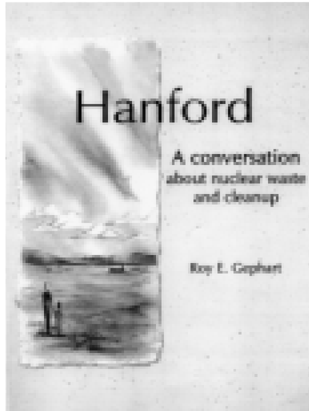
Why Hanford's Nuclear Waste Cleanup Wastes Your Money

by Michael Fox, Ph.D.



Hanford: A Conversation about Nuclear Waste Cleanup
By Roy E. Gephart
Columbus, Oh.: Battelle Press, 2003
Hardcover, 388 pp., $34.95
(available from www.battelle.org/bookstore)

To this day, the history of Hanford, the eastern Washington laboratory of the Manhattan Project, remains largely in the minds of its retirees, and in the highly technical old reports stored in several repositories. Prior to Roy Gephart's book, the histories which have been attempted are largely (but not completely) written either by anti-nuclear critics or newcomers to Hanford. The few attempts which have been written by scientists, are good as far as they go, but they are not nearly as comprehensive as the topic needs and deserves.

Dr. Gephart recognized the glaring need of setting the historical record straight regarding the activities at Hanford, and what has transpired there over the past 60 years. As such, he undertook the extraordinary task, with the support of his current employer, Pacific Northwest National Laboratories, of researching the incredibly complex activities.

I should note here that I have known the author, Roy E. Gephart, for nearly 20 years. I know him to be a knowledgeable scientist (in hydrology), and we worked together on one of the many projects which have come and gone at Hanford, namely, the Basalt Waste Isolation Project (BWIP).[1]

Because of Gephart's diligence and attention to detail, this book represents, by far, the best history which has been written to date. He captures much of the technical, engineering, and radiological issues so often garbled or exaggerated by less qualified historians. For these reasons alone, I recommend his book for anyone curious to learn what actually transpired. The book is immensely readable, complete with helpful highlights in the margins.

I have a number of criticisms of the book, however. I'll start with his subtitle, "A Conversation About Nuclear Waste Cleanup." Conversations are fine, but what do comments of the critics of Hanford, which the author provides in many places, add to the conversation? Introducing the negative comments of Hanford critics may appeal to some, but it adds nothing to the understanding of Hanford, detracts from the overall presentation of important history, and reduces the rigor needed for such an important document.

Further, the critics' comments are well known for being predictable, judgmental, and relatively free of scientific insight. A hint of this emerges as early as in the book's Foreword, where the judgmental margin comments were disappointing, and continues in too many places throughout the book.

In fact, Gephart seems to join the Hanford critics in the *presumption* that the risks from Hanford radioactivity are unacceptably high. Thus, Gephart introduces an aspect of Hanford history which has little to do with science and engineering, and a lot to do with unsupported criticism of Hanford. Unfortunately, these quotes, apparently intended to show deference to critics (however unscientific and motivated with political agendas), weakens the book. If we wanted such criticisms, we could read the local and regional newspapers, where they get wide coverage.

Exaggerated Risks

What does not come across in Gephart's chosen format is the fact that the clean-up activities and the $2 billion a year being spent on them are completely out of proportion to the actual Hanford risks involved. To this day, the quantified risks to the public from Hanford (as demonstrated in all appropriate Environmental Impact Statements) are *statistically indistinguishable from zero!*

These risk analyses are not secret, but have been performed, and the risks quantified and published a number of times for many Hanford activities. For example, every Environmental Impact Statement (EIS) is required by law to include a study of the risks that would be incurred by doing nothing—the so-called "No Action" options. In the matter of the Interim Storage of Hanford Tank Wastes, the "No Action" option would produce estimated collective doses at the Hanford boundary that range between 2.6×10^{-4} to 1.6×10^{-2} person-rem. These are extremely small collective doses. (In comparison, the natural background radiation is 360 millirem per year, individual dose.)

