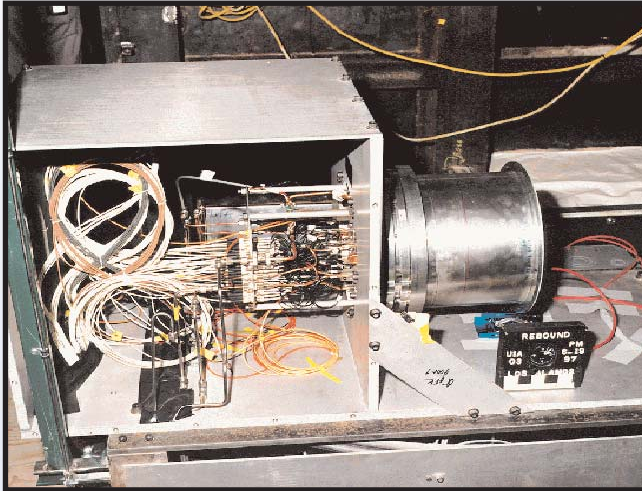


Subcritical Experiments at the U1a Facility

Introduction

The U1a Complex is an underground laboratory consisting of horizontal tunnels, each about one half mile in length, where experiments supporting the nation's nuclear stockpile are conducted. The U1a Complex is mined at the base of a vertical shaft approximately 960-feet below ground surface. The vertical shaft is equipped with a mechanical hoist for personnel and equipment access while another vertical shaft, about 1,000 feet away, provides cross ventilation, instrumentation and utility access, and emergency exits. A third shaft was excavated to provide additional access for personnel and equipment.



Rebound was the first subcritical experiment conducted at the U1a Facility.

The underground U1a Complex is the location for subcritical experiments. Subcritical experiments are physics experiments that obtain technical information about the U.S. nuclear weapons stockpile. These experiments support the U.S. Department of Energy, National Nuclear Security Administration's (NNSA) Stockpile Stewardship Programs, created to maintain the safety and reliability of the U.S. nuclear weapons stockpile.

Subcritical experiments use chemical high explosives to generate high pressures that are applied to nuclear weapon materials, such as plutonium. The configuration and quantities of explosives and nuclear materials are such that no nuclear explosion can occur. Because there is no nuclear explosion, subcritical experiments are consistent with the U.S. nuclear testing moratorium. They are called "subcritical" because

there is no self-sustaining nuclear fission chain reaction. Scientific data is obtained on the behavior of nuclear weapon materials by the use of complex, high speed measurement instruments.

The explosive assemblies for the subcritical experiments are placed in small alcoves mined in the sidewalls or in vertical shafts of the underground U1a Complex. The complex provides a high degree of safety for Nevada Test Site workers and the public and minimizes environmental impacts. The shaft was originally excavated in the 1960's, and a nuclear test was conducted in a horizontal tunnel mined from its base in 1990.

The First Experiments

Subcritical experiments are conducted at the U1a facility by the Lawrence Livermore and Los Alamos National Laboratories. Los Alamos National Laboratory conducted the first subcritical experiment, Rebound, on July 2, 1997. The purpose of the experiment was to record the responses of plutonium to shock wave compression at different pressures. Rebound involved three measurements of different pressures, which were done in a single experiment room, 10 feet by 15 feet by 30 feet, located 962 feet below ground in the U1a Complex. All three of the experiments utilized high explosives for driving stainless steel flyer plates into target assemblies to generating pressure in the plutonium targets.



The second subcritical experiment Holog was conducted by Lawrence Livermore National Laboratory scientists on September 18, 1997. It was designed to yield information on the metallurgical properties of plutonium under extreme shock conditions.

The Holog experiment allowed scientists to study plutonium reactions when shocked - something that could not be studied with plutonium substitutes. The explosion was comparable to that of a large fire cracker or shotgun blast. During Holog, the ejecta cloud resulting from the explosion was analyzed. Information about the ejecta cloud mass, particle size distribution, and mass velocity distribution provided a clearer understanding of shocked plutonium. Images were then analyzed by computer to obtain measurements of particle size distribution, and particle size and speed relationships.



Aboveground, the U1a Facility is composed of innocuous structures; below ground, the complex is composed of half-mile long tunnels.

Future Experiments

While it is always difficult to forecast into the future, both laboratories have long range plans to continue their respective subcritical experiments, information from which will play a large role in ensuring the safety and reliability of the nation's nuclear stockpile.

For more information, contact:
U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office
Office of Public Affairs
P.O. Box 98518
Las Vegas, NV 89193-8518
phone: 702-295-3521
fax: 702-295-0154
email: nevada@nv.doe.gov
<http://www.nv.doe.gov>

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