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**MEASURES TO STRENGTHEN INTERNATIONAL CO-OPERATION
IN MATTERS RELATING TO NUCLEAR SAFETY AND RADIOLOGICAL PROTECTION**

**(a) IMPLEMENTATION OF RESOLUTIONS GC(XXXIV)/RES/529
AND GC(XXXIII)/RES/508**

**The extrabudgetary project on the safety of
WWER-440/230 plants**

The attached reports by the Board of Governors and the Director General are being submitted to the General Conference pursuant to a request made by the Conference last year in resolution GC(XXXIV)/RES/529. The report in Attachment 1, prepared in January 1991, describes the objective, scope and organization of the project; the report in Attachment 2, prepared in August-September 1991, describes the implementation of the project and outlines future activities.

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ATTACHMENT 1

STATUS OF THE EXTRABUDGETARY PROJECT ON THE SAFETY OF
WWER-440/230 PLANTS^{*/}

1. The safety of older power reactors has become a matter of international concern that is receiving more and more attention. In this context, and also following recent political changes in Eastern Europe, the IAEA has received, from Member States operating Soviet-designed WWER-440/230 plants, requests for the provision of assistance through several of the IAEA's nuclear-safety-related services.

2. In response the Secretariat last year proposed a project for international assistance in assessing the safety of WWER-440/230 plants as a complement to relevant ongoing national, bilateral and multilateral activities. The General Conference endorsed the proposed project and invited Member States to make voluntary contributions in support of it.^{1/}

3. The general objective of the project is to assist countries operating WWER-440/230 plants in performing comprehensive safety reviews in the light of all available international experience. Such reviews - aimed at identifying design and operational weaknesses that may threaten plant safety and at suggesting safety improvements - should form the technical basis for the safety decisions which must ultimately be taken by the countries operating these reactors.

^{1/} See para. 7 of resolution GC(XXXIV)/RES/529.

^{*/} It should be noted that this report, prepared in January 1991, has not since been modified in any way.

4. An advisory group met early in September 1990 in order to establish the technical scope and work programme of the project; the meeting was attended by 42 participants from 19 Member States and from the Commission of the European Communities (CEC) and the World Association of Nuclear Operators (WANO).

5. The advisory group, having considered – inter alia – the results of IAEA safety missions to Bohunice (Czechoslovakia), Kozloduy (Bulgaria) and Greifswald (the former German Democratic Republic), agreed upon a work programme involving:

(a) A review of the conceptual design in order to evaluate the safety aspects of WWER-440/230 plants;

(b) Safety review missions (each lasting about three weeks) by teams of some 15 experts to the individual reactor sites in order to evaluate plant-specific design deficiencies and the conduct of operations, maximum use being made of the IAEA's experience with the provision of safety services – particularly through OSART missions; and

(c) Studies on matters of generic safety concern such as reactor pressure vessel embrittlement and the applicability of techniques for the early detection of leaks – and in this context accident analysis re-evaluations using modern computer codes and the conduct of probabilistic safety assessments.

6. A steering committee with specialists from Bulgaria, Czechoslovakia, Germany, France, Spain, Switzerland, the United Kingdom and the USSR has been established to monitor the implementation of the project and to give technical guidance to the IAEA on the resolution of safety issues and the prioritization of activities. The first meeting of the steering committee took place earlier this month.

7. Also, a sub-group established by the International Nuclear Safety Advisory Group (INSAG) is preparing a list of technically significant safety issues relating to WWER-440/230 plants which will be examined by INSAG.

8. Secretariat staff have already been assigned to the project, and it is expected that in addition cost-free experts will be provided by Member States.

9. As already indicated, there are various bilateral and multilateral activities under way relating to the safety of WWER-440/230 plants. CEC, WANO and the Organisation for Economic Co-operation and Development (OECD) are involved in them - and are keeping the Secretariat informed. For its part, the Secretariat is inviting these organizations to participate in meetings and safety missions organized by it. It is hoped that such co-operation will prevent duplication of effort.

10. The conceptual design review is to take place in Vienna from 4 to 15 February, with the participation of more than 40 experts from the USSR and other countries. Safety missions to Kozloduy (units 1-4), Bohunice (units 1 and 2), Novovoronezh (USSR, units 3 and 4) and Kola (USSR, units 1 and 2) are scheduled for the period March-September of this year.

