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REPORT TO THE SECRETARY-GENERAL OF THE UNITED NATIONS ON THE PROGRESS OF THE AGENCY'S FURTHER STUDIES AND ACTIVITIES IN CONNECTION WITH NUCLEAR EXPLOSIONS FOR PEACEFUL PURPOSES

Introduction

1. In 1969, the Agency submitted to the Secretary-General of the United Nations a report entitled "The Agency's responsibility to provide services in connection with nuclear explosions for peaceful purposes". [1]
2. In Resolution 2605 B (XXIV) the General Assembly invited the Agency to submit to the Secretary-General, not later than 1 October 1970, a special report on the progress of its further studies and activities in this field, to be considered by the General Assembly at its twenty-fifth session.
3. The present report is designed to meet that request. It should be read in conjunction with the main part of this year's comprehensive annual report of the Agency to the General Assembly [2] and with its report on further action taken on the recommendations made by the Conference of Non-Nuclear-Weapon States. [3]

The Agency's review of the technology of peaceful nuclear explosions (PNE)

4. A Working Group on peaceful nuclear explosions was convened by the Agency from 15 to 17 December 1969, for the purpose of preparing an agenda for a panel on this subject, which was held in March 1970, and of making recommendations concerning the Agency's role in connection with peaceful nuclear explosions. The Working Group recommended that the Agency should:
 - (a) Undertake a detailed scientific and technical review of the technology of peaceful nuclear explosions through convening a series of panels;
 - (b) Publish an introductory review of the current state of the art of using nuclear explosives for peaceful purposes;
 - (c) Publish a bibliography on PNE;

[1] GC(XIII)/410.

[2] GC(XIV)/430.

[3] GC(XIV)/INF/120.

- (d) Consider the usefulness, scope and timing of a handbook of technical and scientific data on PNE;
- (e) Consider making plans for the arrangement, in due time, of education and instruction on PNE;
- (f) Consider developing a plan for international co-operation for using PNE in scientific research;
- (g) Consider what written material on PNE could be made available to interested Member States; and
- (h) Review in due time its staffing requirements to cope with its role in PNE.

5. The agenda prepared by the Working Group for the panel was divided essentially into the following three sections:

- (a) Summary statements on national activities concerned with peaceful nuclear explosions;
- (b) Survey of peaceful nuclear explosions by an Agency consultant; and
- (c) Phenomenology of contained and cratering explosions.

6. The agenda had been forwarded to 15 Member States for use as a guide in preparing papers for the panel. Australia, France, India, Japan, Mexico, Sweden, the Union of Soviet Socialist Republics, the United Kingdom of Great Britain and Northern Ireland and the United States of America were invited to send participants to the panel. Invitations were also sent to Brazil, Canada, the Federal Republic of Germany, Norway, South Africa and Switzerland, who had expressed strong interest in, or have experience with, explosion technology. The latter group of countries was invited to present papers through panel observers who would attend without cost to the Agency. The agenda was also sent to other observers from Member States and international agencies as their nominations were received.

7. The Panel on Peaceful Nuclear Explosions was held in Vienna at the Agency's Headquarters from 2 to 6 March 1970. In view of the wide interest in the subject, arrangements were made to permit the attendance of observers from any Member State wishing to follow its work. There were eight panel members and 49 other representatives or observers from 29 Member States, the United Nations and the World Health Organization. The Agency had engaged two consultants - one from the Soviet Union and the other from the United States - to prepare the technical summary of the Panel.

8. A total of eight papers was presented at the session on summary statements and 17 at the two technical sessions. The Agency submitted a paper entitled "Technical Status Summary of Peaceful Uses for Nuclear Explosives". The paper reviewed the progress so far made in using nuclear explosives for peaceful purposes. It described the present understanding of the effects of nuclear explosions, reviewed some of the suggested applications, and outlined the nature of the safety problems associated with these applications. It discussed the industrial applications of nuclear explosives for contained, cratering and excavation purposes and dealt briefly with scientific applications, data obtained from experiments performed to date and possible future experiments. Brief summaries of the other papers submitted are given in paragraphs 9-17 below.

