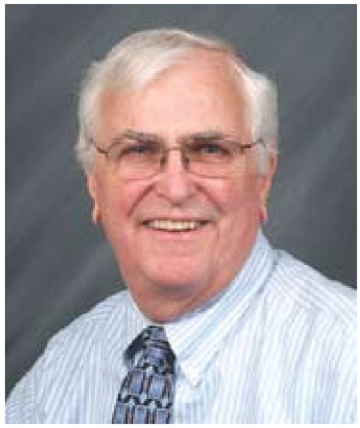
# Let's Tell the Truth About Plutonium and Hanford

*by Michael R. Fox, Ph.D.*



On July 10, 2010, the *New York Times* published another article about the Hanford nuclear site in Eastern Washington, this one by veteran reporter Matthew Wald. (http://tinyurl.com/2azj5kz). It requires some corrective comments.

During World War II, Hanford was chosen by the Army Corps of Engineers to be one of the sites in what was then called the Manhattan Project. Hanford produced the majority of the nation's inventory of plutonium, including that in the bomb dropped on Nagasaki.

Having many decades of experience working at Hanford, including working with plutonium and managing a plutonium laboratory, it gets wearisome to read such superficial, inadequate, and misleading articles.

Given this specialized background, I feel an obligation to comment on the article by *Times* reporter Wald, the report he reports on, the authors of the report,* and some of the references listed in the report. My objections include the huge lack of context, exaggerations, omissions of fact, omissions of key research findings regarding health effects of plutonium, omissions regarding interesting aspects of the Hanford environment, inadequate literature sourcing, and omission of comments on other materials such as americium.

Let's start with the headline: "Analysis Triples U.S. Plutonium Waste Figures." Nowhere in his article does the reporter provide the relative magnitudes of the before and after values. Therefore, the reader cannot assess for himself the amounts of plutonium involved. Three times a small number is still a small number, for example. As written, therefore, the headline is irrelevant and meaningless.

But in the universe of problems with this *Times* article and the report it is based on, the lack of information on "Plutonium Waste Figures" only hints at what lies ahead in terms of other irrelevancies.

Savannah River Site/DOE

*A processed "button" of plutonium.*

The apparent purpose of the paper and the *Times* article is to create another image of looming doom related to the Hanford clean-up mission. Such stories of impending doom from Hanford have been frequent fare from Hanford critics for more than two decades, and all of them suffer from the same litany of exaggerated fears.

Central to the scare stories are the two familiar concepts—"deadly" plutonium and 24,000-year half-life. These have been common bugaboos since the 1970s, when the antinuclear forces and their friends in the media yapped in concert like Pavlovian dogs. The scare stories haven't changed for nearly 40 years, yet during this time thousands of workers operated quite safely with plutonium, because we happen to know a lot about it and how to work safely with it.

When one is managing a plutonium lab, with dozens of workers, personal safety of friends and colleagues was always of utmost importance and a no-nonsense part of everyday life. That safety effort paid off, in terms of establishing an excellent health and safety record. Obviously, we worked hard and carefully with safety training, laboratory conduct, practices, and habits.

### Gee-Whizzy Half-Lives

Now for that big number: One is reminded of children discovering a gee-whizzy new word or big number for the first time. "Hey, Dad, want me to count to 100?" With regard to that frightening 24,000-year half-life, the term half-life is commonly applied to all known radioactive materials, and is not scary for anyone

DOE

*The F Reactor plutonium production complex at Hanford. The boxy building between the two water towers on the right is the plutonium production reactor; the long building in the center of the photograph is the water treatment plant*

who has taken course work in radiochemistry.

Nor in the universe of radioactive substances is the 24,000-year number unusual for a half-life. For example, potassium-40 is radioactive and along with two other non-radioactive forms of potassium, is measurably present in all forms of life—including humans, this author, the report authors, and the *Times* reporter. It has a half-life of 1.4 billion years. It is there in living tissue and quite measurable with today's detectors.

Radioactive thorium exists in all soil samples around the world, and has a half-life of about 14 billion years. Carrying the half-life discussion to its obvious absurd ending, elements such as lead, mercury, and arsenic, as stable elements may be described as having half-lives of eternity in length.

When one checks with the "Chart of the Nuclides," there are more than 3,000 known nuclides, and all but about 250 are radioactive. Many of them form and decay in trillionths of a second or less, and do not occur in abundance naturally. But we still know a lot about them. Others, as noted above, have half lives of billions of years.

