

# H-Bombs, Science, and Baby Teeth

By Robert Alvarez and Joseph Mangano

How many nuclear weapons can be detonated in support of weapons development or during a war before imperiling humans from radioactive fallout? That's the question the Atomic Energy Commission (AEC) asked in the 1950s. To find the answer, independent scientists and citizens turned to baby teeth. Lots and lots of baby teeth.

Why baby teeth? The AEC collected human tissues from around the globe (Kulp, 1957) to understand the cumulative impacts of radioactive fallout from nuclear testing. The most commonly measured isotope in these tissues — strontium 90 (Sr-90) — is absorbed as if it were calcium. This isotope lodges in human bone tissue for many years and was the principal contaminant of concern in fallout investigations, known as Project Gabriel and Project Sunshine, done in the early 1950s. This effort, which started as a health study, later inspired a political movement to end nuclear weapons testing.

“The most worldwide destruction could come from radioactive poisons,” researchers at Los Alamos National Laboratory speculated in 1945. They suspected that radioactive fallout from 10,000 megatons exploded in the open air might be enough to threaten human life on the planet (Manhattan District History Project, 1961).

Edward Teller, the prime mover in developing thermonuclear weapons, applauded building a 10,000 megaton “gadget” during a meeting of the AEC’s General Advisory Committee in July 1954. This “shocked” committee member Walter Whitman, head of the department of chemical engineering at MIT, because, “it would contaminate the Earth” (U.S. Atomic Energy Commission, July 1954).

At the time, Project Sunshine was secret. More than 1,500 human samples were collected in this effort, including many from deceased children in Europe and Australia without parental consent (ABC News Live, 2005). The United States also developed registries to study the uptake of plutonium from weapons fallout of human tissue samples collected from deceased members of the U.S. general public (McInroy, 1995) and deceased nuclear workers (Washington State University, 2021).

## Scientists recommend a landmark baby tooth study

Atmospheric testing of hundreds of nuclear weapons continued, leading Herman Kalckar, a biologist with the National Institutes of Health, to propose an international program measuring Sr-90 in baby teeth. In his August 1958 *Nature* article, Kalckar wrote:

“The official public health agencies of every nation... should organize a large-scale collection of milk teeth ... and conduct measurements of radioactivity on this material.... Such an International Milk Teeth Radiation Census would contribute important information concerning the amount and kind of radiation received by the most sensitive section of any population namely, the children” (Kalckar, 1958).

In response, the St. Louis Committee for Nuclear Information and scientists at Washington University, starting in December 1958, began assembling the most significant collection of human samples in the atmospheric bomb test era. Parents of children born after World War II donated 320,000 baby teeth. Unlike the AEC, which had shrouded its human tissue collection in secrecy, the baby tooth survey was widely advertised. The survey’s goal was to demonstrate that a child’s absorption of consequential radioactive elements from nuclear testing was not an abstract issue. The survey was deliberate in combining scientific research with a political movement to end the nuclear arms race.

The baby tooth survey showed that America’s children from the “baby boom” generation were absorbing Sr-90 from nuclear weapons testing. While the survey results played an important role in the ratification of the Limited Test Ban Treaty in 1963, the treaty did not slow the pace of nuclear buildup. Still, the treaty became the first, little-recognized, global

environmental agreement to stem the poisoning of the planet. Also, the wisdom and extraordinary effort of preserving these baby teeth for some 60 years opened doors for cutting-edge research involving an array of pollutants.

## Citizen scientists collect 320,000 teeth

Schools, libraries, parent-teacher associations, churches, dental offices, scout groups, and other community organizations volunteered to help the St.



Photo by American Childhood Cancer Organization

Louis Committee for Nuclear Information collect baby teeth. Each tooth was placed in a small envelope and given a unique number. In addition, information was collected on small index cards about the tooth and tooth donor. Washington University set up a speaker’s bureau to increase public knowledge about the program, in which they recruited luminaries like Benjamin Spock and Linus Pauling to speak on behalf of the tooth study.

While St. Louis remained the center of the program, activists in other states contributed teeth as well. Teeth were prepared for Sr-90 lab testing by volunteers, who sent them to Harold Rosenthal, a chemist at Washington University. Rosenthal then measured the ratio of Sr-90 to calcium. Lab costs were covered by grants from the U.S. Public Health Service and the Danforth Foundation.

