

Key questions addressed by the research

Q. What were the most significant contaminants released from the plant?

A. Of the more than 8,000 materials used or stored at Rocky Flats, plutonium and carbon tetrachloride were identified as the major contaminants that moved off-site. Radioactive tritium also was released into the creeks on the plant site on several occasions and entered a reservoir downstream. Beryllium, used in weapons production, dioxin, a byproduct from incineration, and uranium also were carefully studied.

Q. When and how were the materials released from the plant?

A. Plutonium was released during routine industrial production from 1953 to 1989. Within the facilities, plutonium operations were conducted in enclosed cabinets, called gloveboxes. The gloveboxes allowed manipulation of the plutonium but kept it separated from the workers. Many minor fires and accidents released plutonium dust inside the gloveboxes. Gloveboxes had filtered ventilation systems that discharged through air exhaust systems or through separate vents. The filtration systems did not collect all the airborne plutonium, and small amounts were released to the environment through building rooftop vents and the tall stack of Building 71. The stack and vents were monitored, and the measured releases reflect the discharges that resulted from routine work.

The researchers identified two major events that caused the largest plutonium releases to areas outside the plant boundaries. These events included a fire that occurred in the plutonium processing building in 1957, and windblown releases, mainly during 1968 and 1969, from an outdoor waste oil storage area. A second, larger fire occurred in Building 776 in 1969. Because of multiple effluent filters and the actions of firefighters to maintain building integrity, the release of plutonium to the environment was smaller compared to the two other events. Another major release from Rocky Flats was the chemical carbon tetrachloride. This release occurred over many years.

1957 Fire



The fire burned through air filters in the ventilation system, leaving the metal framework.

A major release of plutonium from Rocky Flats occurred on September 11 and 12, 1957, as a result of spontaneous combustion of plutonium stored inside gloveboxes in Room 180 of Rocky Flats Building 71. Plastic in the gloveboxes caught fire and burned. The fire spread from the gloveboxes through the ventilation system to banks of flammable filters. While the fire in the room was extinguished in less than an hour, the fire in the large main filter bank burned vigorously for three to four hours. Most of the release occurred during this period, although smoldering continued for another nine hours.

The exact amount of plutonium released from the 1957 fire is impossible to determine accurately for several reasons. After 40 years, firsthand information is limited about when the fire started and how it progressed. However, despite such limitations, scientists found new data and information to develop better estimates. Scientists were able to reconstruct a plausible fire scenario and to calculate the amount

of plutonium released. They estimated that between 40 and 500 grams (or 2.9 and 36 Ci) of plutonium-239, -240 were released into the air and carried off-site. The median value was 300 grams (or 20 Ci).

903 Area



Barrels corroded and leaked plutonium-contaminated oil onto soil. Weeds grew through the badly corroded bottoms of these barrels.

Additional major releases occurred at the 903 Area, located directly east of the main buildings at the Rocky Flats Plant. The 903 Area contained about 5,000 30- and 50-gallon steel barrels filled with waste oil and solvents that were contaminated with plutonium and uranium. Acids created in these waste barrels caused extensive corrosion. An estimated 5,000 gallons of plutonium-contaminated waste oil leaked from the corroded drums onto the soil.

The leaking barrels were moved in 1967 and 1968; however, contaminated soil was disturbed during the clean-up effort and left exposed for months. Researchers estimated that between 20 and 200 grams (or 1.4 and 15 Ci) of plutonium-239, -240 had leaked onto the 903 Area soil.

When Rocky Flats staff monitored and mapped the area in July 1968, they found soil contamination covering 261,000 square feet (six acres), with the highest plutonium concentrations in the top inch of soil. Windstorms in late 1968 and early 1969 blew plutonium-contaminated soil particles on- and off-site, affecting a much larger area.

Subsequent soil sampling east of the 903 Area indicated that this wind-blown soil was a major contributor to off-site contamination. The amount of plutonium-239, -240 estimated to have been released to the off-site environment from the 903 Area was between 25 and 200 grams (or 1.8 and 15 Ci), with a median value of 52 grams (or 3.7 Ci).

An asphalt covering (commonly called the 903 Pad) was placed over part of the 903 Area in mid-1969 to control windblown contamination. However, winds continued to transport smaller quantities of plutonium from areas not covered by asphalt. Gravel was later placed in the 903 Area east to the interior fence line to reduce subsequent wind-driven suspension of plutonium-contaminated dust.

1969 Fire

On May 11, 1969, a plutonium fire broke out in the processing section of Building 776, creating what was then considered to be the most costly industrial accident in United States history. As a result of independent measurements of soil contamination after the fire, the public learned about earlier plutonium releases from the 903 Area and the 1957 fire.

