

Oak Ridge's secret plutonium experiment, part 2

(As published in *The Oak Ridger's Historically Speaking* column on January 11, 2016)

This is part two of a two part series of *Historically Speaking* in which Carolyn Krause brings us the account Ebb Cade, the first human to be injected with plutonium. I know that sounds horrible...but it happened, right here...in Oak Ridge! It happened to Ebb Cade.

Carolyn Krause has thoroughly researched the hard to accept facts surrounding this first attempt to learn the effects of plutonium on a human. Here is what she learned:

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Ebb Cade was the first of the 18 hospital patients nationwide selected for a plutonium injection. Ironically, the small amount of plutonium-239 delivered as a citrate salt to the Army hospital in Oak Ridge came from Los Alamos, which had obtained its first grams of plutonium from the Graphite Reactor in Oak Ridge; the Clinton Labs reactor was a pilot plant that first demonstrated that usable amounts of plutonium could be produced and separated from a uranium-fueled reactor.

Dr. Louis Hempelmann, director of the Los Alamos Health Group, ordered Wright Langham, a biochemist in the group, to send the plutonium (with injection instructions) to Dr. Hymer Friedell. He in turn sent the sample with a written order to Dr. Joseph Howland, an Army physician at the Oak Ridge hospital who initially objected to the oral order. [In testimony to the Advisory Committee on Human Radiation Experiments in 1994, Dr. Friedell said Dr. Dwight Clark did the injection.] Cade was injected with 4.7 micrograms of the plutonium on April 10.

Five days later Cade's bones were set, and bone samples were taken for a biopsy to determine how much of the injected plutonium remained in his bones. Because medical personnel observed that Cade's teeth were badly decayed, 15 were extracted. At the Los Alamos lab Langham analyzed Cade's bone, urine, fecal and possibly tooth samples for plutonium content.

The urine samples were collected from Cade daily or every three days up until the 89th day after the injection. Then Cade departed suddenly from the hospital on his own initiative. Eight years later he died of heart failure on April 13, 1953, in Greensboro, N.C. No evidence autopsy was performed on Cade's body to look for radiation effects.

Whether Cade had signs of cancer within eight years after his injection is not known. Had he lived 10 to 20 years longer, he might have developed radiation-induced cancer. What is known is that he was not asked to sign an informed consent form that stated he was willing to subject his body to a radiation experiment.

In 1947, in response to the human radiation experiment in 1945 in Oak Ridge, the Army's Medical Board of Review stated:

"We believe that no substances known to be, or suspected of being, poisonous or harmful should be given to human beings unless all of the following conditions are fully met: (a) that a reasonable hope exists that the administration of such a substance will improve the condition of the patient, (b) that the patient give his complete and informed consent in writing, and (c) that the responsible next of kin give in writing a similarly complete and informed consent, revocable at any time during the course of such treatment."

After a Chicago meeting in May on the results of the first two plutonium injection experiments, the Manhattan District Medical Office in Oak Ridge in June 1945 lowered the provisional allowable body tolerance for plutonium to a conservative 1 microgram. Thus, a plutonium worker with a "body burden" of close to 1 microgram should be transferred to a job with no plutonium exposure. (Cade's body had retained more than 85 percent of the injected 4.7 micrograms because of extremely low rates of urinary and fecal excretion.) The Hanford site adopted an even lower provisional limit of 0.5 microgram. Later results comparing fission tracks of plutonium and radium injected in dogs showed that radium deposits throughout bone but plutonium particles deposit only on bone surfaces. Plutonium was once

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considered 50 times less dangerous than radium, but results from plutonium injections in the 1940s suggested that plutonium is only 4 times less dangerous than radium, which may have killed its discoverer, Nobel Laureate Marie Curie.

The plutonium, polonium, and uranium injection experiments were investigated in 1974 by the Atomic Energy Commission and in 1994 by the Advisory Committee on Human Radiation Experiments, created by President Bill Clinton's executive order, after Secretary of Energy Hazel O'Leary declassified Cold War-era records, including those on human radiation experiments. In the 1990s it was revealed that none of the long-lived plutonium patients and workers had plutonium-induced tumors.

The Environmental Protection Agency states on its website: "External exposure to plutonium poses very little health risk, since plutonium isotopes emit alpha radiation, and almost no beta or gamma radiation. In contrast, internal exposure to plutonium is an extremely serious health hazard. It generally stays in the body for decades, exposing organs and tissues to radiation, and increasing the risk of cancer. Plutonium is also a toxic metal, and may cause damage to the kidneys. Plutonium particles in dust are the greatest concern, because they pose the greatest health risk. "

Although he was not given the right to informed consent or compensation (other than free healthcare), Ebb Cade should be remembered for his legacy as a source of data that led to protection of plutonium workers from deadly toxicity and disease.

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Thank you Carolyn for a well-researched treatment of the facts of a hard to accept and understand situation that happened right here in Oak Ridge. While there are tremendous advances in technology coming from research done here, there is also the Ebb Cade story that is a part of our history and has its place in the interpretation of the Manhattan Project National Historical Park – Oak Ridge.



Operating room in early Oak Ridge Hospital (Photo by Ed Westcott)

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Oak Ridge Hospital close up looking north (Photo by Ed Westcott)



Oak Ridge Hospital front view looking west (Photo by Ed Westcott)