A Look Back: The Plowshare Program

06/19/2018

Project Gnome, the first nuclear Plowshare experiment held Dec 10, 1961.

High Resolution Image

The Atomic Energy Commission (AEC) established the Plowshare Program in June 1957 to explore the peaceful uses of nuclear energy. The program took its name from the Bible (Isaiah 2:4), "they will beat their swords into plowshares." The purpose of the AEC program, instituted by the Lawrence Livermore National Laboratory (LLNL), was to develop the necessary technology for using nuclear explosions for civil and industrial projects, such as the creation of harbors and canals and the stimulation of natural gas reservoirs.

Watch the 11 minute film, "Civilian Applications of Nuclear Explosives."

The idea of using nuclear explosions for non-military purposes was first raised by President Dwight D. Eisenhower in his famous "Atoms for Peace" speech in December 1953 -- an idea that resonated with Edward Teller. In the summer of 1956, Harold Brown (LLNL director, 1960-1961) proposed a symposium on the subject to the AEC, and a meeting was held at LLNL in February 1957. Some 24 papers were presented, covering a broad array of ideas. While interest was high, discussions were hampered by the lack of data on the effects of underground explosions. Such data was subsequently generated with the Rainier event in September 1957.

On Sept. 19, 1957, LLNL conducted the first contained underground nuclear explosion. Rainier was fired beneath a high mesa at the Nevada Test Site. While Rainier was not officially a Plowshare test, the data and confidence generated from the event proved pivotal to the nascent Plowshare Program and to the future of arms control and the conduct of nuclear tests.

Following an end to the international nuclear test moratorium, broken by the Soviets in August 1961, LLNL conducted the first Plowshare test, Gnome, on Dec. 10, 1961. Unlike the first nuclear test conducted in 1945, Project Gnome was widely publicized and was attended by more than 400 observers from the press, public and foreign nations. The project was a multipurpose experiment designed to explore the feasibility of using a deeply buried explosion in a dry salt bed for isotope production, power recovery and scientific experiments. The culmination of three years of planning, Gnome involved the detonation of a 3.1-kiloton nuclear device, some 1,200 feet below the surface, creating a nearly 70-foot-high, 165-foot-diameter underground cavity near Carlsbad, New Mexico.

The international crisis precipitated by Egypt's seizure of the Suez Canal in 1956 placed the initial focus of the Plowshare Program on large-scale earth excavation for the creation of harbors and canals. Because of the Panama Canal Company's long-held interest in a sea-level canal, Plowshare continued to emphasize civil engineering applications in this direction. Thus, in July 1962, LLNL conducted the Sedan event, the second and largest Plowshare experiment. Two years later, in 1964, President Lyndon Johnson ordered a study to determine a site for the construction of a new sea-level canal. The subsequent study, published in 1970, was the most exhaustive U.S. study on nuclear excavation to date. However, it concluded that traffic on the

Project Gasbuggy was a stimulation of natural gas production via a nuclear explosion, which took place on Dec. 10, 1967.

High Resolution Image

Panama Canal wouldn't exceed capacity till 1995 -- effectively shelving plans for a new sea-level canal.

In addition to large-scale earth excavation projects, other Plowshare projects conducted between 1962 and 1969 focused on the production of new heavy isotopes unobtainable by conventional means. Such isotopes were expected to open new areas of nuclear physics research, provide diagnostic and therapeutic applications in medicine and serve as sources of energy.

The AEC also encouraged private industry partnership to explore the use of nuclear explosions for commercial purposes. In 1967, the first of three joint government-industry experiments was conducted to investigate the feasibility of using nuclear explosions to stimulate natural gas production. On Dec. 10, 1967, Project Gasbuggy was carried out by LLNL with joint participation by the El Paso Natural Gas Company and the Bureau of Mines of the U.S. Department of the Interior. The detonation produced an underground chimney 335 feet high with a diameter of almost 165 feet. While Gasbuggy's results were encouraging, with an increase in gas production six to eight times over previous rates, the quality of the gas produced showed some undesirabilities. Gasbuggy and two subsequent gas stimulation nuclear tests, the last in 1973, effectively brought Project Plowshare to a close.

While 27 nuclear tests were conducted in the Plowshare Program between 1957 and 1973 to develop such peaceful use technology, environmental concerns, as well as opposition to nuclear energy and nuclear devices, led to the demise of the program. Project Plowshare was terminated in 1977.

However, important legacies from the Plowshare Program live on at LLNL, including the biomedical program, which was first established to study the effects of fallout and other radioactive hazards on biological systems, and the Atmospheric Release and Advisory Capability (ARAC) program, now NARAC, which grew out of the need to predict the potential for atmospheric release from cratering shots.