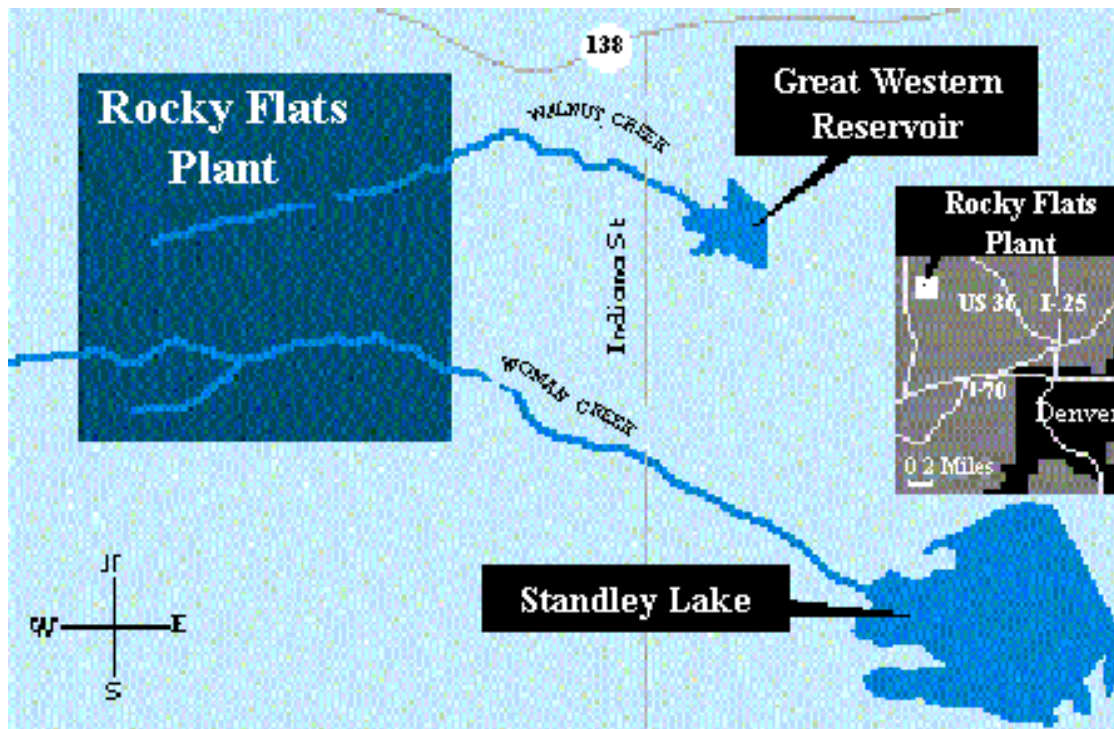


Technical Topic Papers Rocky Flats Historical Public Exposures Studies



Contaminants Released To Surface Water From Rocky Flats

Were contaminants released to surface water from Rocky Flats?

Contaminants were released into the air and water during routine manufacturing at the Rocky Flats Plant located 16 miles northwest of downtown Denver, as well as during unplanned incidents. The Historical Public Exposures Studies on Rocky Flats were conducted to identify potential health risks to residents in nearby communities who may have been exposed to chemical and radioactive releases from Rocky Flats during its years of operation (1952 to 1989). After extensive study, researchers determined that nearby communities received the greatest exposure to contaminants through the air, rather than from drinking water. However, some questions remained about contamination released into creeks that flowed off Rocky Flats into reservoirs east of the site.

Which creeks and reservoirs received discharges of contaminants from Rocky Flats?

The two major creeks that drain Rocky Flats are Walnut Creek (which has north and south branches on site) and Woman Creek. The creeks collected storm runoff from the plant site, which contained numerous waste storage and burial sites, incineration areas and spray fields where spray irrigation occurred from 1968 through 1989. Contaminated water ran off these areas and drained into the creeks.

Walnut Creek flowed into Great Western Reservoir in northeastern Jefferson County about a mile and a half from the plant. In 1989, the city of Broomfield built a diversion ditch around the reservoir to prevent surface drainage and runoff from Rocky Flats from entering the reservoir via Walnut Creek. In 1997, the city of Broomfield secured a new drinking water supply; Great Western is no longer used as a drinking water source.

