration of radioactive material at the point of release. The inspector made independent calculations that showed that the average daily concentration of tritium in the air leaving the tower, assuming one cooling tower fan operating at the rated flow rate, was substantially below the permissible Technical Specification limits for concentrations at the point

of release to the atmosphere. However, the limits in the Technical Specifications apply to releases from the reactor stack (elevated release) whereas the releases in question were from the cooling tower (ground level release). The top of the tower is 21' high whereas the top of the stack is about 100' high. The applicability of the Technical Specification limits to such ground level releases will be reviewed during a future inspection.

The releases of radioactive gases to the atmosphere during normal reactor operation over the past several years is shown below to provide a perspective. The table shows the quantities released and the average annual concentrations at the point of release. Argon-41 is generated in the reactor by neutron capture in naturally occurring argon in the air.

	Argon-41		Tritium	
	Ci	pCi/cc (annual average)	Ci	pCi/cc (annual average)
1983	477	1.2	728	1.8
1984	274	0.7	768	1.9
1985	852	2.1	234	0.6
1986	1087	2.7	450	1.1
1987	727	1.6	1154	2.6
1988	900	2.3	393	1.0

The average annual concentrations for Ar-41 and tritium shown in the table are substantially below the limits specified in the reactor's Technical Specifications.

The break in the N-16 monitor released about 10 Ci of tritium and about 100 uCi of Co-60 to the storm drain. The licensee added about 2 million gallons of clean water to the storm drain over a nine-day period in an attempt to dilute this activity. Independent calculations by the inspector showed that the average concentration of radioactivity in the drain resulting from this release, without allowing for the dilution, was less than the maximum allowable concentrations for liquid effluents to unrestricted areas specified in 10 CFR Part 20.106.

The licensee also released about 110 Ci of tritium and about 2 mCi of Co-60 to the sanitary sewer during the three month period of reactor shutdown. Most of this activity originated mostly from draining the heat exchangers after shutdown, the remainder coming mostly from blowdown from the cooling tower. The water is drained from the heat exchanger to a sump, analyzed for radioactivity, and then released to the sewer. The water released in this manner is then diluted by the daily flow of water in the sewers, which

averages about 340,000 gallons per day. The daily average concentration of tritium after allowing for this dilution, was below the maximum concentration permitted by 10 CFR Part 20.303.

5.0 Reporting Requirements

According to the reactor's Technical Specifications, Section 7.7, "Action To Be Taken in the Event of a Reportable Occurrence", all reportable occurrences shall be reported to the NRC in accordance with Section 7.8(1) of the Specifications. According to Section 7.8 "Reporting Requirements", Part (1), reports shall be made to the NRC no later than the following day by telephone or telegraph to the Director, NRC Region I. In addition, a report is to be submitted within 2 weeks, in writing, to the Director, Division of Reactor Licensing, NRC, Washington DC. It should be noted that the NRC forwarding address for such a reportable event was amended by 10 CFR 50.4 to "U. S. Nuclear Regulatory Commission, Document Control Desk, Washington DC 20555".

According to section 7.7 (4) of the Specifications, reportable occurrences shall include "(f) major degradation of one of the several boundaries which are designed to contain the radioactive materials resulting from the fission process". The inspector determined that the leak identified on August 28 constituted a major degradation of a boundary to contain radioactive materials. This is based on the Technical Specifications requirement that the reactor be shut down and corrective action taken if primary coolant leakage in the heat exchanger exceeds 36 gallons per day. The leak in question was estimated to be 400 gallons which most probably occurred within a period of about 24 hours. The inspector stated that although a telephone notification to Region I was made, failure to submit the required two-week written report to the NRC constitutes an apparent violation of Technical Specifications reporting requirements (50-184/89-01-01).

6.0 Exit Meeting

The inspector met with licensee representatives at the conclusion of the inspection. The inspector presented the inspection findings to licensee management. Licensee management stated that they believe they had conducted repair of the leak and subsequent effluent release in accordance with applicable safety principles and regulatory requirements.

ENCLOSURE 3

Future Region I Actions

As a result of our review of the 1987 tritium release event at the National Bureau of Standards reactor, the following actions are deemed appropriate:

1. NRC Region I will hold a management meeting with the National Bureau of Standards licensee to discuss the event, its significance and the licensee's reporting of the event.

2. NRC Region I has been planning a seminar with Test and Research Reactor licensees. The NBS event and Lessons Learned will be discussed during this seminar.

3. NRC Region I Division of Reactor Projects and Division of Radiation Safety and Safeguards will hold training sessions to sensitize their respective staffs on the special handling considerations for non-routine reports from test and research reactor licensees.