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ASSOCIATED UNIVERSITIES, INC.

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Department of Nuclear Energy

(516) 345-2362

October 30, 1979

Mr. Ernest Sylvester
Plant Systems Branch
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: Pilgrim Nuclear Power Plant - Supplement Review.
Suppression of Charcoal Fire in Augmented Off-Gas System - Item 3.2.6.

Dear Ernie:

The Safety Evaluation Report (SER) dated December 21, 1978 stated that unless the licensee can demonstrate that, in the event of a fire, the two-hour whole body dose at the nearest exclusion area boundary is less than 5 REM, a suppression capability will have to be provided.

The licensee responded on January 16, 1979 and February 5, 1979 stating that a 2 rem dose would be found at the exclusion area boundary. The following assumptions were made:

1. A puff release of all activity on charcoal delay beds.
2. No decay in transit to exclusion area boundary.
3. Utilized conservative ground level release X/Q.
4. Utilized conservative coolant activities.

On April 12, 1979 I responded to Leo Derderian requesting further information on the above assumptions and requested that the licensee advise us as to the levels of radiation for the major isotopes assumed to be in the filter at the time of the fire.

The licensee responded July 6, 1979 with the answers to their original assumption and stated that the activity for the important isotopes was 8000 curies of Xenon-133. The assumptions listed above were checked out by Brookhaven National Laboratory (BNL) personnel and found to be acceptable. The

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To: Mr. E. Sylvester

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October 30, 1979

Xenon-133 level was checked out by Battelle Columbus Laboratories, under contract to BNL (see Attachment 1). Based on the information available to us, Battelle has found the assumed level of activity is conservative.

We find, therefore, that this item is satisfactory.

Yours truly,



Edward A. MacDougall
Reactor Engineering Analysis

EAM:sd

attachment

cc.: L. Cerbone wo/att.

R. Ferguson "

R Hall

T. Lee

W. Kato wo/att.

V. Panciera "

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Calculation of PNPS Xe-133 Inventory
in the Charcoal Delay System

by R. C. Dykhuizen

September 26, 1979

Charcoal beds are employed in BWR condenser off-gas systems to hold up radionuclides prior to release. This hold up period allows for delay of the shorter lived radionuclides in the condenser off-gases.

The Xe hold up time can be closely approximated by the following equation:

$$T = K_D M/V$$

where:

T = hold up time of a given gas, sec.

K_D = dynamic adsorption coefficient for the given gas,
 cm^3/gram

M = mass of charcoal, gram

V = flow rate of carrier gas, $\text{cm}^3/\text{sec.}$

The charcoal delay system holdup times for Xe and Kr for the PNPS were given to us, via a Telex from Ed MacDougall, as 240 days and 160 hours respectively. We did not have available to us the design of the PNPS charcoal delay system so we were not able to verify these numbers. If we assume a 0°F operating temperature and a -20°F dew point, we infer the PNPS system contains approximately 75 tons of activated charcoal using the dynamic adsorption coefficients reported in the GALE⁽¹⁾ report. In calculating the Xe-133 inventory of the charcoal, the exact hold up time is not critical however as long as it is much greater than the 5.27 day halflife of Xe-133. The calculation then becomes an analysis of the equilibrium activity of xenon released to the charcoal.

(1) Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from BWR's, NUREG-0016, April, 1976.

The Xe-133 concentration in the PNPS reactor steam was calculated to be 2.6×10^{-9} Ci/gm, from data reported in the GALE⁽¹⁾ report. It was assumed that the entire amount of Xe-133 in the reactor steam was carried with the condenser off-gas. Using the design PNPS steam flow rate of 8×10^6 lbm/hr, this results in a 9.44 Ci/hr Xe-133 flow rate into the off-gas treatment system.

This Xe-133 input rate results in 1722 Ci of Xe-133 inventory in the off-gas treatment system, with over 99 percent of this in the charcoal filters. We therefore recommend this value for use in the charcoal fire analysis. In the Telex that was sent to us, a Xe-133 inventory of 8000 Ci is quoted which is supposed to be based on four times the design activity in the PNPS Appendix I. We were unable to confirm this reference in our copy of the PNPS FSAR. Our own calculation does imply a factor of four conservatism in the 8000 Ci inventory, however.