

## ABSTRACT

### Tritium Evaporative Losses From the Spent Fuel Pool

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The evaporative losses from the spent fuel pool (SFP) are large. Typical evaporative losses may be on the order of 400 gallons per day. The SFP typically contains relatively high concentrations of tritium. The amount of tritium lost from the SFP to the plant vent stack may be estimated by knowing the tritium concentration in the SFP and the estimated evaporative losses from the SFP. The plant vent stack is continuously sampled for tritium, and the amount of tritium discharged is calculated monthly. Theoretically, the amount of tritium reported discharged through the plant vent stack should always exceed the amount of tritium evaporated from the SFP. This paper compares the tritium losses from the SFP to the tritium reported discharged from the plant vent stack.

The evaporative losses from the SFP can not be measured directly. The evaporative losses may be estimated by knowledge of the make up rates recorded by the plant Operators. The operator logs were reviewed, and they indicate evaporative losses are approximately 440 gallons per month during winter months. If make-up rates are not recorded, evaporative losses from pools may be estimated using formulas in the technical literature such as the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) handbooks. One equation for estimating evaporative losses from pools is shown below:

$$W = \frac{(95 + 37.4 \times V)(P_w - P_a)}{Y}$$

W - evaporation rate, lb/hr per sq. ft.

V - air velocity over water surface, mph

P<sub>w</sub> - saturation vapor pressure at the water temperature, in. Hg

P<sub>a</sub> - saturation vapor pressure at the air dew point, in. Hg

Y - Latent heat at pool temperature, Btu/lb

The factors “95” and “37.4” are constants that attempt to account for variations in wind speed. The values selected for these factors are disputable and other investigators found the factors “68.3 and 32.0 better characterize evaporative losses.

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### **Tritium Evaporative Losses From the Spent Fuel Pool (Cont'd)**

The plant vent stack is continuously monitored for tritium using a color-indicating silica gel desiccant cartridge. Calvert Cliffs is a dual unit site with separate plant vent stacks for each unit. Each stack is monitored as required by Technical Specifications. The ventilation configuration indicates the SFP exhaust is directed to the Unit-1 plant vent stack. The Unit-1 plant vent stack tritium surveillance indicated that during the first quarter of one year, 1.57 curies tritium was discharged from the Unit-1 plant vent stack as determined from the silica gel method. During the same period, evaporative losses from the SFP were initially estimated to be 159,200 liters with a tritium concentration of  $1.94\text{E-}2$  uCi/ml. This represents 3.1 curies of tritium lost from the SFP over that calendar quarter.

Over one calendar quarter, 1.57 curies of tritium were reported discharged from Unit-1. Surveillances on the Unit-2 plant vent stack indicate 1.02 Ci were discharged from Unit-2. Evaporative losses from the SFP were estimated to be 3.1 curies. The author will discuss this disparity and the various uncertainties and assumptions inherent in this method.