

Overview of

SAVANNAH RIVER SITE TRITIUM DOSE ASSIGNMENT (ORAUT-OTIB-0003)

Due to the nature of work at certain Department of Energy facilities, workers may be exposed to radiation from tritium, a radioactive form of the element hydrogen. The Technical Information Bulletin (TIB), *Savannah River Site Tritium Dose Assignment* (ORAUT-OTIB-0003), provides guidance on how to estimate doses to workers at the Savannah River Site (SRS) from internal exposure to tritium. The tritium isotope can appear in several different forms and can be taken into the body through inhalation, ingestion, or skin penetration. Internal doses from tritium cannot be measured directly and must be calculated based either on (1) the amounts known to have been taken in, or (2) the amounts estimated to be in the body based on measurements of the amount of tritium found in urine samples.

At the Savannah River Site, most of the tritium which may have been taken into the body by workers was in the form of water vapor, where the water molecule in the vapor contains a radioactive hydrogen (tritium) atom. When inhaled, the tritium is distributed throughout the body, and is gradually excreted through the urine at a well-known rate. Measurement of the amount of tritium excreted each day permits a reliable estimation of the amount of tritium in the body.

It is also possible that some tritium may have present in the work environment in a more complex chemical form, such as carbon compounds. Tritium in such compounds is referred to as organically bound tritium. These more complex organically bound tritium compounds can stay in the body longer than the water form and, therefore, may result in higher doses. It is also possible for some of the tritiated water to become organically bound once inside the body.

At the Savannah River Site, the estimate of a worker's dose from tritium exposure was previously based only on the tritium excretion rates associated with tritium in the water or water vapor form and did not take into consideration that some workers might have been exposed to tritium in other forms. Some forms do have the potential to be retained in the body for time periods longer than for tritiated water. Thus, doses estimated from only the water vapor could underestimate total worker doses.

An additional concern with estimating doses from materials excreted in the urine has to do with the sensitivity of the detection instruments used to measure the tritium in urine. There is always a detection limit to testing methods. That limit is commonly called the minimum detectable activity. Below the minimum detectable activity, instruments are unable to detect very small amounts of radioactive material. This limit can change over time as modern technology makes it possible for instruments to become more sensitive.

To compensate for the instrumentation limits, dose reconstructors assign a "missed dose" to represent an amount of radioactive material that might be present but undetected in the urine. The dose reconstruction process requires that the "missed dose" be included in the estimate of the total dose. This procedure was originally issued to provide guidance on how to assign tritium dose from both measurable and missed dose urine levels of tritium at Savannah River Site. This guidance

appeared in the document in the form of two flowcharts which the dose reconstructors used in combination with data provided by the claimant.

SUMMARY OF FINDINGS RESULTING FROM TECHNICAL REVIEW

Review of the Technical Information Bulletin by the technical contractor for the Advisory Board on Radiation and Worker Health (the Board) produced the three findings summarized below:

Finding #1: The flowcharts are not self-explanatory and not entirely clear.

Finding #2: Guidance for the assignment of “missed” tritium dose in the procedure may be inconsistent with instructions provided in another guidance document, *Maximum Internal Dose Estimates for Savannah River Site Claims* (ORAUT-OTIB-0001).

Finding #3: The procedure only provides guidance for estimating doses from exposure to tritiated water or water vapor. It does not provide estimates of dose from organically bound tritium.

RESOLUTION OF FINDINGS

The National Institute for Occupational Safety and Health (NIOSH) agreed with all findings, cancelled the procedure, and replaced it with a new document, *Tritium Calculated and Missed Dose Estimates* (ORAUT-OTIB-0011). The Board found that the new document addressed the three findings satisfactorily.