



# NUCLEAR DYNAMITE

# Background

## Peaceful Nuclear Explosions (PNE)

The idea of applying nuclear explosives to massive engineering projects is as old as the bomb itself, and it promised to fulfill many of the ambitious projects proposed by an earlier generation of engineers who had harnessed the power of steam to dig the first Panama Canal. The Russians, like the Americans were entranced by the possibilities from the beginning.

*One can straighten out the beds of large rivers to construct gigantic dams, cut canals literally in minutes... the cold current that washes our transpolar region can be made warmer than the Gulf Stream. The tundra will disappear, the subtropics will reach up to Moscow, and in Kolyama, there will be the climate of France* Professor. G. Poskrovsky, 1954

Neither the US or the USSR took steps toward such "peaceful applications" until the mid 1950s when President Eisenhower's "Atoms for Peace" initiative promoted non-military applications, especially in the areas of medicine and electrical power generation. Experiments in "geographical engineering", as Edward Teller called them, began after 1957 when the US created Project Plowshare at the Lawrence Livermore National Laboratories in California.

## Fallout from military testing

At the same time, high levels of radioactive fallout from military testing provoked international protests and increased demands for an end to atmospheric testing. The efforts of the Citizens for Nuclear Information, and the publicity surrounding their campaign to collect and analyze baby teeth for evidence of radioactive fallout in the form of Strontium-90 contributed to the pressure on the Eisenhower and Kennedy administrations to negotiate limits on testing.

Fallout in the form of strontium 90 was detected in children's milk in the mid 1950s, and was traced back to plants eaten by cows. Strontium 90, a radionuclide with a half life of 27 years, is created during nuclear explosions and disseminated in the form of dust over large areas. Travelling through the food chain, it mimics calcium and is bound up with calcium during the formation of bones and teeth. While the consequences were debatable, the evidence of an increase of strontium 90 in children because of atmospheric testing was not. As one activist remarks

during the program, concern about children's health recruited many young parents into anti-nuclear protests and the peace movement

## A moratorium

A voluntary moratorium was initiated by the USSR and joined by the US between 1958 and 1961. The moratorium slowed the progress of Project Plowshare, but at the same time the military began to explore the possibilities of underground testing, in order to continue weapons testing while limiting fallout. Some of the early tests, notably the Ranier and Blanca explosions at the Nevada Test Site erupted unexpectedly and created small craters. The potential for moving huge amounts of earth quickly was evident. Plowshare's nuclear cratering experiments began in earnest after the moratorium was abandoned in 1961. The first Soviet tests began in 1965 with the Chagan Reservoir excavation.

## Radiation and the environment

Plowshare's plans for experimental blasts in the Alberta tar sands and on the Alaskan coast near Point Hope collided with rising public concern about radiation. This concern was fuelled by further scientific discoveries about the concentration and transmission of radiation through food chains. By 1959 another food chain was documented in the arctic where strontium 90 is taken up by lichens, eaten by caribou, and passed on to Aboriginal peoples in the North. Evidence was also accumulating from studies of the use of x-rays in hospitals that increased exposure was associated with increased risk of cancers. Inside Plowshare some scientists had increased reservations about the dangers of fallout. However, throughout the 1960s, many Plowshare scientists remained largely convinced that radiation levels could be safely managed, and work continued on the planned excavation of a new 1000' wide sea-level Panama Canal and other large scale projects.

## Friendly rivalry, cancelled programs

The American program relied on Congressional support, and Teller chose the high profile Panama project in order to rally the influential Joint Committee on Atomic Energy behind Plowshare. Publicity about Plowshare was not lost on scientists in the Soviet Union who happily used Cold War rivalries

to stimulate internal support for their own program. The resulting experiments were remarkably similar. Both programs were designed to use the compact energy of nuclear explosives for purposes of blasting, excavation, seismic sounding, fracturing gas-bearing rock formations, creating new elements, digging canals, diverting rivers, and a number of other imaginative applications including lifting large and heavy spaceships into orbit. But nuclear blasting was increasingly out of step with public concern about radiation which continued to escalate during the 1960s.

## Test Ban Treaties

The Partial Test Ban Treaty (PTBT) was signed in 1963. It eliminated explosions in the atmosphere, under water, and in space. This led to the cancellation of the Orion project, but underground explosions, and cratering shots were still permitted provided the fallout did not cross international boundaries. PNE advocates held out hope that the treaty would be modified in favour of peaceful excavations. The 1976 draft PNE treaty was a step in this direction, but by this time the US had abandoned Plowshare.

Plowshare continued to develop the tools and techniques of geographical engineering during the 1960s. Explosives that released far less radiation were also developed, but public resistance to nuclear technology was rising faster than radiation levels were falling. The Panama project was abandoned as "unproven technology" in 1970, and Plowshare continued, much diminished, until funding was cancelled in 1974. The much larger Soviet program continued until 1988 when the first "green" movement emerged in Russia, following Chernobyl.

The Comprehensive Test Ban Treaty of 1996 eliminates all nuclear explosions by the signatories, which do not include Pakistan and India. While the US Senate has not ratified the treaty, it is honored by the US administration. A clause in the treaty allows for a review in 2006, and leaves open the possibility, if all parties agree, that peaceful explosions could resume. While some geographical engineers retain hope that nuclear excavation might one day dig canals and harbours, a more likely use of nuclear explosives would be small scale high energy

experiments.

## A footnote: the future of PNEs

The energy released in nuclear explosions is so much more powerful than chemical explosions that they may yet be considered for use in space where weight is a critical factor. One theoretical use, based in part on the cratering experiments of the 1960s, is the diversion of asteroids. Another, being considered by NASA, is the use of small atomic explosions to propel rockets in deep space, to explore regions beyond the reach of chemical rockets.