One long-lived uranium nuclide has a half-life of about 4.5 billion years, the age of the Earth. Uranium, which can be found in all soil samples in the world, was discovered in 1896 by Antoine Becquerel of France. It has been 114 years since that discovery of natural radioactivity, yet I'd dare estimate that even as a part of our natural environment, 99 percent of the public cannot give a 5-minute discussion on the subject. Same for about 100 percent of the media.

After more than a century of such public ignorance regarding our natural environment, it's way past the time that we learn. This is but a part of the huge context missing from these discussions and articles.

**Natural Radioactivity and Risk**

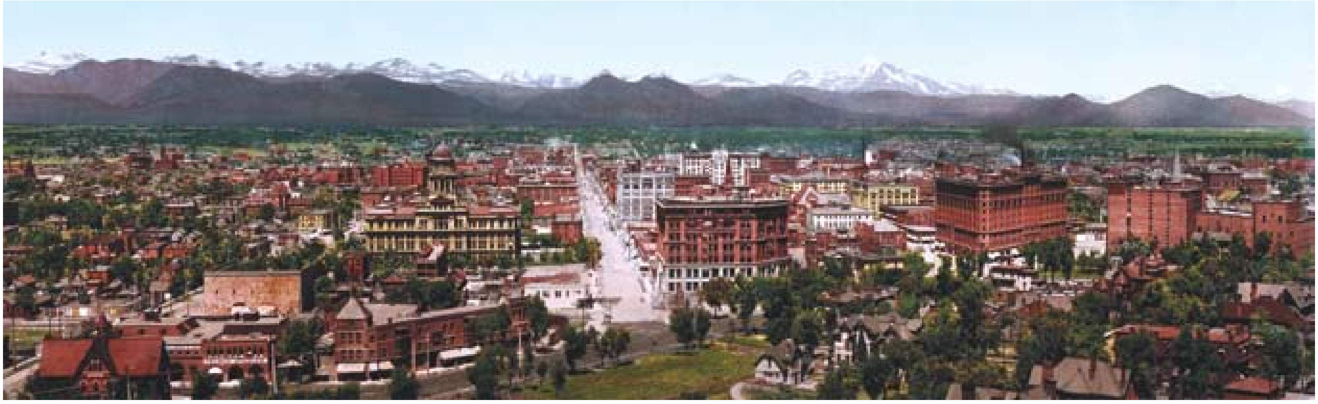
The discovery of natural radioactivity turned the world of physics upside down for the next 60 years, and was and still is a major factor in the history of 20th Century physics. There is much more to this subject than merely plutonium and its 24,000-year half-life. This world of physics is essentially unknown to the American public and to the uncurious media.

The Hanford Reservation is one of the most heavily monitored tracts of land in the world, and it has been reported on annually for about 40 years. These annual reports are in the open literature, and available to all. (See for example *Hanford Site 2008 Environmental Report,* http://hanford-site.pnl.gov/envreport/) Not surprisingly, these reports are rarely discussed by either the anti-Hanford critics or by any of the media.

These reports are phenomenal in both scope and depth of details. The distribution list for these annual reports is huge, going to state and Federal agencies across the nation. The reports also help explain why Hanford is *not* a threat to public health, because the radiation doses are far too small—often less than

DOE

*The canyon deck of the 820-foot-long 221-B plutonium processing plant at Hanford, which produced weapons plutonium during World War II.*



Library of Congress

*Putting radiation in perspective: The "Mile High" city of Denver, Colorado in 1898. Then, as now, residents of Denver received more natural background radiation (50 millirem) than U.S. citizens living at sea level (26 millirem). Radiation doses at the Hanford site are small, often less than the doses received from natural radioactivity.*

the doses received from natural radioactivity.

Based upon these environmental monitoring programs, relevant epidemiology programs, dosimetry measuring and monitoring programs, etc., for both workers and surrounding populations, the radioactive health threats from Hanford operations are so extremely small that they are statistically indistinguishable from zero.

Since the health threats from the Hanford operations are so small, a huge ethical problem arises out of risk management considerations. As of July 2009, Washington State had 6,664,195 people. The average mortality rate was 725 per 100,000, or a total of 48,285 funerals in 2008. Nearly 22 percent (10,622) of these were from heart disease and about 20 percent (9,657) of these were from cancer. Suppose we were concerned about reducing the cancer mortality rates for the State of Washington, with a fixed budget to do so. How would we allocate such resources?

Common sense would dictate using such allocations where the mortality rates were well above expected values. These locations do exist in Washington State, but such locations do not include Hanford. Given that the cancer excesses occur elsewhere in the state, what fraction of that fixed budget should be directed at reducing cancer at Hanford? The answer, if fairness applied, would be little or none.