9. South Africa in its paper stressed the need for considerably more information on PNE before assessing possible specific applications. It foresaw the role of the Agency in the co-ordination and evaluation of results obtained in the experiments of Member States with PNE programmes.
10. The possible application of nuclear explosives to mining of non-ferrous metal deposits was a point of particular interest in the paper presented by India. It expressed the desire for information on recent developments in pressure leaching, extraction of primary sulphide ores and possible product contamination arising out of the use of this technology.
11. The paper from Japan stressed the need for more information to be disseminated by the Agency through the medium of further panel meetings.
12. The Swedish paper reviewed Sweden's activities in programmes related to PNE, such as calculations on rock blasting, studies on the mechanical effects of sub-surface and near-surface nuclear explosions and environmental analysis of radio-activity arising from PNE.
13. The United Kingdom in its paper offered the services of its experts in the assessment of radiological hazards and the use of seismic techniques. The United Kingdom also foresaw the functions of the Agency as including the familiarization of industry and the engineering profession with the potentialities and limitations of nuclear explosives engineering.
14. The summary statement of the United States was a broad review of governmental and industrial programmes in the domestic economy. It is evident that significant progress has been achieved, particularly as far as contained explosions are concerned. However, as was emphasized in the paper, the nature of the current programme is still in the research and development stage, and many technical problems remain to be solved before PNE can become truly practical.
15. The Australian statement, while pointing out that no national programme on research and development in PNE exists, reviewed its continuing interest in the possible application of nuclear explosives to major engineering, construction and mineral resources development. Close liaison is being maintained with the Plowshare programme of the United States in the form of development reviews and the provision by the United States of available information on specific applications.
16. The statement of the Soviet Union presented an extensive review of the various uses to which contained and cratering nuclear explosions have so far been put in the Soviet Union. The applications have included an oil stimulation experiment, gas and oil underground storage, a mining experiment, excavation of dams and mining by using nuclear explosives for directional overburden removal.
17. The paper from France gave detailed information on experiments with PNE performed to date, in particular the contained explosions executed in the granite of the Hoggar massif of the Sahara. These have added to the knowledge on cavity shapes and growth rates, geological, thermal, mechanical, seismic and chemical effects and the activation of the containment rock. Significant differences in cavity volumes between the French and comparable United States experiments were pointed out. Contained nuclear explosions for the stimulation and underground storage of oil and gas and the extraction of mineral deposits were of particular interest.

18. Considerable discussion took place on the future activities of the Agency connected with PNE. The Panel studied the recommendations of the Working Group[4] and added its own recommendations, particularly on:

- (a) The role of the Agency in the exchange of information and in publication, including the usefulness, scope and timing of a handbook of technical and scientific data on PNE; the preparation of bibliographies and other relevant documents;
- (b) Education, training and scientific research; and
- (c) Future Agency meetings on PNE and the formulation of their scope and agenda.

19. As a first step in the Agency's fulfilment of its role in the exchange of information and in publication the Panel recommended the early preparation of an introductory review of PNE technology. The primary function of such a review will be to serve as a reference source to individuals and countries becoming acquainted with this technology; the necessity of including in it the most recent advances in this field was stressed. Preparations for the compilation of such a review are under way.

20. In addition the Panel recommended that the Agency sponsor the publication of a multilingual glossary of PNE terms. This would be of help to specialists engaged in the exchange of information, at meetings and in publications at national or international levels. Since the inception of the various national PNE programmes the experts in this developing technology have inherited or borrowed terms from other engineering and scientific disciplines (e.g. nuclear, mining, geological and drilling terms) and/or used those which have been generated in the course of their work (e.g. an inversed crater called a "retarc", overburden, explosive yield). Precise definitions of these terms with their translations into the four official languages of the Agency will be invaluable for international meetings and other information media. The Agency is initiating the compilation of such a glossary by asking for input from countries with national PNE programmes and related activities.

21. As far as education, training and scientific research are concerned, the Panel recommended that the Agency consider arranging for travelling lecturers on PNE, the setting up of academic programmes, and encourage scientific research in related fields. While such recommendations would have to be implemented by the Agency, interested Member States would have to initiate action.

22. Furthermore the Agency was asked what it can do to facilitate the assignment of scientists from interested Member States to projects in countries with PNE programmes. In this connection informal approaches are being made to Governments of countries which have such programmes.

23. On the subject of future Agency meetings on PNE it was recommended that the next panel meeting should deal with the practical aspects of contained nuclear explosions for industrial purposes including safety matters, such as seismic motion and product contamination, and that it should be convened towards the end of 1970 or as early as possible in 1971. The Agency now plans to hold this panel in January 1971, and the agenda for it was prepared by the two technical consultants mentioned in paragraph 7 above.

[4] See para. 4 above.

24. The timing and scope for a third panel were not yet defined pending the progress of the second panel. It was felt that it should be held so as not to conflict with the Fourth International Conference on the Peaceful Uses of Atomic Energy which will be held in Geneva in September 1971.

The Agency's activities relating to the exchange of information on PNE

25. In addition to the report entitled "Status of Plowshare Technology" by the United States Government, the Agency circulated in January 1970 three technological papers submitted by the Government of the Soviet Union. These papers review the possible economic applications of nuclear explosives for peaceful purposes in the Soviet Union, and consider methods of predicting environmental contamination due to nuclear explosions.

26. In May 1970 the Agency published a bibliography on PNE containing 1759 references to literature published up to June 1969. The main bibliographic sources used were Nuclear Science Abstracts, primary journals and reports submitted by Member States.

27. Within the framework of the Agency's International Nuclear Information System (INIS), operating since April 1970, provision is made for the exchange of information on PNE. From the beginning of INIS' operation, all geological, geophysical and seismological aspects as well as the actual or potential uses of nuclear explosives for peaceful purposes were included. The monthly Atomindex will provide Member States with a regular world-wide survey of all publications dealing with PNE. Moreover, INIS' output tape service will make it possible for Member States to run selective dissemination of information services according to their needs.

