

DUKE POWER COMPANY  
OCONEE UNIT 1

Report No.: RO-269/77-3

Report Date: February 3, 1977

Occurrence Date: January 19, 1977

Facility: Oconee Unit 1, Seneca, S. C.

Identification of Occurrence: Inadvertent release of liquid radioactivity to the unrestricted area

Conditions Prior to Occurrence: Unit 1 at cold shutdown, partially drained, in process of identifying leaking steam generator tube

Description of Occurrence:

On January 15, 1977 an indication of a primary-to-secondary leak in the "1B" once-through steam generator" (OTSG) resulted in a shutdown of Oconee Unit 1 (see RO-269/77-2). As a result of efforts to locate the leaking steam generator tube, an inadvertent release of radioactivity occurred which exceeded the limits of Technical Specification 3.9. The following is a summary of those pertinent events leading up to and resulting from this situation:

- 2210 January 17, 1977 - Identification of the leaking OTSG tube was in progress. The method employed was to drain the primary side of the OTSG and to fill and pressurize the secondary side of the OTSG using a hotwell pump. At this time a main generator hydrogen cooler gasket developed leakage (contaminated condensate water) and sprayed this water in the turbine building on the 5th, 3rd and basement levels. The coolers were isolated and areas in the turbine building were surveyed and found to be contaminated. The turbine building sump was aligned to discharge to the oil collection basin during this time.
- 2330 January 17, 1977 - The turbine building sump discharge was aligned to the lower of two waste water collection basins (WWCB) and this basin discharge was isolated to provide holdup. The normal discharge of the pump is to the oil collection basin (OCB) which cannot be isolated.
- 0600 January 18, 1977 - The lower waste water collection basin began overflowing and discharging to the oil collection basin.
- 0800 January 18, 1977 - Water from the WWCB flowing into the OCB resulted in releasing radioactive water to the Keowee Hydro TailRace via the yard drain. This activity, even when diluted by the leakage through the Keowee tailrace, exceeded the limits permitted on an instantaneous basis by Technical Specification 3.9.3. The extent of this activity was not realized at this time.
- 0850 January 18, 1977 - Periodic sampling of the yard drains was initiated.

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- 1245 January 18, 1977 - Keowee Hydro Station was placed in operation to provide for system load. Although not considered at the time, this provided sufficient flow to dilute water released from OCB to be within the limits of Technical Specification 3.9.3.
- 1700 January 18, 1977 - The turbine building sump discharge was aligned to the upper WWCB to provide holdup.
- 2230 January 18, 1977 - Keowee Hydro was stopped reducing the dilution flow. The resulting residual activity in the OCB overflowing resulted in concentrations exceeding Technical Specification 3.9.3.
- 0700 January 19, 1977 - Keowee Hydro Station placed in operation for system load.
- 1530 January 19, 1977 - Hydrogen coolers were drained to the turbine building sump.
- 2145 January 19, 1977 - Keowee Hydro Station secured, limits of Technical Specification 3.9.3 were exceeded.
- 0800 January 20, 1977 - The upper WWCB began overflowing, releasing more activity to the OCB.
- 1000 January 20, 1977 - A coordinated effort to prepare detailed plans to mitigate the consequences of this occurrence were established.
- 1050 January 20, 1977 to
- 1720 January 21, 1977 - Operations were conducted to create the necessary amounts of dilution flow by either running the Keowee Hydro units, using the Keowee spillway, using the emergency condenser discharge to the tailrace or by restricting flow in the yard drains to assure that the provisions of Technical Specification 3.9.3 were met.

This occurrence also resulted in exceeding the provisions of Specification 3.9.1 in that the experienced release of radioactive materials in liquid wastes when averaged over this calendar quarter, was such that these quantities if continued at the same rate for a year would exceed twice the annual objective. Specification 3.9.4 was also exceeded in that the installed equipment in the liquid radioactive waste system were not operated in such a manner as to keep releases during this calendar quarter to 1.25 curies per unit.

Designation of Apparent Cause of Occurrence:

The normal procedure utilized when identifying a leaking steam generator tube is to isolate the affected steam generator, and drain it to the liquid radioactive waste system if the water is contaminated. The steam generator is then filled with clean water and pressurized with nitrogen or water to identify the defective tube. In this incidence the steam generator was not drained and refilled with clean water. A change was made to the procedure to allow leak testing prior to draining the steam generator to the liquid waste disposal system.

