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84 OCT 31 P1:17

October 24, 1984

Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Re: Oconee Nuclear Station, Units 1, 2, and 3
Docket Nos. 50-269, -270, -287

Dear Mr. O'Reilly:

Please find attached a special report concerning the burning of contaminated oil at Lee Steam Station which had been shipped from Oconee Nuclear Station. This report describes an incident which is considered to be of no significance with respect to its effect on the health and safety of the public.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

RFH:slb

Attachment

cc: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

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Duke Power Company
Oconee Nuclear Station
Special Report

Shipments of Contaminated Oil to
Lee Steam Station for Disposal By Incineration

Introduction:

On September 27, 1984, Oconee station personnel determined that slightly contaminated oil had been shipped to Lee Steam Station for burning, contrary to an NRC Region II interpretation of "exempt quantity". Approximately 19,000 gallons of this contaminated oil were burned at Lee during the period September 1981 to July 1984. The last contaminated oil shipment occurred in June 1984. Prior to an NRC Region II interpretation of 10CFR30.18 on March 20, 1984, Duke had interpreted the regulation as allowing disposal of exempt quantities of radioactive materials. The NRC Region II interpretation of 10CFR30.18, which pertained to McGuire Nuclear Station sludge samples, stated that there are no exempt quantities of radioactive materials for disposal purposes.

Immediate corrective action consisted of ensuring that all contaminated oil shipments were halted. Henceforth, all contaminated oil generated onsite will be burned in the onsite auxiliary boiler or alternately solidified as waste.

Descriptions of Occurrence:

In the latter part of 1978, the need existed at Oconee Nuclear Station (ONS) to find a faster and more efficient method of disposal for secondary side spent oil. Some of the oil contained minute quantities of certain radioisotopes and the oil was accumulating rapidly enough so that storage was impractical. A decision was made that the very slight amounts of activity present in the oil could be categorized as "exempt quantities", defined in 10CFR30.18. As such, the oil could be shipped to and burned at Lee Steam Station. Due to the very small activities involved, this disposal method was not considered hazardous to the health and safety of the public. A station directive was generated and approved, in August 1981, describing the waste oil program for ONS. Primary side oil and secondary side oil with activity greater than 50% of the 10CFR30.70 and 30.71 allowance was required by the directive to be burned onsite. Uncontaminated oil and secondary side oil possessing an activity less than 50% of the allowance could be burned at Lee according to the directive. Shipment of the contaminated oil commenced in September 1981 and a total of eight shipments were made by June 1984, amounting to 18,635 gallons.

Discussions were held between the NRC Region II and Duke regarding the term "exempt quantity" in connection with McGuire Nuclear Station in February 1984; the NRC indicated at that time that their interpretation allowed non-routine shipments of contaminated substances for laboratory analysis only. A written clarification followed on March 20, 1984 which specifically stated that no "exempt quantities" are recognized for disposal purposes. A period of time elapsed between the issuing of the clarification by NRC and the realization by Duke that the interpretation applied as well to the Oconee contaminated oil shipments to Lee. Shipments were halted immediately, once the situation became clear.

Cause of Occurrence:

The burning of the contaminated oil at Lee Steam Station occurred as a result of Duke personnel interpreting the intent of 10CFR30.18, as applying to the disposal of very slightly contaminated materials. The term "exempt quantities" was not perceived as applying to a small sample (e.g., for laboratory analysis). No written interpretation which clarified 10CFR30.18 had been provided by the NRC at the time Duke made the judgement concerning the contaminated oil.

The connection between the NRC Region II clarification of March 20, 1984 and the shipping of contaminated oil to Lee for burning was not immediately recognized. However, a more prompt recognition that the disposal method was in conflict with the NRC Region II interpretation would have resulted in only a reduction of the total volume of contaminated oil burned at Lee. The cause for the delay in recognizing the conflict was an oversight by the personnel involved in the handling of the March 20, 1984 letter.

Analysis of Occurrence:

The original decision to ship and burn the contaminated oil at Lee was based on the fact that the concentration of radioisotopes were very low. Duke elected to restrict even further (relative to 10CFR30.70 and 30.71) the activity levels of oil to be burned; the levels were required to be less than 50% of the exempt levels specified by 10CFR30.70 and 30.71, for shipment to Lee.

Following the suspension of shipments to Lee, a decision was made to reanalyze all data related to the oil that had been shipped for burning. The analysis sought to determine, with at least 95% certainty, whether the shipments indeed contained radioisotopes. Analysis of the data, taking into account background readings, indicated that Cesium-137 was present in a number of waste oil samples, but with a concentration which was at or just above the lower limit of detectability.

