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

1. Last year, under its agenda item "Measures to strengthen international co-operation in matters relating to nuclear safety and radiological protection", the General Conference had before it the following documents prepared by the Secretariat - mostly in response to various resolutions adopted by the General Conference in 1992 or in earlier years as a reaction to a number of issues as they arose:

(a) GC(XXXVII)/1064 - Agency activities related to the safety of nuclear power plants in Eastern Europe and countries of the former Soviet Union;

(b) GC(XXXVII)/1065 - The Agency's safety services (the OSART - Operational Safety Review Team - service, the ASSET - Assessment of Safety Significant Events Team - service, the Incident Reporting System, the International Nuclear Event Scale);

(c) GC(XXXVII)/1066 - The preparation of a nuclear safety convention;

(d) GC(XXXVII)/1067 - Programme for education and training in radiological protection and nuclear safety;

(e) GC(XXXVII)/1076 - Safety principles for future nuclear power plants;

(f) GC(XXXVII)/1077 - The preparation of new Basic Safety Standards;

(g) GC(XXXVII)/1078 - Liability for nuclear damage;

(h) GC(XXXVII)/INF/318 - Strengthening of radiation protection and nuclear safety infrastructures in countries of the former USSR; and

(i) GC(XXXVII)/INF/319 - The implementation and status of the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

2. The present document updates information provided last year[1] and also provides summary information on additional Agency activities aimed at strengthening international co-operation in nuclear safety and radiological protection.[2] It is arranged in such a way as to reflect the functions performed by the Agency in this area. The arrangement, which could also facilitate future reporting to the General Conference, is as follows:

- Annex 1 deals with the **implementation of international conventions**;
- Annex 2 deals with the **provision of services**;
- Annex 3 deals with the **establishment of safety standards**;
- Annex 4 deals with the **provision of technical assistance**, whereby - in particular -
- Annex 5 deals with the **provision of technical assistance related specifically to the safety of nuclear power plants in countries of Eastern Europe and the former Soviet Union**;
- Annex 6 deals with the **promotion of education and training**;
- Annex 7 deals with the **encouragement of research and development**;
- Finally, Annex 8 looks ahead, dealing with **safety principles for future nuclear power plants.**

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[1] Of the topics dealt with in the documents before the General Conference last year, liability for nuclear damage is not covered in the Annexes to this document; it is covered in General Conference document GC(XXXVIII)/INF/4.

[2] The additional activities are:

(a) five services connected with radiation protection and nuclear safety which the Agency has been rendering for some years, but on which the Secretariat has not hitherto reported to the General Conference under such an agenda item - the RAPAT (Radiation Protection Advisory Team) service, the International Peer Review Service (IPERS) for Probabilistic Safety Assessments, the IRRT (International Regulatory Review Team) service, the Engineering Safety Review Service (ESRS), the INSARR (Integrated Safety Assessment of Research Reactors) service and the Individual Dose Monitoring Service;

(b) three new Agency services connected with radiation protection and nuclear safety - the ASCOT (Assessment of Safety Culture in Organizations Team) service, the IRIS (International Review of Irradiator Safety) service and the TRANSART (Transport Safety Assessment Review) service; and

(c) Agency activities designed to encourage research and development and Agency assistance to States in radiation-protection- and nuclear-safety-related areas.

Tables listing OSART, ASSET, RAPAT, ESRS and INSARR missions are presented in an Appendix to this document.

IMPLEMENTATION OF INTERNATIONAL CONVENTIONS

The Convention on Nuclear Safety

1. A Diplomatic Conference meeting at the Agency's Headquarters from 14 to 17 June adopted a Convention on Nuclear Safety (see documents INFCIRC/449 and 449/Add.1) which will be open for signature on 20 September, during the General Conference's 1994 regular session. The Convention provides that the Director General of the Agency shall be the Depositary of the Convention and confers a role on the Agency (see document GOV/2743).

2. Subject to the entry into force of the Convention on Nuclear Safety, should the Board approve the role conferred on the Agency by the Convention and request the Director General to assume the Depositary function provided for in the Convention, the General Conference will be regularly informed about the Convention's implementation.

The Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency

Background

3. The Convention on Early Notification of a Nuclear Accident (the Early Notification Convention) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (the Assistance Convention) were adopted on 26 September 1986 - five months after the Chernobyl accident - by the General Conference at the end of a special session at which the Conference reaffirmed "the central role of the Agency, under its Statute, in encouraging and facilitating international co-operation in the peaceful uses of nuclear energy, including nuclear safety and radiological protection".[1] The Director General is the Depositary of the two Conventions, and the Secretariat has since 1987 reported to the General Conference each year on their implementation and status.