And for latent cancer fatalities (using the Linear No-Threshold conversion methodology) the "No Action" option would result in 2×10^{-7} deaths per year to 8×10^{-6} deaths per year. Again, these are very small numbers, so small as to be completely unmeasurable. In other words, even with this flawed methodology of considering any radiation above zero to be dangerous, the predicted risks are less than one death per 200,000 people per year.

Thus the huge expenditures for cleanup are protecting the public from tiny to zero risks. The members of the taxpaying public are entitled to know what are the actual annual risks, deaths, injuries, and so on. They are also entitled to be told what the expected benefits of

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spending an estimated $50 billion will be. Further, they are entitled to be told when these benefits will occur—now, or 10,000 years from now. And they need to be told how flimsy the science is underlying the decisions to spend $50 billion in the pursuit of zero risk.

Spending Billions on Nothing

For the record, based upon numerous risk analysis and safety analysis results, the expected health benefits from this huge investment will be so small as to be *unobservable.* This absence of health effects is the direct result of the many safety programs implemented at Hanford over the years. Overall, the historical safety record at Hanford has been excellent. Simple comparisons of the Hanford safety data with the safety data of other more common industries (agricultural, lumbering, logging, fishing, manufacturing, and so on) show the Hanford health risks to be impressively small.

As thousands of health records and epidemiology studies show, worker monitoring was extensive and diligent, and millions of taxpayer dollars have already gone into this effort. The excellent health and safety data of Hanford are consistent with more than a half dozen epidemiology studies of Hanford workers, and residents of the surrounding communities. These show nothing unusual—no greater incidences of disease, for instance. Such results are studiously avoided, however, by Hanford critics, the media, elected officials, contractors, and regulatory agencies.

Based on this and other information, I consider the clean-up activity in great measure to be a grotesque waste of the nation's resources. I contend that these expenditures are totally out of proportion, relative to the expected health benefits, are scientifically unjustified, and would be socially unacceptable if the public were honestly told of this sad situation. Throwing billions of the nation's resources at small or unobservable risks, however, is all too common across the nation.

Gephart himself says this, "The whole process screams for simplification" (p. viii).

How Did We Get in This Mess?

The Linear No-Threshold model of radiation harm bears much of the blame for this waste. The LNT was first established as a management tool, simply as a conservative device to protect workers by *overestimating* the health effects of radiation. It was never intended to describe the actual biological relationships between radiation and health effects.

Over the years, the transformation from a simple radiation management tool to the scientific expression of the health effects of radiation took place in full view of the scientific world. This transformation developed gradually over time, and has been the underlying basis for the horrendous costs needed to comply with the large overestimations of observable risks. The actual health research data and analyses are not adequately considered by radiation protection agencies in setting radiation dose limits. They presume, despite the data, that low-level radiation, even at the smallest levels, causes adverse health effects. Current knowledge of biology and carcinogenesis has refuted this presumption.[2]

The Secrecy Issue

My other chief criticism concerns the secrecy issue. On page 6.1, Gephart states: "It took several decades to chip away the wall of secrecy surrounding Hanford contaminant release." Although this is the prevailing dogma of the Hanford critics and the media, it is not accurate.

First, the secrecy imposed on the operations of Hanford was demanded by federal law, and was not the choice of those who operated or worked at Hanford. The Atomic Energy Acts of 1946 and 1954, and related amendments, were just the beginning of the legal strictures imposed.

Many Americans today are too young to remember the frightening days of World War II, the first Soviet bomb test in 1949, and the clearly stated warnings of conflict by Winston Churchill, so it is not surprising today that so many condemn secrecy out of hand. They don't have the historical perspective that we older people had when our nation's very future was in doubt. There was good reason for such secrecy then, and American citizens would not have tolerated putting the nation's future and its defense, and military secrets, in the hands of enemies.

