



# Plutonium Dispersal Tests at the Nevada Test Site

## Introduction

In the days of large, heavy, fission bombs, the possibility of dangerous nuclear accidents were minimized by assembling the bomb in the final moments before actual use. Modern nuclear weapons adopted 'sealed pit' designs in which all parts of the fission bomb were placed in their final configuration during assembly. This evolution created more compact, lightweight, and low maintenance nuclear weapons, but these weapons could not accommodate separate handling of internal components before actual use, raising significant safety concerns about the possibility and ramifications of a nuclear weapons accident.



*A radiation technician surveys the Operation Rollercoaster test area in 1963.*

## Testing the new design

Tests were planned to evaluate the safety of these new 'sealed pit' designs. Safety margins were small, and it was impossible to precisely calculate what would happen in an asymmetrical detonation, as would occur in an accident. The adopted standard required that the fission device must be "one point safe," meaning that the initiation of the high explosive at one point (in contrast to the simultaneous multi-point detonation of a proper implosion) could not cause a detectable release of nuclear energy - the result must be "zero yield."

Safety tests were necessary because aircraft crashes and other operational and logistic accidents involving nuclear weapons were a distinct possibility and could result in detonation of the weapon's high explosive components, producing no nuclear yield but contaminating the surrounding areas with radioactive materials.

## Project 56

To test the safety of the new nuclear weapons design, the Atomic Energy Commission, predecessor to the U.S. Department of Energy, began a series of plutonium dispersal safety experiments as early as 1955. The purpose of these safety experiments was to determine whether a weapon or warhead damaged in an accident would detonate with a nuclear yield, even if some or all of the high explosive components burned or detonated. Four atmospheric plutonium-dispersal safety tests, conducted under the name Project 56, were conducted in the northern portion of Area 11 of the Nevada Test Site (NTS) in 1955 and 1956.

## Project 57

In 1957, the Atomic Energy Commission conducted a safety experiment, named Project 57, just outside of the NTS on the Nellis Air Force Range. The Project 57 test area, also known as Area 13, was a 10 mile by 16 mile block of land abutting the northeast boundary of the NTS. On April 24, 1957, the safety experiment commenced when the high explosive charge of a nuclear weapon's warhead destroyed the weapon with no atomic explosion. A radiological survey team entered the experiment area to confirm whether or not any beta or gamma radiation hazard existed from a partial nuclear yield. There was no beta or gamma radiation detected, but all personnel entering the area were required to wear full protective suits and respirators to shield themselves from alpha radiation.



## Cleaning up

The extent and distribution of plutonium contamination in Area 13 was mapped and the contaminated area fenced off and posted with radiation hazard signs. Contaminated equipment was disposed of in waste burial sites inside Area 13. The Project 57 site lay abandoned and nearly forgotten for more than 20 years. As part of an environmental clean-up effort in 1981, the U.S. Department of Energy Nevada Operations Office sought funding for the decontamination and decommissioning of Area 13. Hundreds of thousands of cubic yards of soil were removed from Area 13 during decontamination efforts. Contaminated soil and debris from Area 13 was disposed of in a waste facility at the Nevada Test Site.

## The fate of Area 13

Preliminary site characterization was conducted at the Project 57 safety experiment site and landfill in Area 13 in 1998. The landfill was located and found to contain buried metal debris. The safety experiment characterization data are currently under review.

## Operation Roller Coaster

Operation Roller Coaster was an experimental series of plutonium dispersal tests designed to evaluate the resulting radiological hazards. These experiments were conducted on the Tonopah Test Range in 1963 under a joint exercise conducted by the United Kingdom, the U.S. Department of Defense, and the U.S. Atomic Energy Commission. The devices were detonated at the Double Tracks and Clean Slate 1, 2 and 3 sites, resulting in contamination that required some form of corrective action.

Double Tracks is the smallest site of the Roller Coaster experiments. The site was characterized, corrective actions performed, and re-vegetation occurred from mid-1995 through early 1996. Contaminated soil was transported to the Area 3 Radioactive Waste Management Site at the Nevada Test Site.

The Clean Slate 1 corrective actions were performed from May through July 1997. Soils generated during the corrective action activities were transported to the Area 3 Radioactive Waste Management Site on the Nevada Test Site for disposal. Clean Slate 2 and 3 sites are located on the central portion of the Tonopah Test Range. Corrective action of Clean Slate 2 and 3 is pending an agreement between the state and federal government on the corrective action level.

## Plutonium Valley

Area 11 is now known as Plutonium Valley because of the contaminated soil resulting from the safety experiments. Area 11 continues to be used on an intermittent basis for realistic drills in radiological monitoring and sampling operations.

## Plutonium

Plutonium emits alpha particles, the weakest form of radiation which is blocked by paper or skin. If inhaled, however, even small quantities could cause adverse health effects. Plutonium has a half-life of 24,000 years. Project 57 contaminated over 895 acres with plutonium dust and fragments. The exact amount of plutonium expended for the test remains classified.

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