

The Irradiated Dime Atomic Energy Museum



The Radioactive Process

- Irradiation is the process by which a nonradioactive item has radiation directly exposed to it via direct concentrated exposure.
- A mixture of radioactive antimony and beryllium is enclosed in a lead container.
- Gamma rays from the antimony are absorbed by the beryllium atom and a neutron is expelled by the beryllium atom in the process.
- These neutron (having no electrical charge) penetrate the silver.
- This exposure modifies the normal silver-109 designation to a temporary radioactive silver-110 designation.
- After irradiation, the dime is dropped out through a slot in the lead container and rests momentarily in a Geiger tube so the radioactivity may be demonstrated before being put in a souvenir contained.

The Timeline Of Radioactivity

- Radioactive silver with a half-life of 22 seconds long decays rapidly to cadmium-110.
- Every 22 seconds, half of the radioactivity in the dime is gone and continues at this rate until all of the silver-110 has become cadmium.
- Copper atoms (Cu-63 and Cu-65) are converted into Cu-64 and Cu-66 by irradiation. The activated copper had a 5 minute decay process and would have a relatively small impact on the totals of atoms being modified.
- During the entire process only an exceedingly minute fraction of the silver atoms have been made radioactive.
- By the time the visitor would leave the museum, the radioactive concern of any deviation of both the silver and copper atoms had been minimized to practically none. Advanced testing equipment would be needed to find any trace of modification made by the irradiation process.

Why Was This Made For The Public?

- During the 1950s, the Oak Ridge Graphite Reactor was the world's largest source of radionuclides, which revolutionized the field of medicine, industry, and other science disciplines.
- Radionuclides were produced in several ways, but neutron activation was believed to be perhaps the most important. This was because it could be safely demonstrated for people to see and for them to participate in the process.
- The dime irradiator located in Oak Ridge, Tennessee was used specifically to hold such demonstrations for public visitors at what is known today as the American Museum of Atomic Energy.



Miss Universe, Aspasra Hongsakula of Bangkok, Thailand, receives a radioactive dime as a souvenir of her visit to the American Museum of Atomic Energy in 1966. (ORAU News)

Production & Survivability

- According to a 1954 press release for the Atomic Museum of Atomic Energy, at that time more than 250,000 dimes had been irradiated.
- This process was done at multiple locations, and on customer demand, meaning they were not produced with a predetermined quantity.
- In the late 1940s / early 1950s, irradiated dimes were produced at the Oak Ridge National Laboratory under the management of the Oak Ridge Institute for Nuclear Studies.
- Encased dimes were also produced at the atomic energy exhibits at multiple Mid-South Fairs during the 1950s and early 1960s. Some mobilized fairs (just think about how this could have ended badly) include one held in Memphis, Tennessee, and the 1964 World's Fair in New York.
- Best estimates is that the program officially ran for 1949 to 1967.

Examples You Can Look At And Touch!



Production Problems

- Gamma neutron sources have two problems:
 - The gamma emitter is short lived, thus having to be occasionally be reactivated in the reactor.
 - The gamma source presents an exposure hazard that requires shielding.
- Because of this, the antimony-beryllium source was replaced by a plutonium-beryllium source. In the 1960s the museum requested from the Atomic Energy Commission to use an americium-beryllium source.
- AEC Chairman (Glenn Seaborg) who had discovered plutonium denied the request. The solution was to increase activity of the plutonium being used.
- Since casings were not sealed it is possible the irradiated dime has been switched out for one that was not. It is very possible some of these dimes were put back into circulation and even melted for scrap silver purposes.
- After the “clad” composition for the dime started in 1965, the museum would purchase rolls of dimes from local banks and search them for usable silver examples to keep the program going. Both the Roosevelt Dime and Mercury Dime (Mercury Head) were used.