Further, there were serious national defense implications in revealing information about the amounts of radioactivity released from Hanford. Here's why:

If one knows: (1) the fission yields of the fission products for Uranium-235 (or Plutonium-239), one can estimate (2)

Courtesy of Westinghouse Hanford

Studies of Hanford workers and residents of the surrounding communities show no unusual disease rates. Here, Hanford workers in the mess hall, during the 1943-1944 construction era.

Courtesy of Westinghouse Hanford

The Hanford Reservation in eastern Washington, showing construction of the first plutonium production reactors and auxiliary buildings, 1943-1944.

the annual amounts (in curies) of each fission product isotope. If one knows (3) the breeding ratios for producing Pu-239 from the neutron absorption of Uranium-238, one can estimate the annual amounts of Pu-239 being produced at Hanford.

Thus, an intelligent enemy could estimate the number of weapons being produced annually (carried out elsewhere in the complex) by the United States. Revealing this number, or those factors by which it could be estimated, was unlawful and dangerous military and security policy. Therefore, publicizing the amounts released was forbidden by law.

Similarly, the fission energy of U-235 is well known, about 200 MeV/fission. So too are the heat capacity of water (1 btu/lb/°F) and the flow rate of the Columbia River (about 100,000 cubic feet per second) as it passes through the Hanford Reservation). By publicizing the difference between the upstream and downstream temperatures of the Columbia River, again one could estimate the number of U-235 fissions and, therefore, the annual amounts of Pu-239 being produced.

Non-Secrets

Furthermore, much of the Hanford contamination data was never secret, as contended by the Hanford critics and the media! This, among all else, demonstrates the power of the media to mislead the public for decades.

To give some examples: The United Nations convened the first International Conference on the Peaceful Uses of Atomic Energy in August 8-20, 1955, in Geneva, Switzerland. The Proceedings of the meeting were published in a series of 16 volumes. These Proceedings are a matter of public record, and can be found in many public libraries in the United States, including here at Hanford.

These volumes contained hundreds of papers on many subjects, including the health effects of radiation. In turn, many of the papers contained listings of several dozen references to earlier literature on these subjects. These were also not secret.

A second United Nations International Conference on the Peaceful Uses of Atomic Energy was held in Geneva Switzerland, between September 1 and 13, 1958. The Proceedings from this Conference contained a total of 33 volumes. All of these volumes have been in the public domain for 46 years and are quite accessible for anyone interested. In several instances, Hanford scientists presented their findings at these conferences on radioactive materials from Hanford.

On page 6.5, Gephart briefly mentions the 1986 declassification and release of 19,000 pages of secret documents about past contaminant releases, one of several such information releases during those times. But, the question has to be raised: Were these documents all secret, and has any of the information been withheld? The reasons for these questions are that many librarians were involved, as Gephart states, with the "retrieval, declassification, and release of these documents." Being intimately involved with the actual labor-intensive processes of de-classification, they have a somewhat differing view of these "secret documents."

In a letter dated November 15, 1988, one of the research librarians wrote: "In regards to the HEAL FOI request for documents released on April 8, 1987: Of the pages comprised in that request: a. 73% had never been classified b. 24% had been classified earlier (often years earlier) c. 3% had to be classified for the FOI request d. 84% had been made publicly available earlier.

"Of the reports included in that request: a. 48% had never been classified b. 47% had been declassified earlier."

Not to put too fine a point on this, some of the documents which were released were secret weekly reports and had not been formally declassified at the requested time. However, the information contained in the weekly reports had been published in monthly reports which had been declassified earlier.

