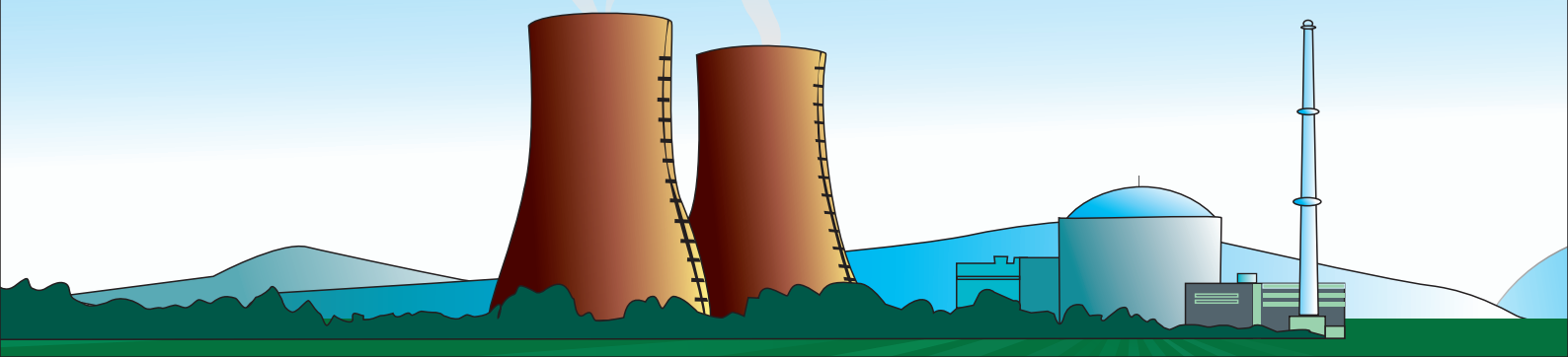
Tritium- A Fact Sheet

Tritium is an isotope of hydrogen. Tritium (^{3}H) is radioactive, emitting a low energy beta particle. It is present naturally in extremely low concentrations and present in our Pressurized Heavy Water Reactors (PHWRs).

Tritium (^{3}H) emits beta particles (electrons) with a maximum energy of 18.6 KeV, average energy of 5.7 KeV, and with a radiological half-life of 12.3 years. Its biological half-life is 6 - 10 days and will be reduced to 3% of its initial uptake within 5 biological half-lives. Tritium half life in the body could be further reduced by drinking extra fluids and thus the doses to body could be reduced.

Being an isotope of hydrogen, tritium has similar properties to ordinary hydrogen. As tritium is a low-energy beta emitter, the range of the most energetic tritium beta particles is only about 5 mm in air or 0.005 mm in water or soft tissue. This range makes it a non-hazard outside the body.

Tritium is considered as a mild hazard only when enters inside the body. Tritium primarily enters the body when people inhale the air borne Tritiated vapors during the course of the work in tritated atmosphere. People may also absorb it through their skin. Once tritium enters the body, it is quickly and uniformly distributed throughout the body. The associated low radiation dose to these tissues is generally uniform and dependent on the tissues' water



content. The body removes tritium naturally in the same way it removes water - by excreting it in the urine, sweat and feces.

In Nuclear reactors the most common mode of tritium uptakes are by inhalation and absorption through the skin. Only a minor part of the tritium inhaled remains in the body, and the majority is rapidly removed (by exhalation) following the exposure. On the other hand, tritiated water vapor is readily absorbed in body fluids and quickly distributed throughout the body within 1 to 2 hours. Hence the dose is uniformly distributed throughout the body.

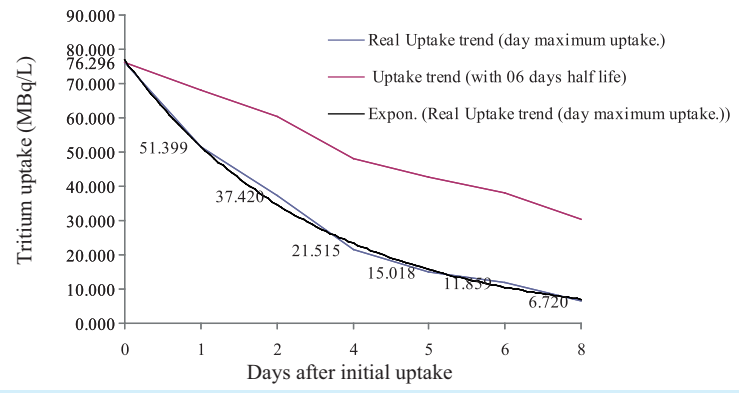
Urine samples are normally used for determining tritium concentrations in body water and committed doses are calculated. Workers who may be or who have been exposed to tritium are required to submit urine samples for bioassay periodically and whenever there is a potential for such exposures. The sampling period may be daily, weekly, or longer, depending on the tritium exposure. Additional urine samples are normally required after a work assignment with a high potential for exposure or actual high exposure.

After coming out of the tritiated atmosphere, the worker should empty the bladder immediately and submit urine sample 1 to 2 hours later to get the representative sample of the tritium concentration in the body water. The biological half-life of Tritium in human body water can be further reduced by increasing fluid intake under the guidance of a physician. The results of the bioassay measurements and their contribution to the worker's dose are informed / shared to the worker.

Limits:

In the absorbed dose range up to around 100 mGy (low LET or high LET) no tissues are judged to express clinically relevant functional impairment. Atomic Energy Regulatory Body (AERB) in India has defined a conservative dose limit of 20 mSv/year averaged over 5 consecutive sliding years. Since the dose limit includes both external and internal doses, AERB has also defined investigation level (IL, Level at which review should be done) of 4MBq/litre for tritium uptake found by urine sample analysis, which corresponds to a committed dose of only 2 mSv (which is approximately 10 % of the annual dose limit). Any radiation worker receiving tritium uptake greater than 1 IL is restricted from working in controlled areas.

Work restrictions are suggested or imposed to make certain that the annual dose limits for workers are not exceeded. Depending on the number of workers available and the importance of the work to be done, work planning is done such that the tritium uptake by an individual will be controlled well below the investigation level. Any dose in excess of the limits specified by applicable regulations is investigated and reported to AERB. In case of accidental high tritium uptakes, the individual dose is reduced by increasing turnover rate of body water, by simply increasing fluid intake, which reduces the biological half-life, as shown in the figure. However, this rate of excretion varies from individual to individual. Consultation with a physician is advised prior to increased turnover rate of body.



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