Update

4. Since the General Conference's 1993 session, at which the Conference had before it the report contained in the Attachment to document GC(XXXVII)/INF/319, there have been no notifications of accidents of the kind specified in Article 1 of the Early Notification Convention or any requests for assistance under the terms of the Assistance Convention.

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[1] The Conventions are reproduced in documents INFCIRC/335 and 336.

The Emergency Response Unit

5. The Emergency Response Unit, which is the Agency's focal point for responding to any incident covered by the one or the other Convention, continued to maintain its state of readiness through periodic drills and the training of Agency staff. It worked closely with the World Meteorological Organization in the development of a programme for the rapid prediction of the global impact of a nuclear accident.

New parties to the two Conventions

6. Since document GC(XXXVII)/INF/319 was issued (July 1993), the following States have become parties to the Early Notification Convention and the Assistance Convention: Armenia (on 24 September 1993), Morocco (on 7 November 1993), Nicaragua (on 12 December 1993), Indonesia (on 13 December 1993), Liechtenstein (on 20 May 1994) and Estonia (on 9 June 1994).

7. By 31 July 1994, 73 States/Organizations were parties to the Early Notification Convention and 70 States/Organizations were parties to the Assistance Convention. Status lists of the parties to the two Conventions will be issued - as INFCIRC/335/Add.8 and INFCIRC/336/Add.9 - early in September.

Status of the two Conventions in "new" countries

8. In response to concern about the status of the Early Notification Convention and the Assistance Convention in the countries of the former Soviet Union, the countries no longer part of Yugoslavia, the Czech Republic and the Slovak Republic, document GC(XXXVII)/INF/319 carried a table indicating the status of the two Conventions with regard to those countries and also indicating which countries had informed the Agency of their points of contact for purposes of the Conventions. An updated version of that table is reproduced at the end of this Annex.

The Convention on the Physical Protection of Nuclear Material

9. A further convention of which the Director General is the Depositary is the Convention on the Physical Protection of Nuclear Material. The Convention, which is relevant both to radiation and nuclear safety and to safeguards, entered into force on 8 February 1987.[2]

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[2] The Convention is reproduced in document INFCIRC/274/Rev.1. As of 31 July 1994, there were 52 parties (51 States and EURATOM). For several years until 1992, the Secretariat, in response to successive General Conference resolutions, reported to the Conference on the signature and ratification status of the Convention; the last such report was contained in document GC(XXXVI)/INF/311.

10. Pursuant to Article 5.1 of the Convention, the Secretariat maintains a list of States parties' central authorities and points of contact responsible for physical protection and nuclear material; updated copies of the list are sent to Agency Member States periodically by means of a circular letter. Also, the Secretariat has been organizing training in the physical protection of nuclear material.

11. On 29 September 1992, at a conference of parties convened pursuant to Article 16 of the Convention, the parties concluded that the Convention was adequate and that it provided an appropriate framework for co-operation between States in the protection of nuclear material and the recovery and return of any such material that is stolen.

Country [1]	Early Notification Convention		Assistance Convention	
	Ratification/ Accession/ Succession	Contact Point	Ratification/ Accession/ Succession	Contact Point
Armenia [2]	24 Sep. 1993		24 Sept. 1993	
Azerbaijan				
Belarus	26 Feb. 1987	Yes	26 Feb. 1987	Yes
Bosnia-Herzegovina		Yes (unofficially)		Yes (unofficially)
Croatia	08 Oct. 1991	Yes	08 Oct. 1991	Yes
Czech Republic [2]	01 Jan. 1993	Yes	01 Jan. 1993	Yes
Estonia	09 June 1994	Yes	09 June 1994	
Georgia				
Kazakhstan [3]				
Kyrgyzstan		Yes (unofficially)		Yes (unofficially)
Latvia	28 Jan. 1993	Yes	28 Jan. 1993	Yes
Lithuania [2]		Yes		Yes
Moldova		Yes (unofficially)		Yes (unofficially)
Russian Federation [2]	24 Jan. 1987[4]	Yes	26 Feb. 1987[4]	Yes
Slovenia [2]	25 June 1991	Yes	25 June 1991	Yes
Slovak Republic [2]	01 Jan. 1993	Yes	01 Jan. 1993	Yes
Tajikistan				
The former Yugoslav Republic of Macedonia				
Turkmenistan				
Ukraine [2]	26 Feb. 1987	Yes	26 Feb. 1987	Yes
Uzbekistan				

All dates are dates of entry into force.

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[1] The names of countries that are Agency Member States are printed in bold type. The General Conference approved Latvia for membership of the Agency in 1991, but Latvia has not yet deposited an instrument of ratification of the Agency's Statute.

[2] Indicates a country with at least one nuclear power plant on its territory. The two plants in Armenia were shut down in 1988, but there are plans to restart one of them.

[3] Has on its territory a dual-purpose (generation of heat for desalination and of electricity) 350 MW fast breeder reactor.