The Agency's views on the appropriate international observation of PNE

28. Plans are being made with the object of formulating the Agency's views as to the role it may in due course assume in the appropriate international observation of PNE. It is foreseen that as a first step the Director General would assemble a panel of experts who, in collaboration with the Secretariat, would prepare a preliminary study of the character of such observation. Member States would be invited to comment on this study, and from the material thus assembled a formulation of the Agency's views could be elaborated.

Views of Member States of the United Nations on the establishment within the framework of the Agency of an international service for nuclear explosions for peaceful purposes under appropriate international control

29. In paragraph 2 of Resolution 2605 B (XXIV) the General Assembly of the United Nations urged all its members to communicate to the Agency any further views they might have on the establishment within its framework of an international service for nuclear explosions for peaceful purposes under appropriate international control. Six such communications had been received by 31 July 1970 and are reproduced in the Annex.

A N N E X

Communications from Member States of the United Nations
in response to the General Assembly's invitation in
Resolution 2605 B (XXIV), paragraph 2

A. Spain

"3 April 1970

".... Spain is greatly interested in the constitution of such an international service for nuclear explosions for peaceful purposes under the control of the International Atomic Energy Agency.

"The Spanish Government views with favour studies relating to the establishment of such a service. The Agency provides an appropriate framework for this activity and, in accordance with its Statute, the service should be available to all States Members of the Agency without any form of discrimination.

"It is the understanding of my Government that this future service for nuclear explosions for peaceful purposes under appropriate international control, which is to be established within the framework of the Agency, cannot be associated with the signing of any treaty or agreement outside the agreements governing the establishment of the International Atomic Energy Agency...."

B. Mexico

"6 April 1970

".... the views of the Mexican Government on this matter are still the same as those expressed in the two memoranda of 28 April and 24 July 1969, reproduced in document GC(XIII)/411 of 25 August 1969."

C. New Zealand

"7 April 1970

".... while New Zealand appreciates the studies which have been made by the Secretary-General and the International Atomic Energy Agency, it does not at this stage have any further comments to make on the subject."

D. Ethiopia

"29 May 1970

"Ethiopia recognizes that nuclear explosions might be potentially useful in very large civil engineering works, and might therefore come under the IAEA objective of promoting the contribution of atomic energy toprosperity. However, we wish to express a deep concern based on ecological considerations and on recurrent controversies in the more advanced countries, that the side-effects and after-effects of nuclear explosions within the ecosphere are often impossible to predict, let alone control. In particular, we note that radioactive contamination of the environment is probably such an overwhelming danger to long-term health as to completely outweigh any economic advantage which might be gained. Therefore, we are prepared to give tentative support only to feasibility studies in the area of nuclear explosions for peaceful purposes.

"Part A of this resolution is also relevant. As the General Assembly has rightly noted, the IAEA has been extremely active and useful in promoting applications of atomic science for genuinely peaceful development of the health and prosperity of its member states. In a world of limited sources, and in particular when concerned with international agencies with resource limitations, Ethiopia feels that the old maxim 'If it is possible, we must do it' must rapidly be replaced by 'Among the many possible things, which ought we to do?' Applied to the IAEA, we feel that a minimum of money and effort (possibly none at all) should be spent on nuclear explosions for any purposes whatsoever, and a maximum on those many projects for which the calculated benefit/hazard ratio is nearly infinite. Let the advanced-technology countries individually take the risk of polluting the biosphere - but not an Agency of the United Nations."

E. Iran

"22 July 1970

"... in accordance with paragraph 3 of the operative part of the United Nations General Assembly's Resolution 2605 B (XXIV) and the communication by the United Nations Secretary-General PO/134/7 of 9 February, 1970 the Imperial Government of Iran is in favour of establishment within the framework of the International Atomic Energy Agency of an International Service for Peaceful Applications of Nuclear Explosions."

F. Canada

"29 July 1970

"... Canada stated its views on the procedures the Agency might employ in connection with the use of nuclear explosions for peaceful purposes in a letter dated 29 May, 1969 At that time, it was stated that Canada was of the view that the Agency's initial activities in this field should be concentrated on the exchange and dissemination of information. Canada regards the convocation in Vienna of a panel on peaceful nuclear explosions during 1970 and the proposal for another panel in 1971 and the planned publications related to the technology of peaceful nuclear explosions as important steps in the fulfilment of the Agency's role in this field.

"... [The] letter of 29 May, 1969 said that it should be possible to define the boundaries of the role which the Agency could play in the field of peaceful nuclear explosions. The views of the Canadian authorities have not changed. One aspect of the question of the role the Agency should assume is in regard to providing appropriate international observation of peaceful nuclear explosions. The Canadian Government authorities agree that the question of observation is an appropriate matter for discussion in the continuing efforts to define the Agency's role in the provision of peaceful nuclear explosion services and Canada, therefore, would support any intention of the Agency to assemble a panel of experts to discuss this question. Finally, the Canadian authorities still believe that greater clarification is required of the Agency's role in the provision of peaceful nuclear explosion services with respect to the question of devices remaining in the custody and under the control of the nuclear-weapon State performing the service."