Woman Creek drains about 35 percent of the Rocky Flats site, particularly the southeastern part. In the past,

Woman Creek flowed from the Rocky Flats site into Standley Lake, a drinking water supply for the cities of Westminster, Thornton, Northglenn and some residents of Federal Heights. In 1996, the new Woman Creek Reservoir was completed to prevent Rocky Flats surface water from flowing into Standley Lake.

What kind of surface water contamination was released off-site?

Plutonium and tritium were the key radioactive materials released from Rocky Flats, which were detected in water samples in creeks flowing off-site. The metal beryllium has been monitored in wastewater effluent since 1980. Levels have always shown lower than the analytical detection limit. Beryllium compounds were used extensively in various weapons production activities.

Plutonium was the main radioactive material processed at Rocky Flats for making nuclear weapons parts. Historically, it was also the primary contaminant released from Rocky Flats into off-site air and surface water. Most of the plutonium from Rocky Flats was in a form that does not readily dissolve in water. As a result, a large portion of the plutonium released into the creeks sank to the bottom and is now found in the streambeds of Walnut and Woman Creeks, and on the bottom of off-site reservoirs.

Another U.S. nuclear site, the Lawrence Livermore Laboratory, shipped scrap material to Rocky Flats for processing on several occasions. In 1973 it was discovered that the scrap material had been contaminated with tritium, another radioactive element. It was determined that about five accidental surface water releases of tritium, from contaminated scrap material, occurred from April 1969 through September 1974 to Great Western Reservoir.

Was a liquid waste treatment system used at the plant?

During most of the time that Rocky Flats operated, wastewater containing some contaminants was released into creeks on the site. However, when the plant was built in the early 1950s, well-defined liquid waste handling procedures were used to reduce the amount of plutonium released off-site. A special building was constructed in 1952 to process plutonium liquid wastes. All liquid wastes containing fairly high levels of plutonium were sent directly to the waste processing facility for plutonium removal. In the very early years, the treated wastewater was discharged directly into on-site creeks.

Weren't ponds built at the plant to store some of the liquid wastes?

Two series of ponds were constructed at the site for two different purposes. The holding ponds, a series of uncovered and unlined ponds, were constructed on Woman Creek and the north and south branches of Walnut Creek. The holding ponds provided an important way to decrease the levels of radioactivity in water that was released off-site. The first three holding ponds were built in the early 1950s. Eight additional ponds were added over the years.

A second series of ponds, called solar evaporation ponds, were built on-site in the mid-1950s. These served a different purpose than the holding ponds. In July 1955, when newly-constructed homes in the Broomfield Heights area were to use the domestic water supply coming from Great Western Reservoir, state health department and Rocky Flats officials knew it was necessary to retain wastes containing high nitrates, which violated the Public Health Service Drinking Water Standards. These ponds were constructed to hold and allow the evaporation of liquids that had low levels of radioactivity but high concentrations of nitrates.

How effective were the liquid waste treatment systems and holding ponds?

At times, these systems did not operate as effectively as they should have. Sometimes liquid wastes with some plutonium contamination drained directly into the creeks.

Although liquid waste from the asphalt-lined solar evaporation ponds was never intended to be released into the creeks, leakage sometimes occurred through cracks in the lining. Due to problems with leakage, the solar evaporation ponds were often relined with upgraded materials to prevent further releases from occurring. Leakage from the ponds was detected at various times beginning in the 1950s. The five solar ponds have not been used to hold industrial process water since 1986. By 1996, the sludge had been removed from all the solar ponds.

When did the largest releases of plutonium to surface water occur?

The largest concentrations of plutonium flowed from Rocky Flats to the creeks in the early 1950s before the holding ponds were built and from 1972-73 when the holding ponds were drained and reconstructed.

How much contamination flowed off-site in surface water?