[4] The Russian Federation informed the Agency on 26 December 1991 that it was continuing the participation of the Soviet Union in the two Conventions.

PROVISION OF SERVICES

1. The Agency is authorized to provide services related to its objectives, and in recent years it has been providing a variety of services aimed at strengthening international co-operation in nuclear safety and radiological protection.

2. The Attachments to this Annex update information already conveyed to the General Conference on certain Agency services and contains information on other services, including three new ones.

3. The services covered in the Attachments are the following:

(Update - services already reported on to the Conference)

- Attachment 1: The **Operational Safety Review Team (OSART)** service;
- Attachment 2: The **Assessment of Safety Significant Events Team (ASSET)** service;
- Attachment 3: The **Incident Reporting System (IRS) for Nuclear Power Plants**;
- Attachment 4: The **International Nuclear Events Scale (INES)**;

(Long-standing services not reported on before to the Conference)

- Attachment 5: The **Radiation Protection Advisory Team (RAPAT)** service;
- Attachment 6: The **International Peer Review Service (IPERS) for Probabilistic Safety Assessments**;
- Attachment 7: The **International Regulatory Review Team (IRRT)** service;
- Attachment 8: The **Engineering Safety Review Service (ESRS)**;
- Attachment 9: The **Integrated Safety Assessment of Research Reactors (INSARR)** service;
- Attachment 10: The **Individual Dose Monitoring Service**;

(New services)

- Attachment 11: The **Assessment of Safety Culture in Organizations Team (ASCOT)** service;
- Attachment 12: The **International Review of Irradiator Safety (IRIS)** service; and
- Attachment 13: The **Transport Safety Assessment Review (TRANSART)** service.

4. Lists of OSART, ASSET, RAPAT, ESRS and INSARR missions are presented in an Appendix to this document.

THE OPERATIONAL SAFETY REVIEW TEAM (OSART) SERVICE

Background

1. The OSART service, which has been available for more than ten years, aims to help Member States enhance the safety of operation of their nuclear power plants (NPPs) by reviewing operational safety practices and performance at individual NPPs, identifying strengths and weaknesses, providing objective advice on improvements and making the results of operational safety reviews available to other Member States.

2. Besides OSART missions of various kinds, the service provides for follow-up visits to operating NPPs, during which OSART members meet with plant managers and other senior personnel and assess their responses to the proposals made regarding the safety issues identified in the course of OSART missions.

3. Last year, the General Conference had before it a report on the Agency's OSART service in Annex 1 to document GC(XXXVII)/1065. That report is updated below.

OSART missions since the 1993 session of the General Conference

4. Since the 1993 session of the General Conference, there have been full-scope OSART missions to the Cattenom NPP in France (12-31 March 1994), the Hunterston B NPP in the United Kingdom (11-29 April 1994) and the Ulchin NPP in the Republic of Korea (7-29 June 1994); safety review missions to the Chernobyl and Zaporozhe NPPs in Ukraine (7-18 March and 9-27 May 1994 respectively); and follow-up visits to the Fukushima Daini NPP in Japan (25-29 October 1993), the Grafenrheinfeld NPP in Germany (8-12 November 1993), the Grand Gulf NPP in the United States (14-18 February 1994), the Sizewell B NPP in the United Kingdom (14-18 February 1994), the Kola NPP in Russia (6-10 June 1994) and the Kozloduy NPP in Bulgaria (11-15 July 1994).

Results of OSART follow-up visits

5. The table overleaf is an updated version of the table presented in paragraph 4 of Annex 1 to document GC(XXXVII)/1065.

Results of OSART follow-up visits during the period 1989-94 (July)*

PERIOD	ISSUES RESOLVED	SATISFACTORY PROGRESS	LITTLE OR NO PROGRESS	PROPOSAL(S) WITHDRAWN	TOTAL
(Number of visits)	Number of issues (%)	Number of issues (%)	Number of issues (%)	Number of issues (%)	Number of issues (%)
1989/90 (6)	219 (40)	236 (43)	74 (14)	18 (3)	547 (100)
1991/92 (10)	521 (43)	465 (38)	206 (17)	16 (1)	1208 (100)
1993/94 (8)	410 (49)	313 (38)	108 (13)	4 (--)	835 (100)

* Quantitative results are available from all follow-up visits except the first two.

6. From this table it can be seen that the percentage of resolved safety issues has continued to rise and the percentage of withdrawn proposals has fallen still further. This suggests that the effectiveness of the OSART service has continued to increase, with NPP operators taking OSART missions seriously and making worthwhile improvements in operational safety.

OSART database

7. A database of OSART findings has been established; it covers all strengths and weaknesses identified during OSART missions and is to be augmented with the results of follow-up visits. It will be available to NPP operators, utilities and regulatory authorities, and it is expected that the database material will be used by them in their operational experience feedback programmes and that all interested organizations will therefore benefit from the lessons learned through OSART missions.