Releases vs. Natural Radiation

Most of these documents are also publicly available in the Hanford Reading Room in Richland, Washington, and maintained as a repository for such purposes. In one short visit, I found a public Hanford document (one of thousands) entitled "Evaluation of Radiological Conditions in the Vicinity of Hanford for 1959, HW 64371, R.L. Jenkins, et al." What is remarkable about the document was its distribution list of dozens of agencies around the nation, including many universities, companies, government agencies, and others. It included the U.S. Public Health Service regional office located in Portland, Oregon, at the time. It also included the Oregon State Board of Health (Portland), Washington State Department of Health (Seattle), Washington Pollution Control Commission (Olympia, Wash.).

That is, not only was this document *not* secret, but dozens of copies were mailed all around the United States. This was a common distribution practice for many of these Hanford documents.

This particular document of 1959 reported a number of radioisotopes contained in agricultural products grown around the Hanford site, including carrots, beets, turnips, asparagus, potatoes, beans, fruits, grains, and even milk. While the report provided isotopic concentrations of fission products from Hanford in these food crops, it also provided the food concentration of radioactive potassium-40 (K-40) as well. This is crucial, because the K-40 is a *naturally occurring radioisotope* with a half-life of 1.3 billion years.

In all the tables in the report, the K-40 levels always were *higher* than those of the other isotopes, often by factors of 10 to 20! That is, the naturally occurring K-40 was more prevalent in the food than were the man-made isotopes. The K-40 levels were in the range of 2 to 6 picocuries (pCi) per gram of food sample. Even today, the K-40 levels found in milk from around the world are typically 0.8 to 1.4 pCi/gm, or about 800 to 1,400 pCi per liter of milk.

The presence of naturally occurring K-40 in all living organisms, plant and animal, has largely escaped notice, discussion, and understanding. For nuclear scientists, natural radioactivity such as K-40 is well known, even a nuisance, especially in environmental samples, because it is always there along with others. For the rest of the uninformed public, the fact of natural radioactivity is a revelation!

Thus, most of the allegedly "secret" and "withheld" Hanford pages/documents were neither secret nor withheld! Certainly several of the documents were still formally secret, but little or no analyses were made to determine whether the information contained in

The Mission of the Hanford Reservation

The Manhattan Project was created during World War II to exploit fission energy in the pursuit of making nuclear weapons for military purposes. It was divided into two main pathways: the making of a nuclear weapon based upon the Uranium-235 device, and the other based upon the Plutonium-239 device. Each process required different physics, different chemistries, and different separation and purification processes. For example, the use of U-235 required diffusion plants for isotope enrichment, while the Pu-239 required chemical separations and no enrichment.

On December 2, 1942, Enrico Fermi and his team successfully demonstrated a controlled chain reaction in a small fission reactor at the University of Chicago. President Roosevelt appointed General Leslie Groves to head the Manhattan Project. Later that month Groves's new military advisor, Colonel Frank Mathias, had explored the Western United States to find the best site for the plutonium half of the Manhattan Project. A very memorable moment in this reviewer's life, was sharing an evening with Colonel Mathias discussing these momentous historical decisions and events.

By March 1943 (notice only three months had passed), the small towns of Vernita, White Bluffs, and Hanford in eastern Washington, had been evacuated, and the Manhattan Project had begun in the desert of eastern Washington. According to Colonel Mathias, the criteria for siting Hanford included: great distance from the uranium efforts (sited in Oak Ridge, Tennessee), remoteness, access to large amounts of water (such as the nearby Columbia River), and access to large amounts of electricity (Grand Coulee Dam in eastern Washington had just been completed).

Making Plutonium

Hanford produced plutonium oxide. No nuclear weapons and no weapons-ready plutonium were manufactured at Hanford. The plutonium making processes included: (1) breeding of plutonium in nuclear production reactors; (2) ejection of the irradiated fuel rods from the reactor after a predetermined time; (3) chemical separation of the plutonium from the nuclear wastes, unused uranium, and fuel cladding; (4) conversion of the plutonium to a solid oxide from a solution; (5) shipping the oxide to other weapons facilities for fabrication into weapons; and (6) pumping the large amount of liquid nuclear wastes to underground storage tanks constructed for this purpose. (By contrast, the Soviet nuclear weapons programs handled their high level nuclear wastes by simply pouring them into the Techa River near Chelyabinsk.)