11. Secretariat staff have already visited these sites to discuss technical and administrative matters relating to the conduct of the missions. Also, there have been ASSET missions to Kozloduy, Bohunice and Greifswald - and ASSET missions to Kola and Novovoronezh are due to take place in April and May respectively.

12. There will be a project review meeting this year in Vienna to consider the findings of the missions and of the conceptual design review meeting and to determine what further action is required.

13. Subsequently, the project will focus on assisting Member States both with the evaluation of proposed generic safety improvements and with the implementation of plant-specific modifications.

14. The project is an extrabudgetary one and, as indicated in operative paragraph 7 of resolution GC(XXXIV)/RES/529 adopted by the General Conference last year, it relies on voluntary contributions from Member States. The total estimated cost of the activities planned for 1991-92 is about US\$ 3 million. This amount is divided approximately equally between three elements: (1) safety review missions and meetings; (2) expert services, including Agency staff costs; (3) studies on matters of generic safety concern and assistance with the implementation of plant modifications. So far the Netherlands has contributed US\$ 175 000. Spain has pledged US\$ 300 000 on the condition that these funds are used for Spanish experts and equipment. It is understood that Austria, Germany and Switzerland will also be making a contribution this year. The Director General appeals to Member States to provide the necessary funds and in-kind contributions in a timely manner, so that the project can proceed as described in this paper.

ATTACHMENT 2

THE EXTRABUDGETARY PROJECT ON THE SAFETY
OF WWER-440/230 PLANTS^{*/}

Design concept review

1. In February 1991, the IAEA conducted a design concept review of WWER-440/230 plants operating in Bulgaria, Czechoslovakia and the Soviet Union. Thirty-two experts from ten countries and three international organizations participated in the review. Together with 25 Soviet specialists, they examined detailed information prepared by Soviet designers and operators.

2. Overall, it was found that the degree of redundancy, diversity and segregation was low in some of the reactor systems, which were therefore susceptible to common-cause failures. It was also found that there were basic weaknesses due to the fact that, at the time of design, specific nuclear standards had not been applied with regard to instrumentation and control and to electric power supply. It was further found that, compared with current practice in the case of most other nuclear power plant types, analyses had been performed of only a narrow spectrum of potential accidents.

3. In addition, the design concept review pointed to major differences between various WWER-440/230 plants, confirming the importance of plant-specific safety review missions.

^{*/} It should be noted that this report, prepared in August-September 1991, has not since been modified in any way.

Safety review missions

4. So far this year, WWER-440/230 safety review missions have been carried out to Bohunice units 1 and 2 in Czechoslovakia (April) and to Kozloduy units 1-4 in Bulgaria (June). A safety review mission to Novovoronezh units 3 and 4 in the Soviet Union is taking place at the moment, and one to Kola units 1 and 2 in the Soviet Union is planned for September.

Bohunice

5. During the safety review mission to Bohunice, the team found that the original design had been improved upon significantly. However, some of the basic weaknesses due to the non-application of specific nuclear standards at the time of design still existed -- a particularly important matter in the case of instrumentation and control and the physical separation of safety equipment.

6. The team recommended -- inter alia -- the improvement of operating procedures for normal and emergency conditions, the provision of additional information to operators on plant parameters during transient conditions, and improvements in on-site emergency planning and in the approach to accident management.

Kozloduy

7. During the safety review mission to Kozloduy, eleven areas related to plant design and operation were reviewed. The team found serious deficiencies in these areas at all four units, although units 3 and 4 have an improved design. Of most concern to the team were: the poor condition of equipment important for safety; inadequate plant procedures for emergency situations; the inadequacy of safety equipment for accident conditions; the insufficient training of operators; deficient emergency planning; serious fire hazards and inadequate fire protection; and a general lack of safety culture in plant operations. Only a very small amount of necessary accident analysis work had been done, owing partly to resource constraints.

8. The team emphasized that the reactor pressure vessel annealing planned for the autumn of 1991 should not be postponed and that, given the excessive leakage rate of the hermetic zones, major leak paths would have to be identified and sealed.

9. In the light of the mission findings, the IAEA expressed the view that it would be imprudent to continue operating the four units. The Bulgarian Government accepted the safety review team's conclusions, but stated that an immediate shut-down of all four units -- which account for some 25% of Bulgaria's electricity production -- would have severe economic and social consequences. It was agreed that units 1 and 2 should be shut down for corrective action in the near future, after units 3 and 4 -- which were currently undergoing scheduled shutdowns -- had been re-started. It was also agreed that decisions regarding alternative energy sources would be taken later, after various assessments of Bulgaria's energy situation had been completed.