Summarizing the above information, it is seen that the original plan to burn the oil at Lee stipulated that very low levels of contamination (less than half the perceived limit of 10CFR30.70 and 30.71) could not be exceeded. Additionally a confirmatory analysis proved that the radioisotope concentration in samples of oil already burned was very low. Attachment 1 provides the radiological assessment of the impact that this incident had on the health and safety of the public and employees of Lee Steam Station. On this basis, Duke submits that this occurrence was of no significance with respect to the health and safety of the public.

Corrective Action:

The immediate corrective action taken was to halt all shipments of contaminated oil to Lee Steam Station. In the future, contaminated oil will be burned onsite in the auxiliary boiler or alternately solidified as waste material. The station directive covering the waste oil program will be revised to remove all reference to the term "exempt quantities". The deficiencies in handling NRC clarifications have been recognized and appropriate corrective actions are being evaluated to assure proper handling in the future.

Attachment 1

Radiological Environmental Impact
Burning Low-Level Contaminated Oil at Lee Steam Station

Study Period: 1982 - 1984

Waste Description: Spent Oils from Oconee Nuclear Station

Waste Volume & Activity

Year	Volume (gal)	Radionuclide	Total Activity
1984	3020	Cs-137	0.16
	2250	Cs-137	2.35
	5270		2.51
1983	7300	Cs-137	2.19
	1350	Cs-137	0.44
	8650		2.63
1982	715	Cs-137	6.34
		Cr-51	1.18
	4000	Cs-137	2.05
	4715	Cs-137	8.39
		Cr-51	1.18

Dose Calculations:

1) Effluent dose - Inhalation Pathway (Assume 100% release through stack)

$$D = 3.17\ E\text{-}8 \sum_i R_i\ [W\tilde{Q}_i]$$

where:

3.17E-08 = The inverse of the number of seconds in a year.

$\tilde{Q}_i$ = The release of radioiodines, radioactive materials in particulate form and radionuclides other than noble gases in gaseous effluents, 'i', in μCi. Releases shall be cumulative over the calendar quarter or year as appropriate.

W = The annual average dispersion or deposition parameter for estimating the dose to an individual at the controlling location.

$W = (\overline{X/Q})$ for the inhalation pathway, in sec/m^3.

$W = (\overline{D/Q})$ for the food and ground plane pathways, in $meters^{-2}$.

R_i = The dose factor for each identified radionuclide, 'i', in m^2 (mrem/yr) per μCi/sec or mrem/yr per $\mu Ci/m^3$, for each pathway. (Tables 3.1-12 → 3.1-30)

1.1 For adult $\bar{X}/Q$ = 2.10E-07

Cs-137 R_i = 4.27E+5 (WB)
R_i = 6.20E+5 (Liver)

Cr-51 R_i = 9.99E+1 (WB)
R_i = 5.94E+4 (Lung)

D_{wb} = (3.17E-8)(4.27E+5)(2.10E-7)(A) = mrem/yr.
D_{liver} = (3.17E-8)(6.20E+5)(2.10E-7)(A) = mrem/yr.

1984	A = 2.51μCi	D_{wb} = 7.13E-9 mrem/yr. D_{liver} = 1.04E-8 mrem/yr.
1983	A = 2.63μCi	D_{wb} = 7.40E-9 mrem/yr. D_{liver} = 1.08E-8 mrem/yr.
1982	A = 8.39μCi (Cs-137)	D_{wb} = 2.38E-8 mrem/yr. D_{liver} = 3.46E-8 mrem/yr.
	A = 1.18μCi (Cr-51)	D_{wb} = 7.85E-13 mrem/yr. D_{liver} = 4.67E-10 mrem/yr.
		D_{wb} TOTAL = 2.38E-8 mrem/yr. D_{liver} = 3.46E-8 mrem/yr. D_{lung} = 4.67E-10 mrem/yr.

Infant doses would be less than those for an adult.

2) Effluent dose - Ground-food Pathway

2.1 For adult where $\bar{D}/Q$ = 3.0E-10

Cs-137 R_i = 5.94E+9 (WB)
R_i = 9.07E+9 (Liver)

Cr-51 R_i = 4.58E+4 (WB)
R_i = 1.15E+7 (GI)

1984	A = 2.51μCi	D_{wb} = 1.42E-7 mrem/yr. D_{liver} = 2.16E-7 mrem/yr.
1983	A = 2.63μCi	D_{wb} = 1.53E-7 mrem/yr. D_{liver} = 2.27E-7 mrem/yr.
1982	A_{Cs} = 8.39μCi	D_{wb} = 4.73E-7 mrem/yr. D_{liver} = 7.23E-7 mrem/yr.
	A_{Cr} = 1.18μCi	D_{wb} = 5.14E-13 mrem/yr. D_{gi} = 1.29E-10 mrem/yr.

