BMB

VERMONT YANKEE NUCLEAR POWER CORPORATION

SEVENTY SEVEN GROVE STREET
RUTLAND, VERMONT 05701
VYV-4353

REPLY TO:
P. O. BOX 157
VERNON, VERMONT 05354

August 5, 1976

United States Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region I
631 Park Avenue
King of Prussia, Pennsylvania 19406

ATTENTION: James P. O'Reilly, Director

REFERENCE: Operating License DPR-28
Docket No. 50-271
Reportable Occurrence No. RO-76-22/1T

Dear Sir:

As defined by Technical Specifications for the Vermont Yankee Nuclear Power Station, Section 6.7, we are reporting the attached Reportable Occurrence as RO-76-22/1T.

Very truly yours,

B.W. Riley

Bradford W. Riley
Plant Superintendent

BMB/kbd

EVENT DESCRIPTION

During a routine pumpdown of the Fuel Oil Storage Tank sump on July 20, 1976, at 0930 hours, a station operator noticed abnormal water level in the segregated Fuel Oil Transfer Pump pit area. An investigation revealed that the water was running in through electrical conduits that were in communication with the Condensate Storage Tank (CST) moat. Examination of the CST moat revealed approximately 10 inches of water in the upper moat enclosure. The pumpdown of the Fuel Oil Storage Tank sump was terminated at 1015 hours and the CST sump pump was started to transfer water to the plant's internal radwaste storage facilities. A station operator observed flow from the Condensate Storage Tank overflow pipe at this time. Control Room indication of CST level was noted as a normal level of 85 percent. The Main Condenser Emergency Makeup Valve was opened to lower level in the CST. A sample of the water contained in the Fuel Oil Storage Tank sump area revealed the presence of tritium. An initial analysis showed a concentration of $5 \times 10^{-3}$ microcuries/milliliter (μCi/ml).

Additional investigation revealed that a second flow path existed between the flooded subterranean portion of the CST moat and a pipe chase that contained a drain which communicated with the Connecticut River. This second flow path existed from ∿2100 on July 18 to 1900 on July 20, 1976. Action was initiated to cease all flow from the pipe chase area and by 1900 on July 20, all spillage was terminated. For analysis purposes, this release was considered to have occurred in two phases. From ∿2100 on July 18 to ∿0700 on July 20, water was being released to the storm drain which had a dilution flow of 7 gpm of natural groundwater. From 0700 to 1900 on July 20, 1976, water was being released to the storm drain system which had a total dilution flow of 300 gpm due to pumping of the cooling tower deep basin water.

Based on water volume inventories, coincidental dilution factors and a CST level history for the affected period, an analysis was performed to determine and quantify the extent and consequences of the release. Evaluation of available data indicates that a conservatively estimated quantity of 83,000 gallons of CST water was released over the two day period. The path of release was via the south storm drain system to the point of discharge immediately upstream of the station's discharge structure to the Connecticut River. It was determined that during the 34 hour period the average concentration at the point of discharge to the Connecticut River was $4 \times 10^{-3}$ μCi/ml of tritium. Technical Specifications Section 3.8.A.2 specifies that the maximum concentration of tritium at the piont of discharge to the Connecticut River shall not exceed $3 \times 10^{-3}$ μCi/ml. During the final 12 hour period, the average concentration at the point of discharge to the Connecticut River was $5 \times 10^{-4}$ μCi/ml. The total release of tritium was 1.6 Curies. A sample of the CST water revealed a gross beta-gamma activity of $1.6 \times 10^{-6}$ μCi/ml. The total beta-gamma activity was determined to be 507 microcuries (μCi). The isotopic concentrations at the point of release are as follows:

Isotopic Breakdown

$Co^{57}$ - $1.38 \times 10^{-8}$ µCi/ml
$Cs^{137}$ - $4.71 \times 10^{-7}$ µCi/ml
$CS^{134}$ - $1.68 \times 10^{-7}$ µCi/ml
$Mn^{54}$ - $3.47 \times 10^{-8}$ µCi/ml
$Zn^{65}$ - $1.84 \times 10^{-7}$ µCi/ml
$Co^{60}$ - $2.25 \times 10^{-7}$ µCi/ml
$Sb^{124}$ - $1.28 \times 10^{-7}$ µCi/ml

7 gpm dilution only — (or 14,280 gal) Does not consider additional 12 hr @ 300 gpm or 216,000 gal.

