



managed by Brookhaven Science Associates
for the U.S. Department of Energy

Memo

date: August 10, 2011

to: Files

from: R. Karol & D. Beavis *DB*

subject: **BLIP Site Boundary Dose - Short Term Release of Water Vapor from Stack**

PURPOSE:

This calculation estimates the site boundary dose from a short term evaporation of BLIP tank water during shutdown. During shutdown the only isotope of interest is tritium. An elevated stack release is assumed under fumigation conditions for the relative concentration meteorological dispersion coefficient, χ/Q .

SUMMARY AND CONCLUSIONS:

The computed site boundary dose per unit of tritium activity released is 4 μrem per Ci of tritium released from the BLIP stack.

APPLICABLE CRITERIA:

The annual site boundary dose must not exceed 10 mrem from routine airborne emissions or 1 rem in an accidental release [1, 2].

INPUT DATA:

1. The atmospheric dispersion coefficient, χ/Q , is obtained by using the worst-case value from Reference 3, fumigation conditions. This value was determined using the method described in Reference 4.
2. The dose conversion factor for tritium was obtained from Reference 4. This value for water vapor is 6.3×10^{-5} rem/ μCi of intake.

DETAILED CALCULATIONS AND ANALYSIS:

1. The dose conversion factor in the units of interest for tritium inhalation is found as follows:

$$\left(DCF_{in} \frac{rem}{\mu Ci} \right) \left(\frac{10^6 \mu Ci}{Ci} \right) \left(BR_{in} \frac{m^3}{sec} \right) = (BR \times 10^6) \left(DCF_{in} \frac{rem}{\mu Ci} \right) = \frac{rem - m^3}{sec - Ci} \text{ units}$$

The breathing rate (BR) is $3.33 \times 10^{-4} \text{ m}^3/\text{sec}$ [5].

2. The BLIP stack release χ/Q value is $1.9 \times 10^{-4} \text{ sec}/\text{m}^3$, which is the fumigation value.
3. The site boundary dose is found as follows:

$$\sum H_i = DCF_i \times A_i \times \chi/Q$$

Where H_i = equivalent dose from radionuclide i, rem

DCF_i = immersion or inhalation dose conversion factor for radionuclide i,
 $\frac{rem - m^3}{sec - Ci}$

A_i = radionuclide i source term, Ci

χ/Q = stack release site boundary relative concentration value, sec/m^3

4. The result of the calculation in units of dose equivalent per unit activity released is shown below:

Site boundary dose = 4 μrem per Ci of tritium released from the BLIP stack.

References:

- [1] Letter from R. J. Borsellino (USEPA Region 2) to M. Holland (BHSO dated August 3, 2009.
- [2] DOE Order 420.2C, Safety of Accelerator Facilities, July 21, 2011.
- [3] R. Karol, "BLIP Stack Release Site Boundary Atmospheric Dispersion Model", November 4, 2010.
- [3] USNRC Regulatory Guide 1.145, Rev. 1 (Nov. 1982-Revised Feb. 1983), "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants".
- [4] DOE/EH-0070, "External Dose Rate Conversion Factors for Calculation of Dose to the Public", July 1988.
- [5] ICRP Publication 23, "Reference Man: Anatomical, Physiological and Metabolic Characteristics", April 1975.