Now, for more than two decades, the plutonium production reactors have been shut down, as have other plutonium facilities. The wastes are still there, although because they are radioactive, they are decaying away as the laws of physics demand.

In this reviewer's 30-year Hanford career, 50 percent of all the cesium-137 and strontium-90 has decayed away to non-radioactive products. So too, have 100 percent of the iodine-131, and more than 85 percent of the low-energy radioactive tritium, which continues to decay.

Gephart also points out (p. 5.4) that between 1989 (when cleanup began) and 2002, about 130,000,000 curies of radioactivity have decayed away to naturally non-radioactive products. This process continues naturally, without any expenditures. Predictably, such inevitable radioactive decay, reduced inventories, and reduced health risks, have not diminished the number of scare stories about Hanford and the exaggerations of the critics.

During the intervening 60 years since the beginnings of the Manhattan Project, many other science and engineering activities have been undertaken at Hanford, including molecular science studies, biochemistry, genome studies, environmental studies, medical isotope production, reactor safety studies, and many others. The Northwest's only commercial nuclear power station is also sited on the Hanford Reservation.

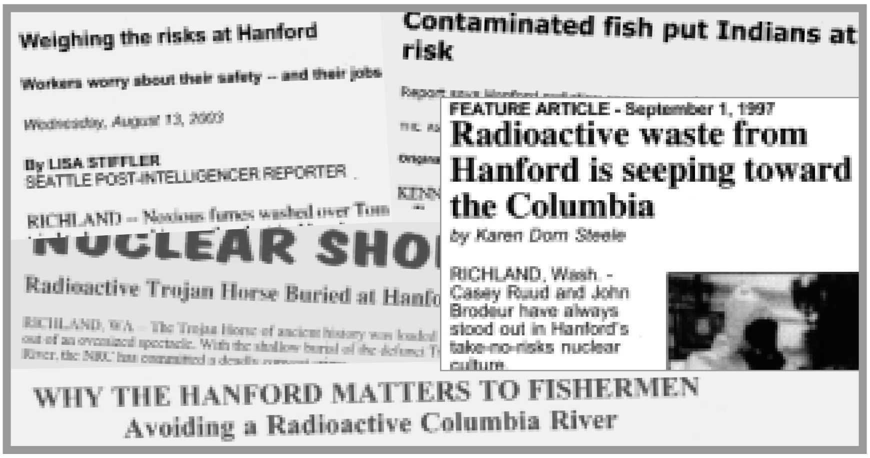
the documents had in fact been secret, and had not been released earlier in other unclassified documents.

What we are dealing with in the media coverage of the Department of Energy "secrecy" issues, could be described as true journalistic incompetence and laziness, invariably with duplicity, if not collaboration, with the many Hanford critics. Collectively, they refused to do their homework and perform the searches of the massive Hanford literature publicly available.

The Federal agencies have also been derelict in their duties to inform the American citizens, and to distribute more widely the findings of their own researchers. There is plenty of criticism to be leveled at the Department of Energy, too. A good place to start would be its Public Information Programs. A 1980 public report of the U.S. House of Representatives Committee of Science and Technology, "The Department of Energy's Public Information Programs: Major Changes Needed," was critical of the politicized DOE. This report documents, for example, that the DOE contributed considerable sums of money to an antinuclear rock group called the "Plutonium Players."

These government weaknesses must not be used as a license to misrepresent Hanford history, which began long before the existence of the DOE.

Given the massive and useful work by Roy Gephart in assembling the huge volume of historical engineering details of Hanford, I don't fault him for the short shrift paid to the secrecy issues, or the environmental radiation issues. These are complex, easy to exaggerate, and difficult to understand. Although in my assessment the history of Hanford remains to be written, Gephart's book takes us much farther down this road than any before.