Outlook

8. The envisaged future OSART missions and follow-up visits can be seen from the tables on pages 1-6 of the Appendix to this document.

9. There is still room for more requests for OSART missions, although the 1995 programme is a full one, with some countries hosting OSARTs for the first time. Although the General Conference has several times recommended to Member States that they avail themselves fully of the Agency's services for advancing operational safety, a few Member States with operating NPPs have never requested a mission and some have not requested one for a long time.

THE ASSESSMENT OF SAFETY SIGNIFICANT EVENTS TEAM (ASSET) SERVICE

Background

1. The purpose of the ASSET service, initiated in 1986, is to promote the analysis of safety-related operating events at nuclear power plants (NPPs) with a view to identifying the root causes of equipment, personnel and procedural deficiencies, to assessing the adequacy of corrective actions and to disseminating the experience gained and recommendations made throughout the nuclear community.

2. Last year, the General Conference had before it a report on the Agency's ASSET service in Annex 2 to document GC(XXXVII)/1065. That report is updated below.

ASSET missions since the 1993 session of the General Conference

3. Since the 1993 session of the General Conference, there have been (as of the end of July 1994) 24 ASSET missions: seven Analysis Missions, 16 Training Missions and one Advice Mission.[1] A table listing ASSET missions is presented on pages 7-9 of the Appendix to this document.

4. The Analysis Missions were requested by: Bulgaria - for the Kozloduy NPP (four WWER-440/230 units); the Czech Republic - for the Dukovany NPP (four WWER-440/213 units); Russia - for the Kola NPP (two WWER-440/230 units), the Novovoronezh NPP (two WWER-440/230 units) and the Kalinin NPP (two WWER-1000 units); and Ukraine - for the Rovno NPP (two WWER-440/213 units), the Chernobyl NPP (two RBMK-1000 units) and the Zaporozhe NPP (five WWER-1000 units).[2]

5. The Training Missions were requested by Greece (1), India (1), the Islamic Republic of Iran (1), Russia (2), Slovakia (1), Slovenia (1), South Africa (1), Spain (1), Switzerland (1), Ukraine (2) and the United Kingdom (3) and by OECD (1). The Advice Mission was requested by France.

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[1] Through Analysis Missions, nuclear power regulators and nuclear power plant (NPP) operators receive advice on corrective actions necessary in order to enhance NPP safety; through Training Missions, they are familiarized with the ASSET analysis procedures; through Advice Missions, peer reviews are performed of NPP operators' own analyses of the root causes of safety-significant events.

[2] An Advice Mission to Romania - the Cernavoda NPP (one PHWR unit of 700 MW) - is taking place in August.

6. The Analysis Missions to the Kozloduy, Kola and Novovoronezh NPPs were follow-up missions, and the teams reported substantial safety improvements aimed at preventing safety-significant events in general and failures during operation in particular.

Meeting of ASSET service users

7. In May 1994, the Secretariat convened a meeting of users of the ASSET service to review experience and consider ways of increasing the service's effectiveness. The executive summary of the report on the meeting highlighted the following:

- ASSET missions and training seminars make a direct contribution to the improvement of nuclear safety, and they are very much appreciated by NPP operators.

- Although there are fundamental differences between different reactor types, ASSET missions bring to light problems that appear to be common to reactors of different types.

- Generic safety problems include problems relating both to equipment and to organization and management.

ASSET findings

8. Ten of the eleven Analysis Missions carried out in 1993 were to countries of Eastern Europe or the former Soviet Union, where families of recurrent operational failures pointed to a number of pending safety problems that suggest shortcomings in NPP defence-in-depth systems. The problems were found to be plant-specific, relating to particular pieces of equipment (e.g. electrical components, instrumentation and control components, diesel generators and motor-operated valves), categories of personnel (e.g. maintenance staff) or types of procedures (e.g. maintenance, operating and test procedures). In addition, however, management problems common to several of the NPPs were identified (e.g. poor management control leading to - inter alia - failure to perform root cause analyses systematically and failure to complete corrective actions).

9. The teams recommended practical measures for coping immediately with the identified problems under conditions of severe resource constraint.

Accident precursors - the major lesson of 1993

10. The 69 operational events reported to the INES Information System in 1993 and the 2520 events reported during the eleven Analysis Missions carried out in 1993 highlighted shortcomings in NPP defence-in-depth systems (see para. 9 above). The most severe ones were three significant incidents that resulted in total losses of off-site and on-site electrical power ("station blackouts") lasting several hours:

- As a result of a tornado, two units of the same NPP were affected by a failure of diesel generators to provide electrical power. In both cases, the safety function "cooling of fuel" was ensured by natural circulation thanks to the large water inventory in the steam generators.

