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Analysis Triples U.S. Plutonium Waste Figures

By **MATTHEW L. WALD**

WASHINGTON — The amount of plutonium buried at the [Hanford Nuclear Reservation](#) in Washington State is nearly three times what the federal government previously reported, a new analysis indicates, suggesting that a cleanup to protect future generations will be far more challenging than planners had assumed.

Plutonium waste is much more prevalent around [nuclear weapons](#) sites nationwide than the Energy Department's official accounting indicates, said Robert Alvarez, a former department official who in recent months reanalyzed studies conducted by the department in the last 15 years for Hanford; the Idaho National Engineering Laboratory; the Savannah River Site, near Aiken, S.C.; and elsewhere.

But the problem is most severe at Hanford, a 560-square-mile tract in south-central Washington that was taken over by the federal government as part of [the Manhattan Project](#). By the time production stopped in the 1980s, Hanford had made most of the nation's plutonium.

The plutonium does not pose a major radiation hazard now, largely because it is under "institutional controls" like guards, weapons and gates. But government scientists say that even in minute particles, plutonium can cause cancer, and because it takes 24,000 years to lose half its radioactivity, it is certain to last longer than the controls.

The fear is that in a few hundred years, the plutonium could reach an underground area called the saturated zone, where water flows, and from there enter the Columbia River. Because the area is now arid, contaminants move extremely slowly, but over the millennia the climate is expected to change, experts say.

The finding on the extent of plutonium waste signals that the cleanup, still in its early stages, will be more complex, perhaps requiring technologies that do not yet exist. But more than 20 years after the Energy Department vowed to embark on a cleanup, it still has not

“characterized,” or determined the exact nature of, the contaminated soil.

The department has been weighing whether to try to clean up 90 percent, 99 percent or 99.9 percent of the waste, but because the extent of contamination is unclear, so is the relative cost of the options. For now, the preferred option is 99 percent.

Government officials recognize that they still have a weak grasp of how much plutonium is contaminating the environment. “The numbers are changing,” said Ron Skinnarland, a radiation expert at the Washington State Department of Ecology, which is trying to enforce an agreement it reached with the Energy Department in 1989 for the federal government to clean up Hanford.

So far, the cleanup, which began in the 1990s, has involved moving some contaminated material near the banks of the Columbia to drier locations. (In fact, the Energy Department’s cleanup office is called the Office of River Protection.) The office has begun building a factory that would take the most highly radioactive liquids and sludges from decaying storage tanks and solidify them in glass.

That would not make them any less radioactive, but it would increase the likelihood that they stay put for the next few thousand years.

In 1996, the department released an official inventory of plutonium production and disposal. But Mr. Alvarez analyzed later Energy Department reports and concluded that there was substantially more plutonium in waste tanks and in the environment.

The biggest issue is the amount of plutonium that has leaked from the tanks, was intentionally dumped in the dirt or was pumped into the ground.

Mr. Skinnarland said much of the waste was 90 or 100 feet underground, too deep to dig out. Some contaminants can be pumped out, but that does not work well for materials that contain low concentrations of plutonium.

The Energy Department has researched the possibility of shooting electric currents through the soil to create glasslike materials that would lock up contaminants, but it has not analyzed whether the technique would work at those depths.

Inés R. Triay, the assistant secretary of energy for environmental management, did not dispute Mr. Alvarez’s new analysis of department figures. She said that decisions on the long-term cleanup would rely not on the 1996 inventory but on a systematic sampling of the waste, which she said had yet to begin.

Mr. Alvarez's report has been accepted for publication later this year by *Science and Global Security*, a peer-reviewed journal published by [Princeton University's Woodrow Wilson School of Public and International Affairs](#).

Another problem raised by the inaccuracies in the 1996 figures is that they could complicate the negotiation of new agreements with Russia or other countries about destroying bomb fuel, said Frank N. von Hippel, a professor of public and international affairs at the [Woodrow Wilson School](#) and a co-chairman of the journal's board of editors.

Gerry Pollet, executive director of the environmental group [Heart of America Northwest](#), said the government should embrace a cleanup plan that assures that even thousands of years into the future, an unsuspecting public will not be overexposed.

"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 hundred years," Mr. Pollet said. "We're going to be killing people, pure and simple."

Plutonium was first manufactured in World War II for use in bombs. (The one that destroyed Nagasaki in 1945 originated with plutonium made at Hanford.) For decades, the government produced it in military reactors by bombarding a natural element, uranium, with subatomic particles called neutrons, converting uranium to plutonium, and then using chemical processes to harvest the plutonium.

The new analysis indicates that the chemical separation process was not nearly as efficient as the government claimed and that a lot of the plutonium was left behind in various stages.

It also suggests that estimates of plutonium production by the Energy Department and its predecessors, including the Atomic Energy Commission and the Manhattan Project, were not nearly as accurate as scientists and bureaucrats said they were.

[Releasing declassified figures in 1996](#), the Department of Energy said that 111,400 kilograms (about 123 tons) of plutonium had been produced at Hanford or taken there from civilian reactors or foreign sources.

Of that, 12,000 kilograms were "removed," the department said. Some of that plutonium was consumed in weapons tests or in bomb attacks like the one on Nagasaki, but 3,919 kilograms of plutonium were stored as waste at Hanford, it reported.

However, Mr. Alvarez's analysis, based entirely on Energy Department documents, shows that the amount discarded as waste was actually 11,655 kilograms, nearly three times as much, and that the total inventory of plutonium produced and acquired was closer to 120,000 kilograms,

not 111,400.

Mr. Alvarez's estimate indicates that enough plutonium is buried at Hanford to create 1,800 Nagasaki-size bombs, he said, but he played down any possibility of a weapons threat. "I don't think anybody stole anything," he said.

This article has been revised to reflect the following correction:

Correction: July 12, 2010

An earlier version of this article misspelled the name of the environmental organization Heart of America and the name of Ron Skinnarland.