Connecticut River flow data for the period starting 0000 hours on July 18 to and including 2400 hours on July 20, is as follows:

| Sunday 7/18/76 | | Monday 7/19/76 | | Tuesday 7/20/76 | |
|---|---|---|---|---|---|
| Time | Flow | Time | Flow | Time | Flow |
| 0000-1100 | 1364 | 0000-0900 | 1364 | 0000-0900 | 1364 |
| 1100-1300 | 6818 | 0900-1900 | 9090 | 0900-2200 | 9091 |
| 1300-2000 | 1364 | 1900-2000 | 2273 | 2200-2300 | 3636 |
| 2000-2400 | 6818 | 2000-2100 | 6818 | 2300-2400 | 1364 |
| | | 2100-2200 | 9091 | | |
| | | 2200-2400 | 1364 | | |

Unreported in the initial 24 hour report, but known at the time, were the following pertinent facts:

1. Prior to June 17, 1976, no radioactivity was ever detected in the CST sump when routinely sampled for rainwater pumpout.

2. Between June 17 and July 18, 1976, on six occasions when samples were taken and the sump contents pumped to the Radwaste System, the sump level was never above the lower grating (ie., there was no potential for leakage path via wall pipe penetrations because the water level did not reach that elevation).

3. On June 29, 1976, while transferring water from the condenser hotwell to the CST with the Control Room CST indication at 93% full, visual inspection by Operations Department personnel determined that the CST was not overflowing.

Based on current plant operational practices and ground water conditions, it is expected that Technical Specifications Section 3.8.A.7, requiring a quarterly average tritium concentration of $<1 \times 10^{-5}$ µCi/ml, will be exceeded. It is projected that the average quarterly concentration will range between $1.6 \times 10^{-4}$ to $2.0 \times 10^{-4}$ µCi/ml. (RO 76-22/1T)

CAUSE DESCRIPTION

An investigation of the cause of the inadvertent release has been completed. The cause was the existence of two leakage paths out of the CST moat to the storm drain system and an inadvertent overflow of the CST. Subsequent investigation determined that a maximum water level of approximately 20" above the moat floor level occurred. The first leakage path was verified to be a nonwatertight electrical junction box placed approximately 1 foot above the floor level inside the CST moat. Conduit from this junction box communicates below ground level, via the Fuel Oil Transfer Pump Room, to the Fuel Oil Storage Tank sump from which rainwater is normally pumped to the storm drain following a sample analysis for the presence of oil. The second leakage path was later discovered to be seepage around pipe penetrations through the CST moat sump wall and an adjacent covered pipe trench. A drain in this pipe trench communicates with the same storm drain system mentioned above. The design bases for the CST moat is currently being reviewed by a special sub-committee of the Plant Operations Review Committee to determine its intended design integrity.

Conditions contributing to this event are as follows: (1) incomplete logging and trending of information by Operations personnel as required by Administrative Procedures A.P. 0150, Responsibilities and Authorities of Operations Department Personnel, and A.P. 0153, Maintenance of Operations Departmental Logs, (2) insufficient procedural controls to perform plant operations defined in O.P. 2160, Liquid Waste Disposal (administrative controls for continuous release of radioactive water) and O.P. 3140, Alarm Response (response to high level alarm on CST), and (3) an unexplained 10% instrument shift of CST level indication. Investigation of the CST water level indicator shift resulted in no conclusive cause for the change.

EVENT EVALUATION

Current "Background" in Surface and Groundwaters

Recent analysis of local domestic water wells and Connecticut River water indicates an average background concentration of $3 \times 10^{-7}$ μCi/ml. The normal variation due to rain or snowfall is about $2 \times 10^{-7}$ μCi/ml. At the current average river flow through the Vernon Dam of 5252 cubic feet per second, this corresponds to a "normal background" tritium flow of 0.161 Ci/hr, or 1.6 Ci every 10 hours. This is independent of any plant release.

Inadvertent Vermont Yankee Release

During the 46 hour event period, 1.6 Ci of tritium contained in an estimated 83,000 gallons of CST water plus 110,000 gallons of dilution water were released to the river at an average concentration of $1.5 \times 10^{-3}$ μCi/ml. The maximum permissible state and federal limit is $3 \times 10^{-3}$ μCi/ml. During this same period, ∿6.5 billion gallons of river water containing ∿7.48 Ci of "background" tritium flowed past the plant at an average concentration of $3 \times 10^{-7}$ μCi/ml. When the two were combined and mixed going through the Vernon Dam, the resultant concentration was $3.6 \times 10^{-7}$ μCi/ml or the current normal tritium level of the river was raised 22% during the period of release. However, the normal variation or fluctuation of river water tritium concentration from month to month is ±70%. In other words, the "normal background" concentration of tritium in the river fluctuates from about $1 \times 10^{-7}$ to $5 \times 10^{-7}$ μCi/ml, depending on rainfall, season of year, etc. The net environmental impact was negligible since the increase was well within normal variations. Full use of the river (i.e., water supply, swimming, fishing, etc.) was in no way impaired by the Vermont Yankee incident.