2.2 For infant where $\bar{D}/Q$ = 3.0E-10

CS-137 R_i = 3.22E+9 (WB)
R_i = 4.54E+10 (bone)

Cr-51 R_i = 1.34E+5 (WB)
R_i = 3.91E+6 (GI)

1984	A = 2.51μCi	D_{wb}	= 7.69E-8 mrem/yr.
		D_{liver}	= 1.08E-6 mrem/yr.
1983	A = 2.63μCi	D_{wb}	= 8.05E-8 mrem/yr.
		D_{liver}	= 1.14E-6 mrem/yr.
1982	A_{Cs} = 8.39μCi	D_{wb}	= 2.56E-7 mrem/yr.
		D_{liver}	= 3.62E-6 mrem/yr.
	A_{Cr} = 1.18μCi	D_{wb}	= 1.50E-12 mrem/yr.
		D_{liver}	= 4.39E-11 mrem/yr.

D_{wb} TOTAL = 2.35E-7 mrem/yr.

EXPOSURE DOSES

feed rate of oil 5.4 gal/min. or 324 gal/hr.
feed rate of coal 67 tons/hr. = 134,000 lbs./hr.
-0.12 ash content

total oil volume = 18,635 gal.
1984 5,270 gal.
1983 8,650 gal.
1982 4,715 gal.

total hours burning oil
1984 16.3 hrs.
1983 26.7 hrs.
1982 14.6 hrs.

Ash volume generated - (134000#)(.12x) hrs.
1984 262,104 lbs.
1983 429,336 lbs.
1982 234,768 lbs.

Total ash generated by Lee = 1.8E+8 lbs/yr.

Radioactivity in Ash - total act/ash volume
1984 Cs-137 - 3.07E-5 ρCi/gm.
1983 Cs-137 - 3.22E-5 ρCi/gm.
1982 Cs-137 - 1.03E-4 ρCi/gm.
Cr-51 - 1.45E-5 ρCi/gm.

3) Dose Rate on Surface of Semi-infinite Source

$$D = \tfrac{1}{2}\Sigma_i A_i \times \bar{E}_1 \left(2.22 \frac{\text{dis.}}{\text{PCi-min}}\right)\times\left(60 \frac{\text{min}}{\text{hr}}\right)\times\left(1.602 \times 10^{-6} \frac{\text{erg}}{\text{Mev}}\right)\times\left(\frac{1}{100 \text{ ergs/g-rad}}\right)$$

Where D = Dose rate at surface in Rad/hr.

A_i = Radionuclide 'i' Concentration in PCi/gm

$\bar{E}_i$ = Radionuclide 'i' effective energy in Mev

D_{1984} = 2.65E-8 mrads/hr.

D_{1983} = 2.78E-8 mrads/hr.

D_{1982} = 8.89E-8 mrads/hr. Cs-137
4.64E-10 mrads/hr. Cr-51

1982 TOTAL = 8.94E-8 mrads/hr.

If an individual stood in ash for 1 year, his dose would be less than 0.001 mrad. Since the ash is placed in a pond with at least 1 foot of water covering the ash and the ash further diluted by the pond ash capacity, the dose to the individual is even less. Assume 1 foot of water will provide 4 HVL of attenuation, then dose will be less than 0.00005 mrad.

Conclusions:

Based on the calculations above, the effluent doses through the inhalation pathway will be:

ADULT & INFANT

1984	7.13E-9 mrem/yr WB	1.04E-8 mrem/yr Liver
1983	7.40E-9 mrem/yr WB	1.08E-8 mrem/yr Liver
1982	2.38E-8 mrem/yr WB	3.46E-8 mrem/yr Liver

and through the food pathway will be:

	ADULT	INFANT
1984	2.16E-7 mrem/yr Liver	1.08E-6 mrem/yr Liver
1983	2.27E-7 mrem/yr Liver	1.14E-6 mrem/yr Liver
1982	7.23E-7 mrem/yr Liver	3.62E-6 mrem/yr Liver

Compare these numbers with the radiological impact caused by atmospheric emmissions of natural radioactive material - coal-fired rural power station maximum individual dose rate:

Lung - 2.1 mrem/yr.
Bone - 16.0 mrem/yr. *See Footnote 1

The exposure rate to stand in ash continuously is < 0.001 mrad/yr. and when covered with water is < 0.00005 mrads/yr.

As can be seen from comparison of dose rates, the effects of burning the oil sent to Lee Steam Station were virtually insignificant.

The health and safety of the public and employees of Lee were not affected.

[1]Federal Register/Vol. 44, No. 249/December 27, 1979/p. 76743, Table 2