

DUKE POWER COMPANY
OCONEE UNIT -1

Report No.: RO-269/76-4

Report Date: April 21, 1976

Occurrence Date: April 12, 1976

Facility: Oconee Unit 1, Seneca, South Carolina

Identification of Occurrence: Release of activity above Technical Specification limits due to procedural deficiency

Conditions Prior to Occurrence: Not applicable

Description of Occurrence:

On April 12, 1976, it was determined that due to a procedural deficiency, liquid waste activity had been released from Oconee Nuclear Station with resulting instantaneous concentrations above the average annual limitations of 10 CFR 20, Appendix B, Table II. This limitation on release rate is specified by Oconee Nuclear Station Technical Specification 3.9.3. Releases had been made which, after dilution in the Keowee tailrace, resulted in instantaneous radionuclide concentrations of up to 1.5×10^{-5} $\mu\text{Ci/ml}$. This value is greater than the 10 CFR 20, Appendix B, Table II limit of 1×10^{-7} $\mu\text{Ci/ml}$ for average annual concentrations for the most restrictive case in which the exact relative concentrations of radionuclides in a liquid mixture are not known, but it is known that neither Ra 221 nor Ra 228 is present.

Designation of Apparent Cause of Occurrence:

This occurrence resulted from an incorrect procedure utilized to calculate release limits for radioactive nuclides released from the station in liquid effluents. By the procedure utilized, a composite average MPC (Maximum Permissible Concentration) for liquid releases was calculated on a weighted fraction basis by the following formula:

$$\text{MPC}_{\text{avg}} = \frac{C_1}{C_T} \text{MPC}_1 + \frac{C_2}{C_T} \text{MPC}_2 + \dots + \frac{C_n}{C_T} \text{MPC}_n$$

where: $C_1, C_2, \text{ etc.}$ = concentration in $\mu\text{Ci/ml}$ of each of the components of the mixture.

C_T = total concentration of all the components of the mixture.

$\text{MPC}_1, \text{MPC}_2, \text{ etc.}$ = 10 CFR 20 MPC of each of the components of the mixture.

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Using data from sample releases, a value of 1.5×10^{-5} $\mu\text{Ci/ml}$ was calculated for MPC_{avg} and designated as an instantaneous limit for the resulting tailrace concentration following the release of any mixture of radionuclides in liquid form. Provisions were additionally made to recalculate this limit on a quarterly basis, or if the relative concentrations of radionuclides in liquid releases should change.

As can be seen, the calculated value of MPC_{avg} is primarily dependent on the relative concentrations of the least restrictive isotopes in a mixture (i.e., those isotopes that can be released at the highest MPC values). The most restrictive isotopes, those with MPC limits several orders of magnitude lower, have little effect on the calculated average MPC value. Similarly, excessive concentrations of these isotopes can be present in a mixture, while the total resulting radioactive concentration of the mixture is below the calculated MPC_{avg} limit. Therefore, this procedure for calculating an average MPC limit is incorrect because it allows releases to be made in which certain isotopes are present in concentrations above their prescribed MPC limits. As stated in 10 CFR 20, Appendix B notes, the following criteria must be satisfied for liquid releases when more than one radioactive isotope are present:

$$\frac{C_1}{\text{MPC}_1} + \frac{C_2}{\text{MPC}_2} + \dots + \frac{C_n}{\text{MPC}_n} \leq 1$$

This criteria limits the resulting average annual concentrations of any radionuclide released as a liquid effluent to less than its MPC value as listed in Table II, Column 2 of 10 CFR 20, Appendix B.

Analysis of Occurrence:

As a result of this occurrence, liquid releases have been made in which the 10 CFR 20, Appendix B most restrictive case limit of 10^{-7} $\mu\text{Ci/ml}$ has been exceeded on an instantaneous basis. Otherwise, no annual or quarterly average objective limits as stated in Technical Specification 3.9 have been exceeded. It is concluded, therefore, that the health and safety of the public has not been affected by this occurrence.

Corrective Action:

The procedure for the release of liquid waste from Oconee has been changed and implemented to comply with the correct criteria as stated in 10 CFR 20, Appendix B.