- At another NPP, a fire broke out in the electrical generator. The safety function "cooling of fuel" was ensured by natural circulation, additional cooling water being supplied to the steam generators by a diesel-motor-driven pump.

11. Although the safety function "cooling of fuel" was ensured in all three cases, the incidents highlighted the importance of a reliable electrical power supply.

THE INCIDENT REPORTING SYSTEM (IRS) FOR NUCLEAR POWER PLANTS

Background

1. The IRS, which is jointly operated by the Agency and the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (NEA/OECD), collects, evaluates and disseminates information on safety-relevant incidents at operating nuclear power plants (NPPs) and systematically analyses the safety implications of such incidents.

2. Last year, the General Conference had before it a report on the IRS in Annex 3 to document GC(XXXVII)/1065. That report is updated below.

Reporting since the 1993 session of the General Conference

3. Since the 1993 session of the General Conference, some 60 IRS reports have been received by the Agency's Secretariat; at the end of July 1994, the Agency database of IRS reports contained a total of some 1500 reports. The reports related mainly to failed/affected NPP systems - primary reactor systems, essential reactor auxiliary systems, and instrumentation and control systems.[1] The reported incidents were due primarily to personnel failure and equipment failure, each accounting for about 40% of those incidents.

The Advanced Incident Reporting System (AIRS) database

4. During the last meeting of IRS national co-ordinators, held in September 1993 and organized jointly by the Agency and NEA/OECD, the Agency's Secretariat was given a mandate to develop a computerized full text and image database for storing IRS reports. The resulting AIRS database will be much more elaborate than the present database, which is capable of storing only summary descriptions of incidents complemented by a list of categorization codes.[2] A prototype of the new database was tested by a group of consultants in April 1994.

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[1] For IRS purposes, NPPs are divided into 11 groups of systems: primary reactor systems; essential reactor auxiliary systems; essential service systems; essential auxiliary systems; electrical systems; feedwater, steam and power conversion systems; heating, ventilation and air-conditioning systems; instrumentation and control systems; service auxiliary systems; structural systems; and waste management systems (see Safety Series No. 93 - " Systems for Reporting Unusual Events in Nuclear Power Plants").

[2] See pages 46-56 of Safety Series No. 93.

5. In addition to storing full report texts and images, the AIRS database will permit faster and more comprehensive searches and better statistical presentation. A further prototype will be presented at the annual meeting of IRS national co-ordinators to be held in Vienna at the beginning of October. It is expected that the AIRS database will be made available for testing by IRS participants early in 1995.

Meetings within the IRS framework

6. In October 1993, a Technical Committee reviewed experience with the root cause analysis of incidents. A document prepared after the meeting summarizes some widely used root cause analysis methodologies and the lessons learned in applying them.

7. In April 1994, at a joint NEA/OECD-Agency specialists' meeting on motor-operated valve issues, questions relating to regulatory activities, operating experience, improvement programmes, R&D, testing and maintenance were covered.

8. In May 1994, a Technical Committee considered national practices regarding operational experience feedback, the ultimate aim being to strengthen the capabilities of Member States for the systematic analysis of NPP operational safety experience and national programmes for the feedback of operational safety experience gained worldwide.

THE INTERNATIONAL NUCLEAR EVENT SCALE (INES)

Background

1. INES was developed by the Agency and the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (NEA/OECD), with the help of experts from Member States, for the purpose of facilitating rapid communication on nuclear events between the nuclear community, the media and the public. The media appear to have had no major difficulties in using INES when reporting on nuclear events, and INES is gaining acceptance by the public. NucNet (the nuclear news agency operated by the European Nuclear Society) is now encouraging its members to report in accordance with the INES communication criteria.

2. Last year, the General Conference had before it a report on INES in Annex 4 to document GC(XXXVII)/1065. That report is updated below.

Notifications received by the INES Information System

3. In 1993 the INES Information System received 76 notifications of operational events. Of the 34 events "on scale" (i.e. above the threshold of safety significance), three were of level 3, 12 of level 2 and 19 of level 1. Thirty-five events were stated to be "below scale" and seven to be "out of scale". Among the level 0-3 rated events, 63 were rated on the basis of defence-in-depth degradation and six were rated on the basis of on-site impact (more details are given in the Nuclear Safety Review 1994).

Participation in the INES Information System

4. Fifty-three countries have now officially informed the Agency that their regulators and operators are using INES. As a result of the extension of INES to non-reactor facilities on a trial basis, in March 1992, more countries have joined the INES Information System. The countries participating in the INES Information System are listed at the end of this Attachment.

Review of ratings

5. A review was carried out in October 1993 - as in October 1992 - of the ratings which had been given to a number of nuclear events. On the basis of the information provided to the INES Information System, there was again consensus that in some cases the rating should have been different by one level. As before, however, there was no evidence of consistent under-rating or over-rating of events. Again as before, insufficient information had been provided in a few cases for the event in question to be rated.

