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My name is Arjun Makhijani and I am president of the Institute for Energy and Environmental Research. The following is my considered professional judgment.

I have looked over the material that STP has filed updating its Environmental Report. STP admits that groundwater at the nearest well, 1,400 feet offsite will be contaminated with tritium and is used for watering livestock (Stephen Burdick to Michael Gibson, November 12, 2009, Attachment 2, p. 8). But the document does not evaluate the effects of the use of this water for livestock and vegetables. Specifically, some of the tritium in the water will be become bound up in the organic molecules of the livestock as Organically Bound Tritium (OBT). The same will occur when tritiated water is used for irrigation and growing vegetables, fruits, or grains. The health impacts of eating contaminated livestock and vegetables for a given level of radioactivity per gram of food or water are considerably greater for OBT, which stays much longer in the body than tritiated water.

The following table provides research data that indicate that adults get higher doses for a given exposure to tritium when that tritium is in the form of OBT. Relative Biological Effectiveness is a measure of the relative biological damage per unit of energy deposition in the body by a radioactive material. The table also shows that fetal exposure is more damaging than adult exposure and that fetal exposure to OBT is the most damaging of all.

Table 9: Integrated Relative Biological Effectiveness of Tritiated Water and Organically Bound Tritium

Age	Form of tritium	5% Confidence limit	Median	95% Confidence limit
Adult	HTO	1.2	2.3	3.8
Adult	OBT	2.3	5.0	11.6
Fetus (maternal ingestion during pregnancy)	HTO	2.1	4.4	8.1
Fetus (maternal ingestion during pregnancy)	OBT	4.0	9.8	23.1

Source: Estimated from J.D. Harrison, A. Khurshheed, and B.E. Lambert, "Uncertainties in dose and coefficients for intakes of tritiated water and organically bound forms of tritium by members of the public." *Radiation Protection Dosimetry*, v. 98, no. 3, 2008, pp. 299-311, Table 8. The Integrated RBEs shown above were calculated by dividing the tritium doses in sieverts per becquerel shown in this paper by 1.73×10^{-11} , which is the dose conversion factor for tritiated water in sieverts per becquerel in the Federal Guidance Report 11 of the Environmental Protection Agency (EPA 1988).

This guide provides the dose conversion factors for "Reference Man." It is the source document for dose conversion factors used in RESRAD.

Note: HTO = tritiated water in which one atom of ordinary hydrogen has been replaced by an atom of tritium. OBT = Organically Bound Tritium. The numbers in the columns for confidence intervals mean that the RBEs would be less than the cited number for the percent of times indicated by the confidence interval were a series of identical experiments to be performed.

Source: Table published in Arjun Makhijani, Brice Smith, and Michael Thorne, Science for the Vulnerable, Institute for Energy and Environmental Research, Takoma Park, Maryland, 2006, p. 61.

The STP ER modification is incomplete in basic ways in failing to fully address the health consequences of the use of tritiated water in farming.



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