

from a gas-bearing geologic formation of low productivity. This was the first joint government—industry experiment in the AEC's Plowshare program to develop peaceful applications for nuclear explosives. A nuclear explosive with a yield of about 26 kilotons was lowered 4,200 feet through a 47-cm-diameter casing and was detonated in a remote area of the San Juan Basin in northwestern New Mexico on Dec. 10, 1967.

Single detonations of 950 to 2,400 liters of nitroglycerin were formerly used in the San Juan Basin to stimulate gas-well production. By comparison, the Project Gasbuggy explosion equalled the energy of about 12 million liters of nitroglycerin. At the Project Gasbuggy site, gas recovery with conventional stimulation might, after 20 years of production, be 10% of the gas originally there. However, the gas recovery with stimulation by a nuclear explosion, after 20 years of production, should be as much as 70% of the gas originally there, a sevenfold increase over conventional stimulation.

A second experiment, Project Rulison, is currently underway near Rifle, Colo. The nuclear explosion for this experiment, on Sept. 10, 1969, equalled 40,000 tons of TNT and was 8,000 ft below the surface. The increased gas pressure at the wellhead indicates that the gas yield will be substantially increased.

Stimulation of oil reservoirs

As in gas stimulation, the major effect of a nuclear explosion in an oil reservoir would be to increase the effective well-bore diameter by creating a chimney and a region of increased permeability. Also, the chimney region would serve as an underground storage tank for periods of peak demand.

Oil reservoir stimulation may be more attractive economically than natural gas stimulation because, for equal reservoir volumes, the value of oil may be 3 to 4 times greater than that of gas.

Production of shale oil

Oil shale is a fine-grained calcareous rock containing a solid hydrocarbon called kerogen. When heated above 350°C, kerogen decomposes into various gaseous and liquid hydrocarbons and a carbonaceous residue. For more than a century retorting—heating—has been used to produce