The teeth were crushed into powder and placed in a liquid solution, which removed decay and fillings. They were divided into separate, homogeneous groups according to the uptake of Sr-90 in teeth. These groups were based on tooth type (molars, incisors, or cuspids), location (by metropolitan area), infant-feeding status (bottle-fed or breast-fed), and birth year and month. Since most Sr-90 in baby teeth is taken up late in pregnancy and early infancy, birth date was a key data element in the study.

Every child donating teeth to the committee was rewarded with a small metal button that children wore on their clothing. The button had a picture of a smiling boy with a gap in his front teeth, with the words “I Gave My Tooth to Science” below the picture. Decades later, thousands of children from that era recall the button, and some have even saved them. The artwork for the teeth is now part of a collection in the Smithsonian Institution.

## Tooth study results hasten test ban treaty

The tooth study results were compelling: Average Sr-90 in St. Louis incisors for bottle-fed persons born in the last half of 1954 were more than three times the amount found in incisors with the same profile in the last half of 1951: 0.588 picocuries Sr-90 per gram of calcium as opposed to 0.188 (Reiss, 1961). These results were published in late 1961 in *Science* by Louise Reiss, an internist who ran the study.

This rise was consistent with the ongoing bomb tests in Nevada, which began in January 1951. Several years later, Rosenthal published a journal article that showed that, for St. Louis births, the Sr-90 average concentration increased sevenfold from 1951 to 1957 (Rosenthal, 1963). Eventually, the increase

was calculated to be 20- to 80-fold from 1950 to 1963 births (Rosenthal, 1969).

Study results were sent to President John F. Kennedy’s science advisor Jerome Wiesner, who discussed them with the president. Kennedy was growing concerned about the buildup of fallout and the need for a ban on aboveground nuclear tests. Historical accounts from that period document Kennedy’s concern, including one written by Kennedy’s advisor and biographer, Theodore Sorenson:

“And I told him that it was washed out of the clouds by the rain, that it would be brought to earth by rain, and he said, looking out the window, ‘You mean it’s in the rain out there?’ — and I said ‘Yes’; and he looked out the window, looked very sad, and didn’t say a word for several minutes” (Sorenson, 1965).

Physician Eric Reiss, husband of Louise and another concerned physician from Washington University, testified to the U.S. Senate in August 1963 during which he

cited the buildup of fallout in humans as a critical reason to support the treaty. Soon after, the Senate overwhelmingly voted for the test ban, Kennedy signed the treaty, and aboveground tests from the superpowers ended permanently.

Barry Commoner, a Washington University biologist and primary organizer opposing nuclear weapons testing, led an effort to collect and analyze baby teeth from children around the country. He sought to speed the enactment of a ban on atmospheric testing. According to Commoner:

“The U.S. Senate was a nest of cold-warriors and, according to common wisdom, was unlikely to ratify the [Limited Test Ban] treaty. But the Senate was besieged by letters, many of them from parents who abhorred the idea of raising their children with radioactive fallout embedded in their bodies. What convinced the senators was not so much their constituents’ fear of radiation, but that they were informed; they knew how to spell ‘strontium-90’ and could explain precisely why it was so dangerous. The treaty was easily ratified” (Hall, 1997).

Thus, the baby tooth survey played a key role in the establishment of the first modern international environmental treaty, which mitigated further poisoning of the planet by radioactive detritus. The baby tooth survey demonstrated that, by joining movements to protect the human environment, scientists and citizens can make a positive difference.

## Tooth study was halted before understanding health effects

The baby tooth study was designed to speed the passage of the treaty, but it also raised concerns about health hazards from fallout. In particular, some proposed that baby teeth could be used to calculate excess risk. A story in *Newsweek* magazine stated:

“But what about the children who have done their growing while Sr-90 levels were high — are they liable to develop cancer? No one can answer with certainty, but St. Louis’s ‘Operation Tooth’ is one way scientists have of finding out” (*Newsweek*, 1960).

“We wanted to do a 10- to 15-year follow-up health study. We always said the value of the research could only be borne out by tracking children 15 years later,” said Yvonne Logan, a Committee for Nuclear Information member who took over operations for the tooth study in the early 1960s (Logan, 2003). However, no such attempt was made due to technical issues of accurately testing single teeth.

The study continued after the treaty. A major fire struck the Committee for Nuclear Information