Weighing the risks at Hanford
Workers worry about their safety -- and their jobs
Wednesday, August 13, 2003
By LISA STIFFLER
SEATTLE POST-INTELLIGENCER REPORTER
RICHLAND -- Noxious fumes washed over Tom

Contaminated fish put Indians at risk

FEATURE ARTICLE - September 1, 1997
Radioactive waste from Hanford is seeping toward the Columbia
by Karen Dorn Steele
RICHLAND, Wash. - Casey Ruud and John Brodeur have always stood out in Hanford's take-no-risks nuclear culture.

NUCLEAR SHO
Radioactive Trojan Horse Buried at Hanf

WHY THE HANFORD MATTERS TO FISHERMEN
Avoiding a Radioactive Columbia River

The scare stories continue, while radioactivity decays.

Notes

1. The BWIP was one of several studies being conducted at the time by the Department of Energy at Hanford. Its purpose was to evaluate the Eastern Washington Basalt Flows as a possible site for the geological disposal of high level nuclear wastes. It was one of the precursor sites to the current Yucca Mountain site now being evaluated in Nevada some 18 years later.
2. Many renowned scientists are extremely concerned with the wasted resources expended in the pursuit of zero risk. To give you a sense of how biology and radiation scientists characterize the use of the LNT (Linear No-Threshold) basis of radiation protection, here are some quotations:

(1) [I find the LNT] "to be without scientific foundation and a deeply immoral use of our scientific heritage" (Dr. Lauriston Taylor).

(2) "I do not hesitate to say that the LNT is "the greatest scientific scandal of the 20th Century" (Dr. Gunnar Walinder).

(3) "Populations have been studied in geographic areas of increased natural radiation, in radiation-exposed workers, in patients medically exposed, and in accidental exposures. No reproducible evidence exists of harmful effects from increases in background radiation three to ten times the usual levels. There is no increase in leukemia or other cancers among American military participants in nuclear testing, no increase in leukemia or thyroid cancer among medical patients receiving I-131 for diagnosis or treatment of hypothyroidism, and no increase in lung cancer among nonsmokers exposed to increased radon in the home.

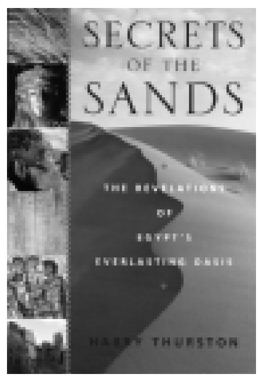
"The association of radiation with the atomic bomb and with excessive regulatory and health physics ALARA radiation levels practices has created a climate of fear about the dangers of radiation at any level. However, there is no evidence that radiation exposures at the levels equivalent to medical usage are harmful.

"The unjustified excessive concern with radiation at any level, however, precludes beneficial uses of radiation and radioactivity in medicine, science, and industry" (Nobel Laureate Rosalyn Yalow, Ph.D., Senior Medical investigator Emeritus, Mt. Sinai School of Medicine, New York).

The Axiomatics of Fascist Archaeology

by Rick Sanders

Secrets of the Sands: The Revelations Of Egypt's Everlasting Oasis
by Harry Thurston
New York: Arcade Publishing, 2003
Hardcover, 388 pp., $25.95



Will this book with its tantalizing title tell us something about the beautiful petroglyphs in the deserts of Africa, or of ships dating back many thousands of years B.C.? Are we going to peer into the minds of the ancient shipwrights, explorers, and hydraulic engineers?

Not in this book! The stories it tells have the following underlying axioms:

- The world is overpopulated.
- The Earth's resources are finite.
- There is no way that man can create new sources of fresh water.
- Irrigation can only lead to salinization.
- Global warming is on the way.
- Anthropologists are nice people, who are concerned that people squander their resources and then die in famines and epidemics.
- George Bush's Barrick Gold, other looters, private armies of mercenary