903 Area

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

Introduction

In the late 1950s and 1960s, barrels of waste oil and solvents contaminated with plutonium and uranium were stored outdoors at the 903 Area of the former Rocky Flats Nuclear Weapons Plant. Many barrels leaked, contaminating the soil around them. The barrels were removed in the late 1960s, leaving freshly disturbed soil open to the elements. Windstorms then blew some of this soil away, causing off-site plutonium contamination east and southeast of the plant. In 1969, an asphalt "pad" was placed over the most contaminated area.

Where did the contaminated waste oils come from?

Oil was used as plutonium and uranium were cut or "machined" into very precise shapes to construct nuclear weapons components at the Rocky Flats Plant. This "machining" created tiny particles of radioactive waste. The solvent carbon tetrachloride was used to clean the cutting oil from the parts and tools. These contaminated liquid wastes were stored outdoors in 30- and 55-gallon steel barrels at the 903 Area, east of the main buildings at Rocky Flats, because no good disposal methods were available for them at that time.

How many barrels were stored outdoors?

By the early 1960s, more than 5,000 barrels containing more than 200,000 gallons of liquids had been placed in the 903 Area. (All Rocky Flats buildings, structures and storage areas were numbered.)

When did the barrels corrode and leak?

Hydrochloric acid was generated in the wastes, causing extensive corrosion of the barrels. They began leaking in the late 1950s, and by 1962, Rocky Flats staff recognized that the leaks were causing significant plutonium contamination in the 903 Area. For example, in the mid-1960s, the staff reported "highly plutonium contaminated" rabbits near the 903 Area.

Removal of corroded barrels began in 1967. By 1968, the barrels, sludges and remaining liquids were shipped to the Idaho National Engineering Laboratory for burial.

What was done about the contaminated soil in the 903 Area?

After the barrels were removed in 1968, the contaminated soil was left exposed to the wind and the weather. The next year, large rocks were removed and the area was graded. The freshly disturbed soil

was easily blown off-site during high winds in 1968 and 1969. By November 1969, an asphalt cover was placed over the 903 Area to reduce further windblown contamination. Gravel was later placed over the contaminated area on-site, east of the asphalt cover.

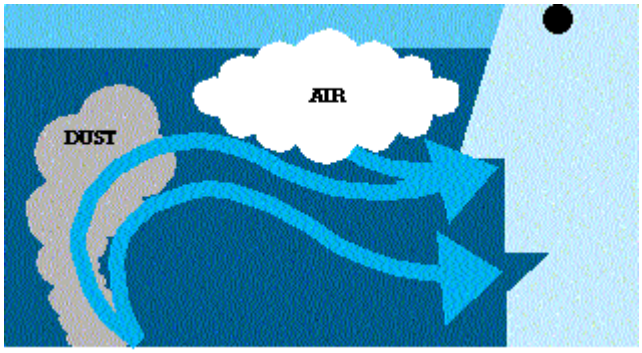
What was the extent of soil contamination in the 903 Area?

Scientists estimated that each barrel contained about 0.2 to 2 grams (approximately 0.007 to 0.07 ounces) of plutonium and that between 20 and 200 grams (or 1.4 and 15 Ci) of plutonium had leaked onto the soil. An estimated 261,000 square feet of soil in the 903 Area were contaminated during the leakage, based on analysis of photographs, interviews and records from the period. The highest plutonium concentrations were in the top inch of soil.

How did winds move the plutonium particles in the environment?

High winds caused suspension of particles in the air. After these particles settled onto the ground some distance away, they were sometimes picked up ("re-suspended") and carried farther away by later windstorms. When present, vegetation, rain and snow reduced the amounts of blowing dust.

The researchers located wind speed and direction information from the National Center for Atmospheric Research (NCAR) and the National Oceanic and Atmospheric Administration (both in Boulder, Colorado), the Jefferson County Airport and the Rocky Flats Plant on-site meteorological station. The wind data were incomplete, but adequate to make estimates of releases.



Inhalation of plutonium from Rocky Flats releases was the primary way people nearby could have been exposed.

Were air samples taken and contaminants measured near the 903 Area?

Rocky Flats staff monitored air samplers at the plant site, including the S-8 sampler just east of the 903 Area, in the main high-wind direction. Alpha radiation was measured in the air samples. Alpha radiation can come from many sources including the 903 Area plutonium or uranium, nuclear weapons test fallout or naturally occurring uranium, radium and thorium in soil. Scientists were able to estimate the fraction of S-8 sampler data linked to 903 Area plutonium releases.

How did high winds affect the plutonium-contaminated soil?

The researchers calculated routine plutonium releases and major releases during 24 high wind events during the 1960s. They found that five powerful windstorms in late 1968 and early 1969 suspended a large portion of the plutonium as dust and caused most of the off-site contamination near Rocky Flats. These windstorms occurred on December 5, 1968, and on January 6-7 and 30, March 19 and April 7, 1969. Winds reached 125 miles per hour on January 7, 1969 and 120 miles per hour January 30 at Boulder weather stations. The dates of the high wind events correspond to the highest amounts of plutonium measured in the S-8 air samples. Researchers also found that even at relatively low wind speeds, some plutonium releases occurred.

How much plutonium was carried away by the wind?

Researchers estimate that between 25 and 200 grams (or 1.8 and 15 Ci), with a median value of 52 grams (or 3.7 Ci), of plutonium were released off-site.

The scientists found that after the 903 Area asphalt covering was in place in November 1969, a small amount of plutonium continued to be released from the contaminated surroundings. Approximately 200 microCuries (millionths of a Curie) per year of plutonium were released from the East Field, a large contaminated area east of the plant boundary. This rate is very small compared to the amounts released before the 903 asphalt pad was completed.

How could people have been exposed to this contaminated dust?

If nearby residents or workers inhaled the contaminated dust, the large dust particles would likely have been filtered out in their noses and throats, and little would have reached important organs in the body. Finer plutonium particles were likely to be deposited in the lung. Some likely moved into the blood, depositing in the liver, bone and bone marrow and irradiating tissue there.

What were the cancer risks to people working or living off-site?

Researchers calculated the cumulative cancer risk of plutonium released from the plant. This information is available in the *Summary of Findings*.

How can I get more information about the studies?

The report, *Development of the Rocky Flats Plant 903 Area Plutonium Source Term*, written by J.M. Weber, M.S., A.S. Rood, M.S., H.R. Meyer, Ph.D., and J.E. Till, Ph.D., (principal investigator) of Radiological Assessments Corporation, provides a detailed, technical account of this topic. For more information on the Rocky Flats Historical Public Exposures Studies call 303-692-2636.

Study Overview

Research concerning releases of plutonium from the 903 Area at Rocky Flats was part of a comprehensive study of all major contaminant releases from the plant. The Rocky Flats Historical Public Exposures Studies involved nine years of research including identification and assessment of past releases of radioactive materials and chemicals from the former Rocky Flats Nuclear Weapons Plant. The researchers estimated the cancer risk to residents living or working in surrounding communities during the plant's operation from 1952 to 1989.

The project was administered by the Colorado Department of Public Health and Environment and overseen by a 12-member Health Advisory Panel appointed by former Governor Roy Romer.

Phase I of the Historical Public Exposures Studies, a toxicologic review and dose reconstruction, began in 1990 and concluded in 1994. ChemRisk, a division of McLaren/Hart Environmental Engineering, conducted Phase I. Radiological Assessments Corporation conducted Phase II, a toxicity assessment and risk characterization, from 1992 to 1999.