



International Atomic Energy Agency

# General Conference

GC(XIII)/410

31 July 1969

GENERAL Distr.

Original: ENGLISH

Thirteenth regular session

Item 15 of the provisional agenda  
(GC(XIII)/400)

## THE AGENCY'S RESPONSIBILITY TO PROVIDE SERVICES IN CONNECTION WITH NUCLEAR EXPLOSIONS FOR PEACEFUL PURPOSES

Report by the Board of Governors

### INTRODUCTION

1. In Resolution GC(XII)/RES/245 the General Conference, referring to the role envisaged for an international body under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) in relation to the application of nuclear explosions for peaceful purposes [1], requested the Director General "to initiate studies of the procedures that the Agency should employ in performing such a role", and requested the Board of Governors "to review the results of these studies and to report thereon" this year.

2. The Board began discussion of the subject last February, when it had before it a preliminary analysis by the Director General. As a first step it asked the Director General to circulate to all Member States an analysis of the role the Agency might play in helping to make available the benefits of nuclear explosions for peaceful purposes in the light of the Board's discussion on the subject, as well as information on the status of the relevant technology.[2] Secondly, because of the importance of the subject, the Board decided that all Members of the Agency should be accorded a full opportunity to express their opinions on the role the Agency could play. It may be added that last December, the General Assembly of the United Nations had requested the Secretary-General to prepare a report on the establishment within the framework of the Agency "of an international service for nuclear explosions for peaceful purposes, under appropriate international control", [3] and that the Secretary-General of the United Nations had written to the Director General on the matter.

3. The Board accordingly invited all Members that so wished to participate in the work of an ad hoc committee which it set up to advise on the preparation of the present report, further inviting them to communicate views in advance for the committee's consideration. Twenty-seven Members responded to the latter invitation, and 28 took part in the committee's meeting on 5 June. The Board took into account the recommendations made by the committee when preparing this report, which it generally approved on 12 June; one delegation, however, expressed reservations with regard to paragraph 13(b) below which it considered inconsistent with Article V of the NPT.

[1] Article V of the NPT.

[2] The analysis was circulated with Circular Letter 0/452-6 on 13 March and information on technology on 29 April and 13 May.

[3] By Resolution 2456 C (XXIII).

## THE AGENCY'S POSITION UNDER THE STATUTE

4. The Statute provides a broad basis for the role which the Agency might play. The provisions of Article II, which defines the Agency's objectives, encompass the kind of activity envisaged. Article III. A. 1 provides the Agency with broad authority to "encourage and assist research on, and development and practical application of, atomic energy for peaceful purposes throughout the world", and to act on request "as an intermediary for the purposes of securing the performance of services or the supplying of materials, equipment, or facilities by one member of the Agency for another". Article III.2 authorizes the Agency to make provision for services and facilities "to meet the needs of research on, and development and practical application of atomic energy for peaceful purposes . . . . with due consideration for the needs of the under-developed areas of the world". In addition, the Agency is authorized, under Article III. A. 3 and 4 respectively, to "foster the exchange of scientific and technical information on peaceful uses of atomic energy" and "to encourage the exchange and training of scientists and experts in the field of peaceful uses of atomic energy". This is supplemented by Article VIII. C which stipulates that the Agency "shall take positive steps to encourage the exchange among its members of information relating to the nature and peaceful uses of atomic energy and shall serve as an intermediary among its members for this purpose". The Statute also provides that, in carrying out its functions, the Agency shall conduct its activities "in conformity with policies of the United Nations furthering the establishment of safeguarded world-wide disarmament and in conformity with any international agreements entered into pursuant to such policies" (Article III. B. 1). Article III. C which stipulates that in carrying out its functions the Agency "shall not make assistance to members subject to any political, economic, military, or other conditions incompatible with the provisions of this Statute", is also relevant.