The fire started when plutonium, stored in an open can, began to smolder. The can was one of many located inside a plastic storage chest in the glovebox. The heat from the slowly burning plutonium caused the plastic to catch fire, igniting large quantities of other materials. During the fire, plutonium was discharged from the booster fan system into the environment. It traveled onto the roof and into the air. It was estimated that between 0.14 and 0.9 gram (or 10 and 60 mCi) of plutonium-239, -240 was released

and carried off-site. The median value was 0.3 gram (or 20 mCi).

Carbon Tetrachloride

Carbon tetrachloride, a commonly used cleaning solvent, was another major contaminant released off-site through routine, day-to-day operations. Carbon tetrachloride releases were found to be the most significant of the plant's chemical releases in terms of potential off-site impact to humans. It is estimated that 1,100 to 5,400 tons were released from the plant between 1953 and 1989. Carbon tetrachloride was released to surface water, but likely evaporated before it reached public water supplies.

Other releases

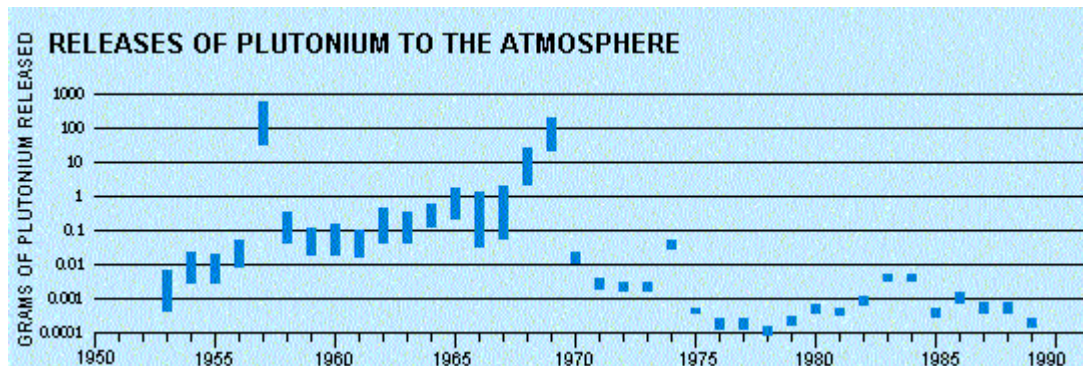


Chart depicting Releases of Plutonium to the Atmosphere (1950 through 1990)

Plutonium Routine Releases

Many smaller fires and other incidents on-site also were examined. Researchers concluded that releases of plutonium from these events and consequent off-site exposure to the public were considerably less than those from the three major release events. Releases from the smaller fires and incidents are included in results on the amount of plutonium from "routine" releases from the stack and building vents. The total amount of plutonium-239, -240 released from 1953 to 1989 was between 1.2 and 3.4 grams (or 0.086 to 0.24 Ci), with the median value at 1.7 grams (or 0.13 Ci).

Tritium

Tritium, a radioactive chemical, was accidentally released during a weapons recycling operation in 1973. Tritium was released into Walnut Creek, which flowed into Great Western Reservoir, a drinking water source for Broomfield at the time. Researchers concluded that potential adverse health effects were considerably less than those from the three major releases of plutonium or from releases of carbon tetrachloride.

Beryllium

Beryllium is a light, hard, grayish non-radioactive metal used to make nuclear weapons components. Beryllium dust was formed during the machining of beryllium, a process that involves cutting and polishing the metal into shapes for weapons use. The dust particles were released through vents and stacks at the plant. Beryllium is a cancer-causing agent. Researchers studied these releases to the air and determined that the cancer risks were much less than those for exposure to plutonium. Beryllium also can cause a serious illness called chronic beryllium disease in people who become sensitized (i.e., show an allergic response) to beryllium. The studies estimated that off-site beryllium air concentrations were well below acceptable levels established by the EPA.

Uranium

Large quantities of both depleted uranium and highly enriched uranium were processed at Rocky Flats, especially during its first 10 to 20 years of operation. In general, researchers found the releases of uranium were not monitored or controlled as well as plutonium. Depleted uranium was poorly monitored. As a result, relatively large, off-site releases of depleted uranium cannot be excluded.

During the studies, researchers located new information about uranium releases. However, significant gaps remain in their knowledge of depleted uranium releases. Researchers concluded that the overall risks from historical releases of depleted uranium and highly enriched uranium are smaller than the overall risk from plutonium releases. However, more uncertainty surrounds these releases.