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### Peaceful Nuclear Explosions

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*Peaceful Nuclear Explosions* is the proceedings of an international panel held March 2-6, 1970 in Vienna by the International Atomic Energy Agency. It presents the first formal across-the-table discussions by representatives from the several countries which have either the capability for or the interest in the use of nuclear explosions for peaceful uses. In the Foreword, the IAEA notes that although nuclear explosions for industrial applications have been under active consideration as part of the atomic energy programs of several countries for nearly two decades, it is only in the last five years that the science and technology has advanced sufficiently to attract international interest as a truly feasible engineering technique. The panel consisted of 60 participants and observers from 29 member states of the IAEA and 3 international organizations.

The first 45 pages of the 454-page proceedings give the "official statements" on the national programs in peaceful nuclear explosions of the 9 official panel countries. These include Australia, France, India, Japan, South Africa, Sweden, USSR, UK, and USA. Four of these statements were from countries considered as "have"

countries under the international treaty on the nonproliferation of nuclear weapons. The statement from France (in French) announced the APEX program of the CEA; the statement from the UK summarized its efforts as an independent evaluation of the USA and USSR efforts and listed some potential projects that might be feasible for nations of high density populations. The statement from the USSR (in Russian) summarized the current status of their national program. The prior status was reviewed in a set of three reports given to the IAEA in September 1969. The review covered the experimental results of the mechanical and radioactivity aspects of both contained and excavation explosions and a summary of the applications being considered for the USSR national economy. This and the other USSR papers in the proceedings have been translated by the USAEC. (UCRL-tr-10475, 10476, 10477 and AEC-tr-7120, available from the Clearinghouse for Federal & Scientific Information, Springfield, Virginia 22151.) The USA paper was a review of the Plowshare program. Appendixes listed the Plowshare chronology and the executed and proposed experiments for industrial and scientific applications.

A feature of the proceedings is a 58-page review paper by Milo Nordyke of the Lawrence Radiation Laboratory who together with V. N. Rodianov of the USSR were the technical consultants to the Panel. The paper, commissioned by the IAEA, is an excellent review, compiling for the first time the collected contributions from the experimental data of the French, USSR, and USA programs and the full range of applications proposed by most of the nations represented.

The 16 technical papers presented by the four "have" countries constitute the major portion of the proceedings. Six of these, from France, summarize the experimental data from a series of some 13 contained nuclear explosions in a granite massif medium in the Sahara. From these data, numerical codes of the geonuclear effects were developed. The one British paper describes a theoretical model of the early phases of the explosion.

The set of five technical papers from the USSR amplifies the details of the earlier set of papers given to

the IAEA. They include two papers on the respective industrial applications of contained and cratering explosions. Among the details of the former are included the increased production following an oil stimulation experiment involving three nuclear explosives. Plans for specific oil and gas stimulation and storage projects and for mining are described. For the latter, details were given of the 1.1-kt excavation in siltstone involving infiltration by groundwater. Plans for specific civil construction of a large water reservoir project in Central Asia and for a water diversion canal to the Caspian Sea are considered.

The four USA contributions contain the experimental results of Plowshare cratering experiments and a description of the numerical codes developed for the simulation of stress wave propagation from explosions and the dynamics of cratering. A 50-page FORTRAN listing of the SOC code used for such calculations is appended.

A four-page summary of the Panel meeting by the scientific secretary completes the proceedings. In it, the secretary suggests some eight technical areas where further research is required to develop the technology and some possible roles the IAEA might play in developing the international aspects of peaceful nuclear explosions.

With the highlights of the national programs of the countries pursuing the development of peaceful nuclear explosions adequately covered in these proceedings, it is apparent that the proceedings will be of value to any reader wishing to acquaint himself with the status of this technology. The proceedings of the First Panel on Peaceful Nuclear Explosions thus constitutes a major reference work in this subject.

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