The INES Advisory Committee

6. The INES Advisory Committee held its second and third meetings in October 1993 and March 1994 respectively. A review of the events communicated again confirmed the satisfactory application of INES to all types of nuclear events at nuclear power plants and other nuclear facilities, but it was concluded that further refinement of the INES rating procedures was necessary. It was also concluded that, to assist INES National Officers in ensuring consistency in the rating of the safety significance of nuclear events by facility operators, the Agency should continue to offer seminars on the use of the INES rating and communication procedures.

Transparency

7. With the gradual decline in the emphasis on confidentiality traditionally associated with the reporting of events, many European countries - including countries in Eastern Europe - have now attained a commendable level of transparency. INES has been playing an important part in the move towards greater transparency, for participation in the INES Information System means not only the right to receive information but also the duty to inform the other participating countries about safety-relevant events at one's own nuclear installations.

COUNTRIES PARTICIPATING IN THE INTERNATIONAL NUCLEAR EVENT SCALE (INES) INFORMATION SYSTEM (as of 29 June 1994)

Argentina, Austria, Bangladesh, Belarus, Belgium, Brazil, Bulgaria, Canada, Chile, China, Costa Rica, Czech Republic, Denmark, Egypt, Finland, France, Germany, Greece, Guatemala, Hungary, India, Islamic Republic of Iran, Ireland, Italy, Japan, Republic of Korea, Kuwait, Lithuania, Luxembourg, Mexico, Netherlands, Norway, Pakistan, Peru, Poland, Romania, Russian Federation, Saudi Arabia, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Syrian Arab Republic, Turkey, Ukraine, United Kingdom, United States of America, Viet Nam, Yugoslavia, Zaire.

THE RADIATION PROTECTION ADVISORY TEAM (RAPAT) SERVICE

Background

1. In 1984, the Agency established the RAPAT service, designed to help developing Member States identify existing or potential radiation protection problems and draw up programmes for the solution of such problems. The service has been operated by the Division of Nuclear Safety with the support of the Department of Technical Co-operation.

2. During the past decade, RAPAT services have been rendered to Member States under the following general terms of reference:

- to assess the status of radiation safety in Member States on request;
- in the light of the findings and of the views expressed by the requesting Member States, to determine immediate and future radiation safety needs and priorities; and, subsequently,
- to propose further steps for meeting the requirements laid down by the Agency's Basic Safety Standards and Agency assistance for achieving this purpose.

3. A RAPAT makes recommendations both to the government of the country visited and to the Agency, including recommendations about technical co-operation activities related to radiation protection in that particular country. Technical assistance in radiation protection is then brought into line with the short- and long-term priorities identified by the RAPAT.

4. An important aspect of a RAPAT mission to a Member State is the presentation of international recommendations and requirements regarding radiation protection to the appropriate authorities, up to the ministerial level, in order to make them aware of the country's radiation protection needs and thereby ready - where necessary - to support the passing of legislation and the creation of organizational infrastructures and to provide manpower and other resources.

RAPAT missions

5. By January 1994, there had been RAPAT missions to 63 countries (see the table on pages 11 and 12 of the Appendix to this document). All RAPATs included - in addition to technical officers serving in the Agency's Secretariat - experts from Agency Member States (Australia, Argentina, Belgium, China, Chile, Canada, Ecuador, Egypt, France, Germany, Hungary, India, Italy, Japan, Malaysia, Mexico, Pakistan, Poland, Spain, Sweden, the United Kingdom and the United States); many of them also included experts from the World Health Organization, the International Labour Organisation, the Commission of the European Communities and the International Commission on Radiological Protection. The participation

of outside experts and the co-operation with other organizations make for an independent approach and a high degree of technical competence.

6. There has recently been a decline in the frequency of RAPAT missions, mainly because of the need to carry out fact-finding missions to countries of the former Soviet Union in the context of the joint UNDP/IAEA initiative described last year in General Conference document GC(XXXVII)/INF/318. Although not part of the RAPAT programme, these missions have involved the same type of expertise and similar team compositions and terms of reference. It is expected that when this series of missions has been completed (in the autumn of 1994) the RAPAT programme will pick up again.

RAPAT findings

7. As a result of RAPAT missions, an awareness of radiation safety issues has been achieved and - in general - radiation safety has been enhanced in most of the Member States visited. However, RAPAT missions have revealed an urgent need to strengthen radiation protection in many developing Member States, some of which do not yet even have national radiation protection programmes. At the same time, they have shown that Agency technical co-operation projects designed on the basis of RAPAT recommendations have been successful in those developing Member States whose governments have allocated funds and resources in support of such projects.