5. The Agency is thus authorized under its Statute to make available its own resources and services to all its Members for projects involving peaceful uses of nuclear explosives, and upon request to assist any Member or group of Members to make arrangements to secure necessary financing from outside sources to carry out such projects. The Agency is also authorized to take all steps needed to promote the development of the technology of nuclear explosions for peaceful purposes at the international level; it is moreover authorized to serve on request as an intermediary for the supply of services in connection with this use of nuclear energy. As the NPT is the kind of international agreement alluded to in the Statute, the Agency could assume appropriate roles, in conformity with the NPT, in regard to the use of nuclear explosives for peaceful purposes. It may be added that Article III. A. 6 and D of the Statute would also be relevant in this context.

## THE AGENCY'S POSITION IN RESPECT OF THE NPT[4]

6. Article V of the NPT foresees that non-nuclear-weapon States (NNWS) party to it will be able to obtain the benefits of nuclear explosions for peaceful purposes "under appropriate international observation and through appropriate international procedures"; it also provides that these benefits shall be obtained "pursuant to a special international agreement or agreements". Negotiations on this subject are to begin as soon as possible after the NPT enters into force. It is to be noted that NNWS may also obtain the benefits in question "pursuant to bilateral agreements".

7. Under Article V, therefore, the Agency would clearly be involved in tasks of several different kinds. For example, it would be prepared to arrange or perform the "appropriate international observation" called for under the Article. Considerable further attention will have to be given to defining the concept of "appropriate international observation", and to determining the procedures under which such observation will be arranged and carried out. The purpose of such observation, apart from any other purposes that might be stipulated in agreements concluded under the Article, would be to provide appropriate assurances

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[4] It should be noted that due account will also have to be taken of the provisions of the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space or Under Water, signed on 5 August 1963, in connection with nuclear explosions for peaceful purposes involving States which are Parties to that Treaty, since it is also applicable to explosions for peaceful purposes.

at the international level that the nuclear explosive devices used in providing the peaceful nuclear explosion service do in fact remain at all times under the custody and control of the nuclear-weapon State supplying the service and that the explosions are not carried out for other than the declared purposes.

#### THE AGENCY'S WORK IN RELATION TO NUCLEAR EXPLOSIONS FOR PEACEFUL PURPOSES

8. The technology of nuclear explosions for peaceful purposes is still at an early state of development, [5] and the Agency's role in bringing the benefits of its application to Member States is likely to evolve gradually in the years ahead. Initially the chief task will be to ensure the fullest possible exchange and dissemination of information, to convene panels and to provide Members with advice on the status of the technology, the feasibility of possible applications, etc.; at a later stage the Agency may be involved in arrangements for actual projects. These functions are analysed in paragraph 10 below.

9. It should be stressed that a start has been made. The Agency has already provided technical assistance for a project dealing with the health and safety aspects of a proposed study for the use of nuclear explosives for peaceful purposes in Panama, and the programme for 1969-74 provides for a number of further activities[6]. A panel on the use of nuclear explosives for peaceful purposes is planned for this year, to be followed by a further panel in 1970.

10. The categories of functions that the Agency could perform in relation to the use of nuclear explosives for peaceful purposes include those discussed below:

- (a) Information exchange. Promotion of the exchange of information on all aspects of the use of nuclear explosives for peaceful purposes (scientific and technical, economic, safety, etc.);[7]
- (b) Services to requesting Member States. The Agency already has extensive experience in related fields, e.g. radiological health and safety, technical and economic feasibility studies, and would add to its staff appropriately qualified experts as necessary. Consultants could be engaged for a particular project, as was done in the case of Panama; additional staff could be recruited on short-term assignments to provide specific advisory services, as is done now in respect of several other fields of nuclear technology. As regards:
  - (i) Economic reviews. The Agency can, upon request of any party to a project, review the information bearing upon the question whether the project is economically feasible. This procedure has already been well developed in the case of the nuclear power projects in Member States with which the Agency has been associated;
  - (ii) Safety reviews. The procedures for making reactor siting assessments, reactor safety assessments, etc. could serve equally well for safety reviews of projects for the use of nuclear explosions for peaceful purposes. The usual arrangement is that the Agency helps the requesting Government to convene an international group of experts selected by the Government from a list provided by the Agency. The experts' findings constitute their advice to the Government on the basis of their personal technical competence; the findings do not commit the countries that provide the experts, or the Agency. In addition, the Agency provides a technical secretariat for the group and may help meet the costs of convening the group;