10. Meanwhile, on 9 July, the Director General had convened a meeting -- attended by representatives of Bulgaria and of Belgium, France, Germany, Japan, the Soviet Union, the United Kingdom, the United States, the Commission of the European Communities (CEC), the World Bank and the World Association of Nuclear Operators (WANO) -- to discuss the situation. This meeting was followed by meetings at CEC headquarters in the course of which a review was carried out of the assistance needed by Bulgaria for the Kozloduy units and an action plan, responding to the safety review team's conclusions and based on a WANO proposal, was worked out. The action plan -- to be financed and supervised by the CEC -- provides for:

- (a) a programme to solve generic safety problems
- (b) a programme to solve urgent "housekeeping" problems

- (c) co-operation arrangements with the Bugey nuclear power station, France
- (d) strengthening of the role of Bulgaria's regulatory body
- (e) a study of the Bulgarian electricity supply situation

11. At the request of the Bulgarian Government, the IAEA is assisting Bulgaria in the regulatory area, particularly with regard to short-term measures for enabling Kozloduy units 3 and 4 to be re-started. In view of the possible long-term involvement of the IAEA, the Bulgarian Government is considering funding this assistance, possibly under the PHARE project.*/

Project review meeting

12. At a project review meeting held in August, in order to help Czechoslovakia and Bulgaria set priorities for the corrective measures required at Bohunice and Kozloduy, the relative safety significance was established of the problems identified by the safety review teams which visited those two sites. This exercise was facilitated by the fact that the Secretariat had created a computerized data base with the results of the design concept review and the two safety review missions and had already prepared a draft document which proposes -- in the light of INSAG's Basic Safety Principles -- a methodology for the classification of safety problems in four categories of increasing significance.

13. A meeting is scheduled for October to consider the results of the safety review missions to plants in the Soviet Union.

*/ The PHARE (Aid for Economic Restructuring in Poland and Hungary) project is a CEC project which now co-ordinates aid to Central and Eastern Europe generally.

Study of generic safety issues

14. The Secretariat has started to prepare a series of documents on generic WWER-440/230 safety issues, the aim being to clearly identify the work still required in order to resolve these issues.

15. Within the framework of WANO, a programme of studies on 13 WWER-440/230 safety issues has been prepared for submission by Bulgaria, Czechoslovakia and the Soviet Union to the CEC for funding.

ASSET missions

16. ASSET missions have by now been carried out to all WWER-440/230 plants, and in July the IAEA convened an advisory group to consolidate the results of the missions and to formulate recommendations aimed at reducing the number of safety-significant events at such plants. The advisory group recommended a generic action plan involving (a) greater use of the experience gained through maintenance and surveillance activities and (b) the performance of systematic root cause analyses.

Other missions

17. In addition, the IAEA has carried out or is planning missions to review the safety of each WWER-440/230 plant against seismic hazards, with emphasis on -- inter alia -- design acceleration and the seismic vulnerability of structures and components important for safety.

Organization and plans

18. The project steering committee is meeting regularly and providing guidance to the IAEA Secretariat. Its meetings are attended by observers from the CEC, the World Bank and WANO.

19. It is expected that by the end of 1991 the project results will have been consolidated to form a technical basis for decisions to be taken by Bulgaria, Czechoslovakia and the Soviet Union regarding improvements in the operational safety of their WWER-440/230 plants.

20. Subsequently, the IAEA will focus on helping countries to make the best use of the assistance which they receive through -- for example -- the CEC and WANO. Such assistance should be in line with the recommendations resulting from the IAEA project and should not duplicate work already completed or initiated internationally or within the framework of national programmes. It is expected that an important feature of such assistance will be the strengthening of the technical capabilities and the role of national regulatory bodies.

Financial aspects

21. As stated in paragraph 14 of document GOV/INF/598, the project is an extrabudgetary one and therefore relies on voluntary contributions from Member States. A few Member States have made contributions both in cash and in kind, but these contributions are well below the needs of the project. The Director General takes this opportunity to reiterate his appeal for contributions so that work can proceed as planned.*/

*/ Germany and the United States have announced that, working with and through the IAEA, they intend to offer joint assistance regarding the safety of older reactors to countries in central and eastern Europe.