Texas Radiation Advisory Board **June 17, 2011**

Advisory on Radionuclides in Drinking Water

The Texas Radiation Advisory Board (TRAB) consists of 18 expert and public advisors on radiation issues appointed by the Governor. TRAB provides advice and recommendations to state regulatory agencies, to ensure effective regulation for the public benefit regarding radiation safety, public health and protection of the environment. This advisory is written to put in perspective the concerns expressed by some over the *potential* health effects from naturally occurring radioactive material that occurs, at some level, in all drinking water.

Everyone is exposed to radiation on a continual basis. People are exposed to three broad categories of radioactive sources: naturally occurring radioactive material (NORM), and medical and industrial sources of radiation. Natural radiation sources can be further subdivided into exposure from the earth, from outer space, and from within our own bodies. Exposure from the earth comes from the natural uranium, radium, thorium, and radon that occur in the air, soil and water.

As with any substance that may be potentially harmful to humans, it is the total amount of exposure to radiation, or the *dose*[1], that matters. The average annual dose from natural sources of radiation is approximately 300 millirem (a unit of radiation dose) per year per person in the US. Medical sources of radiation exposure are now about equal to all other combined exposures to radiation in the US. The total average annual dose for individuals living in the US is 620 millirem, when medical sources of radiation are included in the annual total. (NCRP 2009).

Naturally-occurring sources of radioactive material that humans can come in contact with include uranium and radium in drinking water. Water pumped from a well can carry radioactive material to the surface as part of the drinking water supply. This fact has been understood for decades. It is one of the reasons for the regulations, such as the federal Safe Drinking Water Act (SDWA), that set limits and testing requirements for radioactive material in drinking water.

In Texas, 49 out of the state's 4,728 community drinking water systems have reported radionuclide (radioactive material) levels in excess of state and federal regulatory limits as of June 15, 2011. As of 2003, the SDWA federal regulatory limits include (i) uranium, (ii) radium and (iii) "gross alpha." Gross alpha is a measurement of alpha radiation or energetic alpha particles, emitted from a radionuclide (an

[1] Here, dose (or effective dose) is the amount of radiation energy absorbed by the body, which is calculated to account for the different types of radiation (such as alpha and beta) and how sensitive different organs are to radiation (for example, bone compared to lungs). (HPS 2010a)

alpha particle is made up of two protons and two neutrons, and comes from the decay of some radionuclides, like uranium and radium). In a few Texas communities, monitoring results have indicated levels two to five times the regulatory limits in one or more sampling cycles.

For perspective, if individuals drink water containing radionuclide concentrations at (but not exceeding) a regulatory limit for a year, they would receive a dose for the entire year about the same as the average person gets from other natural sources in the course of a few days, or about 2 millirem. If a person drinks water at twice a limit, he/she would receive a dose for the year equal to the average person's natural dose received in 5 days, or about 4 millirem. Thus, the dose from drinking water for a year that exceeds a regulatory limit is far less than the average annual dose routinely received from natural sources of radiation.

Measuring the radionuclide concentration in drinking water is necessary to determine the radiation dose. Radionuclide concentrations are easily measured by detection of radiation from a water sample. Measurements are used to determine the radiation dose, and in turn, equate to the potential risk of future health effects from that dose. In "Radiation Risk in Perspective," the Health Physics Society (HPS), Specialists in Radiation Safety, stated:

> "In accordance with current knowledge of radiation health risks, the Health Physics Society recommends against quantitative estimation of health risks below an individual dose of 5 rem (5,000 millirem) in one year or a lifetime dose of 10 rem (10,000 millirem) above that received from natural sources," and "Estimation of health risk associated with radiation doses that are of similar magnitude as those received from natural sources should be strictly qualitative and encompass a range of hypothetical health outcomes, including the possibility of no adverse health effects at such low levels." (HPS 2010b)

In other words, the dose received from drinking water that exceeds a regulatory limit, by even a factor of 10 times, results in a dose of approximately 20 millirem, drastically below the 5,000 millirem level the HPS recommends as a dose below the level for calculating potential health risks. Therefore, based on current evidence, individuals who drink water that contains naturally occurring radionuclides at concentrations between 2-5 times a regulatory limit receive a dose that will fall below the range documented above. For other uses of drinking water aside from ingestion, the resulting dose is almost negligible. For people who consume water with such concentrations, there are no verifiable estimates of increased health risks, even after years of exposure, based on the TRAB's understanding currently available data.

NCRP 2009 NCRP Report No. 160, Ionizing Radiation Exposure of the Population of the United States, National Council on Radiation Protection and Measurements, Bethesda, 2009

HPS 2010a Environmental Radiation, a fact sheet of the Health Physics Society, adopted January 2010.

HPS 2010b Radiation Risk in Perspective, a position statement of the Health Physics Society, PS010-[i]2, revised July 2010

[i] For further information please contact John Hageman, CHP (jph@swri.org), or Ian Hamilton, CHP (ihamilton@swmail.sw.org).