This was done in an effort to reduce amounts of radioactive waste which would be generated. This procedure change was not performed in accordance with established provisions of the Administrative Policy Manual for Nuclear Stations, but was made on verbal authorization.

In the course of this evaluation, the steam generator level instrument tap in the reactor building was discovered to be leaking and the hotwell pump was stopped. When the hotwell pump was restarted the resulting pressure surge caused the hydrogen coolers to leak.

The apparent cause of these occurrences are considered to be a procedural inadequacy in the steam generator leak procedure which permitted the test to be performed with contaminated water. Also, a warning was not present in the procedure to caution against starting the hotwell pump with its discharge valve open. The discharge valve should be shut when the hotwell pump is started to eliminate pressure surges in the system.

Analysis of Occurrence:

This occurrence resulted in releases of liquid radioactivity from the restricted area in which the maximum instantaneous concentrations exceeded the 10CFR20, Appendix B, Table II, Column 2 values as required by Specification 3.9.3. The values in 10CFR20, Appendix B, Table II, Column 2 are provided by 10CFR20.106 to place limitations on the unrestricted area releases and may be considered to be averaged over a period of not greater than one year. In this incident, the maximum instantaneous concentration was approximately 20 times the value stated in Table II, Column 2; however, considering the total dilution provided by the Keowee Hydro over each 24 hour period, the following concentrations are within the Technical Specification limits:

January 18, 1977	5.44 x 10 <sup>-9</sup> μCi/ml
January 19, 1977	1.8 x 10 <sup>-8</sup> μCi/ml
January 20, 1977	1.1 x 10 <sup>-7</sup> μCi/ml

The objective of Specification 3.9 is that the annual quantity of radioactive materials in liquid waste, excluding tritium and dissolved gases, shall be less than 5 curies per unit. In general, it is not possible to distinguish which unit is the source of activity and the objective utilized is 15 curies per year (3 units). Specification 3.9.1 requires a report if the experienced rate of release averaged over any calendar quarter would exceed twice the annual objective if continued at the same release rate. In this instance, it is recognized that all activity originated from Unit 1, and therefore the annual objective of 5 curies/year or 1.25 curies/quarter should apply. It is considered that a total of 3.2 curies of activity have been released to date to the unrestricted area as a result of this incident. Presently, a total of 2.0 curies of activity are being retained in the upper and lower WWCB and .009 curies are in the OCB. This activity will be allowed to radioactively decay or be released with sufficient dilution to assure the provisions of Specification 3.9.3 and 3.9.2 are met.

Specification 3.9.4 requires that equipment installed in the liquid radioactive waste system be operated for the purposes of keeping releases in any calendar quarter to 1.25 curies per unit or less. The equipment was not operated in this manner; however, it is doubtful that a significant reduction

of releases could have been achieved due to the limited storage capacity available.

Since the resulting averaged concentrations of radioactivity contained in liquid waste were well within the limitations specified by 10CFR20, it is concluded that the health and safety of the public was not adversely affected by this incident.

Corrective Action:

Corrective actions taken to mitigate the consequences of this occurrence included the attempts to retain the turbine building sump water in the waste water collection basins. When these attempts were exhausted and the magnitude of the incident was recognized, the Keowee Hydro Station was operated for extended periods of time to provide adequate dilution flow.

In order to prevent recurrence of this incident, the procedure to determine the leaking steam generator tube has been revised to require that the affected steam generator secondary side will be drained to the liquid waste disposal system as necessary prior to initial leak tests and will be flushed as necessary to minimize contamination. Also, the requirement to close the hotwell pump discharge valve prior to starting the pump has been added to the appropriate procedure.

Discussions have been conducted with the regional office of Inspection and Enforcement and commitments as outlined in Mr. Norman C. Moseley's letter dated February 1, 1977 have been made.

Extensive environmental sampling has been conducted downstream of the Keowee dam in Lake Hartwell. No significant concentrations of radioactivity have been detected.

Operations personnel have been re-instructed to assure that procedural changes are made in accordance with the Administrative Policy Manual for Nuclear Stations. This should prevent recurrence of this incident.