8. From RAPAT missions and subsequent follow-up activities, and also from other information sources, it is clear that:

- a few Member States do not have any radiation safety infrastructures at all; and

- in several others, although a minimum infrastructure is formally in place, the actual level of radiation safety is inadequate owing mainly to the lack of a national radiation protection programme.

This serious situation calls for prompt assistance from the Agency as in many of these countries the Agency is promoting activities that involve exposure to ionizing radiation, such as (i) technical co-operation involving the provision of radiation sources and (ii) research and development involving work with radiation sources. The Agency has accordingly launched an interregional Model Project for the upgrading of radiation protection infrastructures (see Annex 4 to the present document).

9. With regard to the Agency's activities in the field of radiation protection, the following conclusions may be drawn from the RAPAT missions carried out so far:

(i) Agency technical co-operation projects should in general give priority to the transfer of know-how over the provision of

equipment, special attention being paid to the establishment of national radiation protection programmes, the education and training of manpower (see Annex 6 to the present document), the creation of infrastructures and the establishment of regulatory regimes; and

(ii) continuing surveillance of the radiation protection situation in developing countries is essential if the Agency is to respond properly and in a timely manner to those countries' needs.

Outlook

10. The improvement of radiation protection infrastructures is only a first step. The improved infrastructures have to be maintained - and possibly further improved in response to new developments. Thus, despite the success of individual technical co-operation projects in the radiation protection field following RAPAT missions, such missions will continue to be offered to Member States. The interregional Model Project for the upgrading of radiation safety infrastructures should be viewed as a tool for dealing with shortcomings revealed during RAPAT missions and not as a substitute for the RAPAT service.

11. With this in mind, it is envisaged that future RAPAT missions will focus on the updating of knowledge about countries visited some years before and on the provision of advice in the light of the recently drafted International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources.

THE INTERNATIONAL PEER REVIEW SERVICE (IPERS) FOR PROBABILISTIC SAFETY ASSESSMENTS

Background

1. Under the International Peer Review Service (IPERS) programme, initiated in 1988, international expert teams carry out independent reviews of Probabilistic Safety Assessments (PSAs) being conducted in Member States for specific nuclear power plants (NPPs).

2. The reviews, for which IAEA-TECDOC-543 contains detailed guidelines, are carried out, in response to requests from Member States, by carefully selected teams of experts with in-depth experience in the required PSA fields. A basic consideration in the selection of the experts is that they should be independent of the organizations performing, sponsoring or requesting the PSA.

3. It is believed that such reviews lead to improvements in PSA quality, thereby increasing the credibility of PSAs as an aid to nuclear-safety-related decision-making. In many countries, a PSA is now required as part of the NPP licensing procedure, and reviews are being requested with a view to ensuring that ongoing PSAs correspond to the state of the art and take proper account of the particular features of the NPPs in question.

Focus of reviews

4. Nearly half of the reviews carried out during the past two years have been of PSAs for WWER-440/230 and WWER-440/213 plants[1], such PSAs being considered essential in view of the decisions soon to be taken about the major backfitting and further operation of the plants in question. The PSAs reviewed were for the Paks NPP, the Kola NPP and the Bohunice NPP.[2]

5. There is an increasing demand for reviews of specialized PSAs relating to plant shutdown conditions, to low-power operation conditions, to internal fires and floods and to external events and of Level 2 PSAs.[3]

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[1] A PSA for a WWER-1000 plant (Kozloduy NPP) is to be reviewed in September 1994.

[2] Funding for the Bohunice PSA was provided by the European Community.

[3] Level 2 PSAs address issues such as accident progression and containment analysis, and they constitute a basis for measures aimed at preventing severe accidents or mitigating their consequences.

6. Recent PSAs relating to plant shutdown conditions and low-power operation conditions have shown that the periods in question can account for a substantial part of the risks associated with NPPs, and reviews of such PSAs have shown that for the treatment of these conditions there needs to be some refinement of the PSA techniques being used. For example, it is necessary to improve the modelling of the many possible plant configurations, to take into account potential maintenance and repair outages and to assess the impact of various operator actions and interactions. Such PSAs for the Dodewaard NPP and the Borssele NPP have been reviewed.

7. Internal fires and floods are important as risk contributors in the case of older NPPs, since the provisions for mitigating the consequences of such events were not so extensive in their design. The PSAs relating to such events focus on what cost-effective improvements can be made. In Europe, reviews have been carried out of PSAs conducted for the Muehleberg NPP (in relation to the internal fire risk) and the Dodewaard NPP. In the Republic of Korea, there has been a review of the PSA conducted for Yonggwang Units 3 and 4, which covered external events in addition to internal fires and floods and included a Level 2 analysis.