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[5] The Annex contains a brief summary of possible applications of nuclear explosives for peaceful purposes.

[6] See document GC(XII)/385, paras 404 and 497(b).

[7] At present the Agency is preparing a comprehensive bibliography of the available literature relating to peaceful nuclear explosions. The subject scope of the International Nuclear Information System will cover this subject from the start.

- (iii) Technical assistance. The procedures are well developed both under the Agency's own programme and under the Technical Assistance Component of the United Nations Development Programme (UNDP(TA)); they could also be applied in providing services for a nuclear explosion for a peaceful purpose. The priorities for technical assistance as between different projects and classes of projects are set by Governments. The limiting factor is the shortage of funds;
- (iv) Feasibility study arrangements. It would appear to be in the interest of a State considering the use of nuclear explosives for a peaceful purpose to have a detailed feasibility study of the project made as a first step. Such a study might be performed by the State itself, with the help, if necessary, of outside assistance, including assistance from the Agency. A request for such assistance might be referred to the Agency under UNDP(TA), or might be arranged direct with the Agency on a reimbursable or partly reimbursable basis. A study might cover:
  - (aa) Technological aspects (blast, cavity formation, fracture, earth-moving effects, etc.);
  - (bb) General health and safety aspects (seismology, shock, ecological effects, etc.);
  - (cc) Radiological health and safety aspects (exposure control, site and environmental levels of radiation, radioactivity during and after the explosion, post-explosion safety clearances, etc.); and
  - (dd) Economic aspects and costs (explosion costs, auxiliary costs, economic benefits, financial arrangements, etc.), and
- (v) Intermediary arrangements. The experience the Agency has acquired in serving as an intermediary between States for the supply of special fissionable material and equipment will be useful in relation to the provision of nuclear explosion services for peaceful purposes. The Agency could act as the intermediary in arranging for such services. As far as the NPT is concerned, an agreement would be concluded between the requesting NNWS, the nuclear-weapon State that the NNWS had selected to provide the service, and the Agency, setting forth the terms and conditions, consistent with the NPT, under which the service would be rendered. The nuclear explosive device would remain in the custody and under the control of the nuclear-weapon State performing the service[8];
- (c) Access to scientific by-products. The Agency could make co-operative arrangements to enable national and international scientific organizations to benefit from the scientific by-products which are likely to emerge from the use of nuclear explosives for peaceful purposes.

11. It goes without saying that the effectiveness of the Agency's operations will ultimately depend on the provision by the nuclear-weapon States of all the necessary information. The Board is confident that these Members will do all they can to co-operate fully in this respect.

#### CO-OPERATION WITH OTHER INTERNATIONAL ORGANIZATIONS

12. In carrying out a number of these functions - economic evaluations and safety reviews, for instance - the Agency would seek help in appropriate cases from other organizations in the United Nations family. Within the framework of the co-operation thus envisaged, the

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[8] See para. 7 above.

