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THE PLOWSHARE PROGRAM

(Abstract)

Gerald W. Johnson
Test Division Leader
Lawrence Radiation Laboratory
University of California, Livermore

From the time of the first nuclear explosion, thoughts have turned to using this new power for constructive and scientific purposes. The successful development of thermonuclear explosives and the extension to release of fusion energy with a small fission contribution has added additional impetus to ideas for possible applications. The importance of the newer developments are (1) costs can be reduced per unit of energy release because fusion fuels are cheap and abundant and, (2) radioactivity effects can be reduced because the products of fusion explosions are inherently radioactive and therefore some limitation on total activity produced can be exercised. As an indication of what has been accomplished, the AEC has announced that charges for the detonation and associated safety studies of a million ton explosion would be about $1,000,000. This might be compared with costs of the cheapest chemical explosive for which a million tons would cost at least $400,000,000. In addition, the President announced that explosions in the million ton range can be produced in which only 5% of the energy release is from the radioactive fission reaction.

The AEC in its weapons development program has detonated a large number of explosions ranging in energy release from a few tens of tons up to several millions of tons TNT equivalent. These explosions have occurred under water, underground, on the surface, and high in the air. In this experience much has been learned about the operational effects of air-blast on structures, radioactive fallout and flash. As a consequence, proved methods are available for forecasting magnitudes of effects of air-blast on light structures like windows at long distances, which is complicated by the fact that meteorological conditions drastically affect the results. Similarly, the prediction of fallout patterns has proved to be successful.

In the last few years eight explosions have been set off underground at the Nevada Test Site. From this experience it has been learned under what conditions radioactivity may be completely trapped underground. Also measurements of ground motion and seismic studies have permitted the evaluation of the expected effects of such explosions on surface and underground installations and therefore safe distances for operation. Three of the explosions were at shallow depths with the result that craters were formed which indicated the earth-moving potential of the nuclear explosives.

Based on this experience, a program, the PLOWSHARE program, has been developed to review various possibilities of constructive applications of nuclear explosives. So far, two concrete proposals for experiments have been approved by the United States Atomic Energy Commission.

(1) the Chariot experiment is designed to develop more information on the earth-moving capabilities of nuclear explosions. It is planned as a small harbor experiment in northwestern Alaska. The present plan envisages the detonation of three 20 kiloton and two 200 kiloton explosions buried to contain most of the radioactivity to provide a channel 250 yards by 600 yards and a turning basin 600 yards by 1000 yards.

(2) the Gnome experiment planned for New Mexico is designed as a first step in the study of the power production possibilities of nuclear explosives. In this experiment, a few kiloton explosions will be set off in a deep bed of natural salt with the hope of producing a subterranean heat reservoir from which the extraction of energy can be studied. In addition, an isotope production experiment using the neutrons released by the reaction will be included.

An additional experiment is planned to study the possibility of releasing oil from the Athabaska tar sands by exploding a device below the oil bearing layer to loosen and heat it. If successful, a pool of oil would be formed which could then be pumped to the surface.

Other projects in the early study phase are experiments to shatter oil shale formations to permit retorting in place, water resource development, and low-grade ore studies. Longer range programs envisage experiments in various media to get effects on several earth materials, experiments to study the possibility of production of fresh water from salt water, and experiments to explore the feasibility of causing important chemical reactions to occur.

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ATOMIC ENERGY COMMISSION REGULATIONS AFFECTING INDUSTRY

(Abstract)

James R. Mason, Chief
Isotopes Branch
Division of Licensing and Regulation

The Atomic Energy Act of 1946 gave the Atomic Energy Commission authority to distribute radioisotopes for peaceful uses of atomic energy. The criteria for the use of radioisotopes were not well defined at this time and the program was carried out by administrative orders to radioisotope users.

Formal criteria for distribution of radioisotopes were published in April 1951. The regulation was revised in accordance with the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Part 30, "Licensing of Byproduct Material" became an effective regulation in February 1956. This regulation established the criteria for issuance of licenses. A license is issued if the Commission finds, after detailed review of an application, that the applicant has:

(1) Proposed a use authorized by the act.

(2) Equipment and facilities adequate to protect health and minimize danger to life or property.

(3) Personnel qualified by training and experience to use the material for the proposed use in such manner as to protect health and minimize danger to life or property.

The Commission's regulatory program includes the review of all devices containing byproduct material. These include sealed sources, radiography equipment, and gauging equipment. Manufacturers of such devices are required to submit detailed information on the design specifications, labeling, and use of the devices.

All licensees are required to meet the provisions of Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation." The regulation is based on the recommendations of the National Committee on Radiation Protection. This regulation describes the permissible radiation dose to workers, the levels of radiation which may exist in both restricted and unrestricted areas, the requirements for surveys, the requirements for personnel monitoring, the signs and labels which licensees must have, the requirements for disposal of wastes, and the kind of records which licensees must keep.

In order to determine if licensees are conducting their programs within the scope of the regulations and the terms and conditions of their licenses, a program of inspection was started in 1957. All licensees are subject to periodic inspection.

The facilities for carrying out an industrial radioisotope program vary with the type and quantity of isotopes to be used. For tracer studies, a regular chemical laboratory is adaptable for radioisotope work with some modifications. For larger quantities of isotopes, special attention must be given to the kind of flooring, walls, ceilings, hoods, benches, drainage systems, sinks, etc., so that the radioisotopes may be handled safely and effectively.