However, the Hanford clean-up program (portrayed as a huge safety program) is costing taxpayers about $2 billion per year, with estimates approaching $100 billion before it's done. No matter how much money is spent on Hanford cleanup efforts, a decline in the cancer rates will never be shown, because the Hanford cancer rates are quite normal now. In terms of basic principles of risk management, the Hanford cleanup is a tragic waste of taxpayer resources in the alleged pursuit of public safety.

Using the same fixed budget in the pursuit of public safety, hundreds, perhaps thousands of Washington State lives could be saved by spending these resources protecting people from measurably more harmful activities.

**'Pure and Simple' Lies**

The *Times* reporter quoted the activist lawyer Gerry Pollet as saying "What is reasonably foreseeable is that there are people who will be drinking the water in the ground at Hanford at some point in the next few hundreds years. We're going to be killing people, pure and simple."

Plutonium toxicity is most assuredly not that "pure and simple." The activist lawyer apparently is a captive in his own demon-haunted world, as Carl Sagan might have said. His well-rehearsed lines have been commonly heard from him and from the anti-Hanford movement for years, without supportive evidence.

His statement is not supported by environmental and epidemiology studies of plutonium. His statement that "It has been found to cause lung, liver, and bone cancer in humans" is also referenced in the Alvarez report,* to another pamphlet with the same quote. The pamphlet was published by the Agency for Toxic Substances and Disease Registry (ATSDR). It, too, does not provide the literature source of the above statement about plutonium.

Since the statement is unreferenced it must be considered hearsay, of which there is plenty to choose from.

In strong contrast to the *Times* article, there are many quantitative scientific analyses of the "Myth of Plutonium Toxicity," such as that by Dr. Bernard Cohen, at the Department of Physics at the University of Pittsburgh. (See, for example, http://russp.org/BLC-3.html.)

**Some Plutonium Realities**

My experiences with laboratory studies of plutonium show that it is spectacularly insoluble in water and most other solvents. Plutonium prefers to remain in the solid state, often bound to soil solids; thus any study of the transport of plutonium through underground soil formations begs great and detailed scrutiny.

In many cases, plutonium also should not be considered lethal even if it is ingested. At low doses of plutonium in humans, epidemiology studies show that it was difficult to find observable harm, let alone cancer, and let alone death. The

* The report, by professional anti-nuke Robert Alvarez, has been accepted for publication in *Science and Global Security*, a journal published by Princeton University's Woodrow Wilson School of Public and International Affairs.

DOE

*The Hanford site on the Columbia River. "After nearly 40 years, the Hanford critics continue to repeat the same old scare stories."*

cited report made no mention of these human epidemiology studies and the negative results.

My friend and scientific colleague Richard Emery performed a study of one of the ponds at Hanford which had received low levels of plutonium (http://tinyurl.com/25odcag). It was described as "one of the most contaminated bodies of water" in the world. This may have been factually true, but was missing the important context.

A careful reading of his research paper shows a much more interesting description of the pond, which had phenomenally low levels of plutonium. It actually supported a rich and diverse wildlife population from the bass and bluegill fish in the water, to a number of birds, and the population of predators of herons and coyotes.

These animals were thriving because the plutonium radiation doses were extremely low (in spite of the exaggerations). Emery also calculated that if a human ate one pound of the fish from this U-pond every day for 70 years, he would not receive a significant dose of radiation—hardly cancerous or lethal.

The pond and the rich wildlife populations have now been destroyed, thanks to fear and science illiteracy and the millions of dollars used to do so. This is one of the prices we pay for fear, exaggeration, and lots of money.

After nearly 40 years, the Hanford critics continue to repeat the same old scare stories, and the media continue to repeat the scares without fact checking, and continue to ignore a lot of the scientific literature. We have also learned that these "true believers," in the words of author Christopher Booker, exhibit a kind of moralistic self-righteous fanaticism justified by the supposed transcendent importance of their cause.

For years, this fanaticism has prevented an atmosphere of serious discussion, let alone a rational approach to the risk management of Hanford. In fact, the scare stories have made a mockery of risk analyses and risk management, not to mention the waste of billions of tax dollars thrown at Hanford cleanup in the pursuit of small or zero risk.

---

*Michael R. Fox, Ph.D., is a nuclear scientist and a science and energy resource for* Hawaii Reporter *and a science analyst for the Grassroot Institute of Hawaii. Now retired, he has nearly 40 years experience in the energy field and he also taught chemistry and energy at the university level. His interest in the communication of science has led to several communications awards, hundreds of speeches, and many appearances on television and talk shows. He can be reached via email at mike@foxreport.org.*

*A version of this article previously appeared in the* Hawaii Reporter.