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Handout: Groundwater Cleanup at Hanford: Will Public Health Be Protected?

Washington Physicians for Social Responsibility Hanford Task Force

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Groundwater Cleanup at Hanford: Will Public Health Be Protected?

Washington Physicians for Social Responsibility (WPSR) recently reviewed two reports produced by Columbia Riverkeeper titled, *Hanford 100-BC Reactor Area Cleanup* (Sept. 2005) and *U.S. Department of Energy: Cleanup or Cover-up?* (Sept. 2005). Our goal was to examine potential health threats from contaminated groundwater at Hanford based on the findings in these documents. These reports covered specific sections, the 100 and 300 Areas, rather than Hanford as a whole.

While the Hanford Nuclear Reservation is largely restricted, it is important to note that the Hanford Reach National Monument encompasses about 200,000 acres and a 51-mile stretch of the Columbia River. The Monument, which will be managed by the U.S. Fish & Wildlife Service, is partially open (Saddle Mountain National Wildlife Refuge) and allows visitors. It is expected to offer more tourist attractions in the future. Monument lands come within about 100 yards of the "B" Nuclear Reactor.

The focus of this summary is how groundwater has been impacted by weapons production at the Hanford Nuclear Reservation. Groundwater is water contained in subterranean deposits and can be a significant source for irrigation, drinking, industrial uses, and cooling. An estimated 200-square miles of groundwater beneath Hanford are contaminated, with 80-square miles contaminated above drinking water standards.

According to the Columbia Riverkeeper reports, eight contaminants found in the groundwater at Hanford exceed the Environmental Protection Agency's (EPA) Maximum Contaminant Levels (MCLs) for drinking water. Strontium, tritium, technetium-99, nitrate, carbon 14, trichloroethylene, uranium, and chromium (VI) were all found to exceed the EPA's "acceptable risk" levels for drinking water. Five of these eight are radioactive contaminants: strontium, tritium, technetium-99, uranium, and carbon 14. Radioactive contaminants are of particular concern because of their half-lives. A half-life is the time required for a radioactive substance to lose 50 percent of its activity by decay. Half-lives tell us the great lengths of time some of these toxic substances will remain a threat at Hanford. Other known contaminants in the groundwater that are not discussed here include carbon tetrachloride, which is chemically toxic and carcinogenic, and iodine-129, which is radioactive.

Strontium (Sr-90) is a radioactive isotope with a half-life of 29 years. Sr-90 is a byproduct of the fission of uranium and plutonium in nuclear reactors and nuclear weapons. It is not harmful unless ingested or inhaled. It can bioaccumulate in the bones and bone marrow and replace calcium in the human body, causing bone tumors and blood cell cancers.

Tritium is the only radioactive isotope of hydrogen. It has a half-life of 12 years. As with all ionizing radiation, exposure to tritium increases the risk of developing cancer. About 80 percent of tritium in the environment is from former nuclear weapons production and fallout from past testing. At Hanford, tritium in the groundwater was produced by irradiation of reactor cooling water.

Technetium-99 (Tc-99) is a silver-gray, radioactive metal that is manufactured. It has a half-life of 210,000 years. Technetium-99 has no significant industrial use. It is found primarily in radioactive wastes from former nuclear weapons facilities as a byproduct from the operation of nuclear reactors. According to the EPA, most Tc-99 in the environment comes from detonation of nuclear weapons (especially atmospheric weapons tests), nuclear reactor airborne emissions, nuclear fuel reprocessing plant emissions, and facilities that treat or store radioactive waste. Ingestion is the primary way people are exposed to

Tc-99, either by eating contaminated food or drinking contaminated water. Exposure to technetium-99 increases the likelihood of developing cancer.

Carbon 14 is a naturally occurring radioactive isotope of carbon, best known for its use in radiocarbon dating. It has a half-life of 5,700 years and is present in the low-level radioactive wastes at Hanford. Large amounts of carbon 14 were also released to the atmosphere as a result of nuclear weapons testing. It can enter the body through inhalation, contaminated drinking water, or contaminated food. The health hazard of carbon 14 is associated with cell damage caused by the ionizing radiation that results from radioactive decay, with the potential for subsequent cancers.

Chromium VI is an inorganic metal that is used widely in industry for chrome plating, leather tanning and wood preservatives. Serious industrial exposure through inhalation has led to lung cancer and is therefore considered a carcinogen by the EPA. Ingesting large amounts of chromium can cause stomach ulcers, convulsions, kidney and liver damage, and even death (ATSDR*). Chromium is seeping into the Columbia River through the riverbed and riverbank and may have a genetic-altering effect on salmon.

Trichloroethylene (TCE) is a liquid solvent for cleaning metal parts. TCE causes toxicity to the nervous system, liver, kidney, heart, and immune system. Impaired fetal development in pregnant women may occur, although the extent of this effect is not yet clear (ATSDR).

Nitrates are inorganic nitrogen-oxygen chemicals used primarily in fertilizers. They are also used in weapons production, explosives, pulp and paper mills, and other miscellaneous industries. When nitrates are ingested they are converted to nitrites, which interfere with the oxygen-carrying capacity of the blood. Long-term exposure may interfere with kidney function and cause hemorrhaging of the spleen.

Uranium is both radioactive and toxic. It is a naturally occurring element that is very dense and heavy. The greatest health risk from large intakes of uranium is toxic damage to the kidneys. Uranium-238 is used to produce plutonium-239, which was the primary mission at Hanford. It is mildly radioactive and has a half-life of 4.5 billion years. The U.S. Department of Energy (USDOE) only considered the radioactivity of uranium, not its toxicity, in its modeling. Uranium-238 is a primary groundwater contaminant in the 300 Area at Hanford.

Conclusion

WPSR concludes that based on the reports of Columbia Riverkeeper, and unless the USDOE makes drastic changes in groundwater remediation, the human use of the groundwater at Hanford in the 100 and 300 Areas must be prohibited permanently. Compounding uncertainties are likely to worsen the situation. These include further contamination in these areas from the highly toxic 200 Area groundwater, worsening conditions with the merging of contaminated plumes, unknown extent of contamination in the vadose zone (the area between ground surface and the water table) and how to address it, and the lack of more robust technologies to mitigate many of these contaminants.

**Other references in addition to the Columbia Riverkeeper reports cited include the ATSDR (Agency for Toxic Substances and Disease Registry) and EPA web sites.*

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