

Swords into plowshares

Nuclear explosives were born as weapons of war, and the destruction that can be wrought by nuclear weapons has been widely publicized. In recent years, however, a considerable amount of research has centered on using the vast energy from nuclear explosions for peaceful purposes. The constructive force offered by nuclear explosives is no less awe-inspiring than the destructive force of nuclear weapons. We visualize great canals to aid transportation or bring water to arid regions, harbors on forbidding coastlines, explosions deep underground to aid in recovery of natural resources, and explosions for scientific research to aid man's understanding of his own world and the universe. All these peaceful uses, involving nuclear explosions detonated underground, are currently being studied in the AEC's Plowshare program.

The energy source

The energy for a nuclear explosion comes from within the nucleus of the atom by two different reactions, the fission or splitting of heavy nuclei and the fusion or combining of light nuclei. Each of these two nuclear reactions involves less than a millionth the weight of the materials required in the chemical reactions of more conventional explosives. For example, the complete nuclear fission of 56 grams of fissionable material releases the same amount of energy as the chemical explosion of 1,000 tons of TNT.

Uranium-233, uranium-235, and plutonium-239 are the only nuclear fuels which can be produced in quantity that will also spontaneously fission to sustain and propagate a nuclear chain reaction to release the atom's energy. These fuels are very expensive because of the effort required to obtain them in a pure enough form to be an efficient fuel. Fortunately, however, their expense can be considerably offset by combining the fission reaction with the much cheaper fusion reaction.

There are a number of reactions involving the fusion of light nuclei to release energy. Lithium and the two heavy isotopes of hydrogen,