When the holding ponds on Walnut Creek were drained and reconstructed in 1972-73, some of the pond water and sediments flowed downstream to Great Western Reservoir. Levels of radioactivity in water from Walnut Creek at Indiana Street (the plant's eastern boundary) increased almost eighty-fold during the peak rebuilding phase. By June 1973, the radioactivity levels had returned to pre-pond reconstruction levels.

In the past, the highest levels of plutonium were detected in water that went into the south branch of Walnut Creek. An estimated one gram of plutonium may have been released to South Walnut Creek from the plant's start-up in 1952 through 1969. Much of the plutonium in liquid wastes settled to the bottom of the holding ponds and eventually in the sediments at the bottom of Great Western Reservoir.

The greatest amounts of tritium were released to surface water in April 1973, when wastewater containing tritium flowed into Walnut Creek leading to Great Western Reservoir. The highest tritium concentrations measured in the reservoir during this time were from two to 20 times higher than normal.

What about plutonium in the sediments of Great Western Reservoir and Standley Lake?

The discharge of plutonium into Walnut Creek and Woman Creek over many years has resulted in the accumulation of contamination in the sediments at the bottoms of Great Western Reservoir and Standley Lake. Core samples taken of the sediments show low but measurable concentrations of contamination from 5-10 inches deep in the sediments.

Was any monitoring done in the past to measure radioactive contamination in surface water?

Site personnel have collected surface water samples and analyzed them for alpha radioactivity since 1951, before the plant's operations began in 1952. However, the extent of the monitoring, the spatial distribution of sampling and the types of contaminants measured were fairly limited until the early 1970s, when analysis was done specifically for plutonium and tritium. Water samples from the holding ponds have been analyzed for alpha radioactivity since operations began in 1952.

By the early 1970s, the site was monitoring and collecting daily samples of water in all creeks leaving the site, as well as from the sewage treatment plant and the holding ponds. By 1973, water was sampled continuously downstream where Walnut Creek crossed under Indiana Street.

Sampling of local reservoir and community tap water for radioactivity has been conducted since 1951. From 1951-1971, the water samples were analyzed for alpha activity. Since 1972, water samples from Great Western Reservoir, Standley Lake, Baseline Reservoir, Ralston Reservoir and a number of local communities near Rocky Flats have been tested for plutonium.

What are the health effects from the releases to surface water?

Overall, the risk to the public was small from releases of contaminants from Rocky Flats into surface water. Analysis of releases of contaminants to surface water showed that the 1973 tritium release

was the major contributor to risk from surface water. Following the tritium release in 1973, urine samples were taken from 36 people who lived or worked in Broomfield and drank water from the reservoir. The average tritium concentration for these people was about seven times higher than normal (4,300 picocuries per liter versus 600 picocuries per liter).

Three years after the release, urine samples were again taken from the same group; results indicated that their tritium concentrations were back to normal.

A Summary of Surface Water Issues at Rocky Flats

Research indicates more people were exposed to the plutonium releases from Rocky Flats between 1952 and 1989 by breathing air when releases occurred than by drinking water from nearby reservoirs or by exposure to Walnut or Woman Creeks. A tritium incident in 1973 caused concern among Broomfield residents whose drinking water supply had levels about seven times higher than normal. However, the levels dropped very quickly since tritium is a short-lived radioactive material. No long-term health effects were reported. Beryllium releases from Rocky Flats do not present a problem in surface water. The study of surface water was conducted as part of the Historical Public Exposures Studies on Rocky Flats, which focused on determining potential health risks from activities at Rocky Flats that occurred from 1952 to 1989. Current surface water monitoring procedures may have been modified from those that occurred in the past.

How can I get more information about this topic?

Details about the evaluation of past releases of contaminants to surface water from Rocky Flats may be obtained from the December 1996 technical report, *Characterization of Releases to Surface Water From the Rocky Flats Plant* by K.R. Meyer and J.E. Till of Radiological Assessments Corporation, and from the July 1999 technical report,

Evaluation of Historical Data by S.K. Rope, K.R. Meyer, M.J. Case, H. Grogan, D.W. Schmidt, T. Windsor, M. Dreicer and J.E. Till, of Radiological Assessments Corporation.