Potential Dose as Drinking Water

Assuming a hypothetical person or persons derived their normal drinking water intake of about one pint over the two days from the Vermont Yankee discharge at the point of release and prior to dilution in the river, the total whole body dose would average about 0.27 mRem to each such individual. The maximum permissible dose to the general public from all sources of radiation, other than natural radiation and radiation from the healing arts, is a yearly average of 170 mRem per person. There are no detectable biological effects at this level; however, efforts are made to keep exposures "as low as reasonably achievable" with a goal of 5 mRem/year.

The following table assumes a hypothetical person derives his normal drinking water intake of about one pint from the Connecticut River over a two day period.

| | $H^3$ Concentration (μCi/ml) | $H^3$ Ingested (μCi) | Dose (mRem) |
|---|---|---|---|
| Prior to VY release at average concentration | $3x10^{-7}$ | $1.2x10^{-4}$ | .000020 |
| Prior to VY release at maximum normal variation concentration | $5x10^{-7}$ | $2.0x10^{-4}$ | .000033 |
| During VY release at mixed concentration | $3.6x10^{-7}$ | $1.5x10^{-4}$ | .000024 |

The increase in potential dose resulting from the VY release is negligible when compared to local normal background variations everyone experiences everyday of the year.

Operational Philosophy

Tritium, acting chemically the same as normal hydrogen in water, is not removed by radioactive waste treatment. Upon discharge from the "radwaste" system, Vermont Yankee management has the elective of releasing the effluent to the river with no measurable environmental effects within federal and state regulatory restrictions or recycling the effluent for reuse in the plant. To minimize the total release of radioactivity to the environment, Vermont Yankee has elected to employ the latter, but in so doing the significance and risk of a spill is increased as the inventory of tritium builds to an equilibrium level. The net effect, however, is considerably less total radioactivity released to the environment.

For example, the capacity of the recycled water reservoir is 1,500,000 gallons. It now contains water with a tritium concentration of $5.3x10^{-3}$ μCi/ml or a total of approximately 30 curies of tritium which has been accumulated since initial plant startup in the fall of 1972.

Had this tritium been released well within regulatory limits over the past four years, the current plant inventory would have been considerably less or on the order of 0.1 to 0.5 Ci. Had the same inadvertent discharge occurred at this inventory level, no limit would have been exceeded, but approximately 28 Ci more of tritium would have been released to the environment. Although the "spill" was unintentional and regrettable, Vermont Yankee management believes it rightfully assumed the risk associated with the storage and recycling philosophy which "saved" an additional 28 Ci of tritium from entering the environment.

CORRECTIVE ACTIONS

The Plant Operations Review Committee (PORC) reviewed the occurrence and concluded that no hazard to the general public resulted from the inadvertent release. The following items were recommended by the committee as a result of its review of the occurrence:

1. Establish a PORC Sub-committee to:

   a. Review all plant equipment and structures that can potentially result in a flow path of radioactive water to the river and recommend administrative controls and design improvements for operation of this equipment to further minimize the probability of inadvertent radioactive liquid release.

   b. Review and evaluate the administrative controls for the continuous transfer of water from Radwaste to CST (O.P. 2160) and recommend additional controls as necessary.

   c. Review and evaluate the design intent of the CST moat and associated pipe trenches. Include in this evaluation the potential for migration outside the moat boundary.

   d. Evaluate the possibilities of returning the CST overflow piping to an existing closed plant piping system to prevent inadvertent releases.

2. Lock in the Closed position the CST sump to storm sewer discharge valve. This valve will be unlocked only for a properly issued sump discharge permit.

3. Install a local level indicator on the CST tank and revise A.P. 0150 to require a once per shift comparison of the local and Control Room CST level indicators.

In addition, plant management review of the occurrence and its causes resulted in the following actions:

1. Immediate revision of the Alarm Response Procedure (O.P. 3140) to better define the actions to be taken in the event of a CST High Level condition.

2. Immediate recalibration of the CST level instrumentation and an independent actual level check to confirm its accuracy.

3. A management directive to sample all unmonitored sumps that could possibly communicate with the Connecticut River and to analyze for activity prior to pumping to the river.

4. A management directive to require inspections of the CST sump area once each shift.

5. The Manager of Operations and plant management personnel have met with each operator involved in this incident to insure that he recognizes the seriousness of this situation.

6. Operations Department Control Room personnel have been instructed regarding shift turnover, recognition of abnormal conditions or alarms and the use of plant logs to insure improved knowledge of abnormal trends or conditions.

7. An interim management directive to prohibit continuous discharge of water from Radwaste Systems to the CST. This directive will continue until PORC subcommittee review has been completed and additional controls have been established.

8. Implementation of a program to seal all means of water leakage from the CST moat area. This program is considered to be an interim measure pending completion of PORC subcommittee review of the design intent of the CST moat.

9. As a conservative measure, due to the instrument associated nature of the incident, Instrument and Control personnel have been further reinstructed on the practice of accepted calibration techniques associated with individual circuit alignments.