PDR

PURDUE UNIVERSITY

DEPARTMENT OF
RADIOLOGICAL AND
ENVIRONMENTAL MANAGEMENT

March 18, 1991

U. S. Nuclear Regulatory Commission
Materials Licensing Section
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Gentlemen:

Please find enclosed four additional pages to complete the submissions for an amendment for a field study. The original request was filed in a letter dated December 20, 1990. Supplemental information was filed on March 4, 1991. Complete copies have also been submitted to Dr. Donna-Beth Howe, NMSS, Washington.

If there should be any questions please call me at 317-494-2350. Since the first nesting period is expected to begin any day and valuable data may be lost, we would appreciate expedited handling of this request. Thank you in advance for your consideration of this matter.

Sincerely,

James F. Schweitzer Ph.D.
Radiation Safety Officer

Enclosures
JFS/sas

H005

Watersheds and Drinking Water

Two watersheds drain the NWSCC property. The extreme northern portion of the site is drained by Lake Greenwood which flows into First Creek. This watershed empties into the west fork of the White River, the Wabash River and ultimately the Ohio River. Flow in First Creek is less than 5 cubic feet per second (1.6 million gallons per day). This flow is 0.06% of the capacity of Lake Greenwood. Any tritium released in this watershed would be mixed thoroughly and be at a concentration of less than 2×10^{-9} microcuries/mL as previously discussed. Dose calculations have been previously shown for drinking three liters of water per day from this source.

The majority of the site is served by creeks that empty into the east fork of the White River (3.5×10^{9} gallons per day). The creeks: Little Sulphur, Sulphur, Turkey and Seed Tick all have flows of less than 1.6 million gallons per day. Boggs Creek (central portion of the site) has a flow of 3-6 million gallons per day. In one case (all the tritium released to Boggs Creek at the maximum daily rate) the concentration would be 1.2×10^{-11} microcuries/mL

$$\frac{1.5 \text{ millicuries}}{3 \times 10^{6} \text{ gallons} \times 3785 \text{ mL/gallon}} = 1.2 \times 10^{-11} \text{ uCi/mL}$$

This is one billionth of the MPC of 3×10^{-3} uCi/mL. To approach MPC on any given day, the flow rate of a creek would need to be less than 132 gallons per day.

$$\frac{1.5 \text{ millicuries}}{132 \text{ gallons} \times 3785 \text{ mL/gallon}} = 3 \times 10^{-3} \text{ uCi/mL}$$

There are seven wells in the southern portion of the site ranging in depth from 100-225 feet. These wells serve the test facility and are not a primary source of drinking water. Lake Greenwood is the primary drinking water source and calculations for dose from ingestion have been performed.

Access

Access to the site is strictly controlled however no fences would prohibit site personnel from entry into areas where the bird population nests. The roads are patrolled 24 hours a day and any unauthorized personnel are required to return to the industrial and residential area. Researchers must notify security to advise them of their presence in these areas outside of the industrial complex. Approximately 60 children may live in the residential area at one time. The same methods as above are used to prevent entry of the children into these areas.

Miscellaneous

Gardens may be present only at the residential areas. Due to the prolific deer population it is difficult to grow vegetables since they are consumed by the deer. Therefore a small percentage of food intake would be from gardens.

The recreation activities are limited to fishing in Lake Greenwood and hunting deer during the season (October 10 - December 31).

The procedure described by Nagy includes pipetting by mouth. The researcher is prohibited from mouth pipetting as are all researchers at Purdue.

Lake Greenwood is approximately 820 acres and the dimensions are 3.5 miles by 0.5 miles.

The instructions to people on base will include the phone number of the Command Duty Officer which is manned 24 hours/day. The notice will also include: "If sick, wounded or dead birds are found, they should not be handled." The Command Duty Officer will be given instructions describing procedures if birds are found.

In original documents submitted regarding the release of tritium to the environment some assumptions were made. All the assumptions were very conservative and in all instances illustrated the worst possible case. Many of the assumptions were also mutually exclusive which could lead to an overestimation in exposure by at least a factor of two.

Some of the factors that need clarification and reconsideration are below:

Deposition and Uptake of Tritium

The model assumes total deposition of all tritium on plants or uptake into plants such that consumption of all plants within a given area would result in the ingestion of all the tritium released. In reality many factors would prevent this from occurring.

1. Rainfall and subsequent runoff would remove up to 30 percent of the tritium deposited (NCRP).

2. Much of the water vapor respired by the birds would actually never be deposited on the ground. A small percentage would enter into the groundwater cycle and essentially be lost from circulation. Up to 60 percent may be lost by evapo-tanspiration to the atmosphere (NCRP).

3. In addition concentration by plants would not exceed 0.5 of the amount present in the environment.

Taking these factors into account the amount available from plants in the garden scenario and deer consumption scenario would be one-fourth.

0.5 (concentration by plants) x 0.5 (loss from environment by evapo-transpiration) = 0.25 reduction

Bioelimination

The model also assumed no biological elimination by deer or plants. If a half-life of 5 days in the deer (maximum probable) is assumed from the last release (August 15) to the beginning of deer season (October 6) three half-lives would pass. This could result in a reduction by one-eighth in the amount of tritium present. In addition, most deer would graze outside the 25 square mile nesting area and not have a diet that consists solely of tritiated plants.

0.125 reduction

Bird Density

The concentration of birds in the environment is also likely to be less than the 10 birds per square mile as originally stated. The habitats to be studied cover approximately 25 square miles. (See map provided) With a maximum of eighty birds the average density would be 3.2 birds per square mile. If this is rounded to 5 birds which excrete up to 0.25 millicuries the theoretical maximum would be 1.25 millicuries per square mile.

0.5 reduction

Conclusions

The scenarios regarding garden ingestion and deer consumption would change if these more realistic factors are considered.

1. For the garden ingestion the dose would be reduced by

   0.25 (Deposition and uptake of tritium) x 0.5 (Bird Density) = 0.125

   0.125 x .25 millirem = .031 millirem

2. For the deer consumption scenario the dose would be reduced by

   0.25 (Deposition and uptake of tritium) x 0.5 (Bird Density) x 0.125 (Bioelimination) = .016

   0.016 x 3 millirem = .048 millirem

Again these estimates would pertain to the maximally exposed individual and are not likely to be reached in normal circumstances.

Reference: National Council on Radiation Protection and Measurements, Report No. 62 March 9, 1979