Board has deemed it appropriate to request the Director General to communicate a copy of the present report to the Secretary-General of the United Nations for his use in preparing the report requested by the General Assembly. [9]

## CONCLUSIONS

13. After studying the possible services that the Agency would be able to provide in relation to nuclear explosions for peaceful purposes, and taking into account the Agency's statutory position, the technical competence it has acquired and its existing procedures for providing services to Member States, the Board has concluded that:

- (a) Activities of the Agency in relation to peaceful nuclear explosions will fall within its statutory objectives and functions to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world;
- (b) Performance of the functions of the international body referred to in Article V of the NPT, as well as the international observation called for by that Article, are within the Agency's technical competence and clearly fall within the scope of its statutory functions;
- (c) In the light of the experimental status of the technology, the Agency should approach this subject on an evolutionary basis, devoting its attention initially to the exchange and dissemination of information. The Agency must keep itself informed of technological progress and developments so as to enable it to provide Member States on request with expert advice and assistance in investigating the technology, the economics and the health and safety aspects of the use of nuclear explosives for peaceful purposes; and
- (d) The existing range of services offered by the Agency is appropriate and adequate for the purpose of providing assistance to Member States with peaceful nuclear explosions in the present state of development of the relevant technology. At this stage the tasks of the Agency in relation to peaceful nuclear explosions can be carried out by the Department of Technical Operations of the Secretariat. The Director General will subject the organization of the Agency's work in connection with peaceful nuclear explosions to periodic reviews, and report thereon to the Board.

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[9] See para. 2 above.

## ANNEX

### POSSIBLE APPLICATIONS OF NUCLEAR EXPLOSIVES FOR PEACEFUL PURPOSES

#### A brief summary

1. This paper describes the possible industrial application of nuclear explosive devices, and reviews the current requirements for further information and testing before nuclear explosions can become commercially feasible for peaceful purposes. It cites the advantages of nuclear detonations, such as the considerably lower unit costs both of the explosives themselves and their emplacement, and their disadvantages, e.g. the creation of radioactive contamination, as compared with conventional high explosives.

2. Possible industrial utilization of nuclear explosives may be divided into the following categories:

- (a) The creation of large underground voids for the purpose of storing gas, oil and other fluids;
- (b) Explosions deep underground to fracture low-permeability reservoirs of natural gas and oil-bearing strata to increase permeability, which could result in significant increases in the productivity of gas or oil from a single well;
- (c) The formation of an underground chimney of permeable oil shale rubble. The oil could be recovered by its in situ retorting from the shale by the heat generated during the explosion. Similarly oil from tar sands could become recoverable by reducing its viscosity through the heat generated;
- (d) Comparatively deep underground explosions to create chimneys and fragment ore bodies so as to produce a highly permeable rock mass. Minerals of value may then be recoverable by a modified block-caving technique or by in situ leaching;
- (e) Near-surface explosions in large low-grade ore deposits to fragment rock and reduce the normal open-pit mining costs;
- (f) The use of nuclear excavations in large-scale engineering projects, such as canal-building and harbour excavation; and
- (g) More speculative projects, such as the use of nuclear explosives to fragment rock and increase the surface area of hot rock in marginal geothermal regions, with a view to the use of the steam produced to generate electricity.

3. A disadvantage inherent in nuclear explosions is the accompanying release of radioactivity. While considerable progress has been achieved in reducing the radioactivity generated, more information on this subject would have to be acquired or released.

4. Further knowledge would also have to be gained in the fields of seismic coupling, product contamination, ecology, geology and hydrology. Research projects in these fields should be designed for each peaceful use of a nuclear explosive, since available data in these and other fields pertinent to nuclear explosive devices are limited. A great deal of quantitative information will have to be acquired before many of the applications mentioned become feasible.

5. It is foreseen that in respect of the availability of natural resources, the use of nuclear explosives could have a significant effect on the world's hydrocarbon resources. It is speculated that the number of countries self-sufficient in these fuels could be increased by this means. In a similar vein it is argued that a number of countries could become

exporters of mineral products and develop indigenous hydro-electric schemes more economically. Finally, bottlenecks in both land and sea transport could be overcome by the use of nuclear explosives for creating harbours, canals and highway cuts; and certain beneficial geographical alterations, such as the flooding of desert areas, could become more feasible.