THE INTERNATIONAL REGULATORY REVIEW TEAM (IRRT) SERVICE

Background

1. Under the IRRT service, the Agency provides, at the request of Member States, teams of experienced senior regulators to carry out peer reviews of the practices being followed by the nuclear regulatory bodies in the requesting Member States. The teams take international consensus guidelines[1] and good practices being followed elsewhere as a basis for the reviews.

2. The objective of an IRRT mission is to enhance nuclear safety by:

- providing the requesting country (i.e. its regulatory body and relevant governmental authorities) with an objective opinion about how its nuclear regulatory practices compare with international guidelines;

- providing the host regulatory body with recommendations and suggestions for improvement in areas where organization or performance falls short of internationally acceptable standards;

- providing key staff of the host regulatory body with an opportunity to discuss their practices with experts who have experience of other regulatory bodies' practices in the same field; and

- providing Member States with information regarding good practices identified in the course of peer reviews.

3. An IRRT consists of a leader who is always an Agency staff member and six experts in the field of nuclear power plant (NPP) regulation. No-one from the requesting country is included in the IRRT visiting that country.

4. IRRT missions usually last two weeks. Besides the head office of the regulatory body, the IRRT usually visits (for a period of 2-3 days) one or more regional inspection offices and NPPs.

5. The final mission report, with comments of the IRRT members and of the host regulatory body, is sent to the host government.

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[1] For example, the NUSS Code on Governmental Organization and the associated Guides.

6. Reviews are carried out in accordance with the "Guidelines for IAEA International Regulatory Review Teams (IRRTs)" issued in IAEA-TECDOC-703. They are "performance-oriented" in that different organizational approaches and practices are considered acceptable as long as they help to ensure that the requesting country's nuclear safety regime is a sound one.

7. The areas which may be considered by IRRTs are:

(a) Governmental organization and nuclear safety legislation;

(b) Role and responsibility of the regulatory body;

(c) Organization of the regulatory body;

(d) Regulations and guides;

(e) Licensing process;

(f) Requirements on the applicants/licensees;

(g) Review and assessment during the licensing process;

(h) Regulatory inspection and enforcement;

(i) Emergency preparedness.

The number of areas considered during a particular mission will depend on the needs of the host regulatory body. In some cases, only a few areas of particular concern may be considered.

8. The following IRRT missions have taken place so far:

Brazil	National Nuclear Energy Commission	September 1989
Romania	National Commission for Nuclear Activities Control	February 1992
Bulgaria	Committee on the Use of Atomic Energy for Peaceful Purposes	August 1993
China	National Nuclear Safety Administration	April 1994

Some general findings from the IRRT missions carried out so far

9. The IRRT missions carried out so far have - inter alia - made clear the importance of:

- clearly defining the objectives of the regulatory body,
- revising or finalizing regulations concerned with the assignment of responsibilities under national nuclear laws that are undergoing modification,
- attracting and retaining appropriate staff through remuneration scales equivalent to those in competing industries and in the utilities,
- training regulatory body staff to carry out safety reviews and assessments as part of the licensing process,
- formulating systematic and well documented inspection and enforcement policies as part of the management strategy of regulatory bodies,
- helping regulatory bodies to improve quality assurance and raise the level of safety culture at nuclear installations,
- the role of the regulatory body as an independent advisor to the government in the decision-making process during emergency planning and response, and
- operational experience feedback systems in accident prevention.

Outlook

10. The Commission of the European Communities (CEC) recently suggested that IRRT missions be carried out at the request of countries of Eastern Europe and the former Soviet Union as an independent means of assessing the effectiveness of the CEC's regulatory assistance programmes.

THE ENGINEERING SAFETY REVIEW SERVICE (ESRS)

Background

1. Through the ESRS, Member States can obtain the advice of interdisciplinary teams of independent experts on widely varying engineering safety aspects of planned or existing nuclear power plants (NPPs) - for example, siting, external hazards (such as earthquakes, hurricanes and forest fires), accident management and the impact of ageing. In practice, however, requests for reviews have tended to focus on questions connected with siting and with external hazards.[1]

2. Site safety and external hazard reviews may cover a broad range of disciplines - for example, geology, seismology, hydrology, vulcanology, meteorology and tectonics - and the teams also look into matters like the local population distribution and the impact of possible man-induced events (e.g. an aircraft crash).

Focus of reviews

3. When the focus is on seismic hazards capable of affecting the plant (which are assessed through "seismic safety review missions"), the review team includes experts in structural mechanics with experience of seismic capacity evaluation and the design of NPP structure, system and component upgrades to resist seismic effects.

4. As only a few sites are at present being investigated with a view to the construction of new NPPs, the requests made by Member States in recent years have been mainly for reassessments of the safety of existing NPPs. In particular, the Secretariat has been receiving requests for seismic safety review missions to the sites of WWER-type NPPs.

Review findings

5. A conclusion which has emerged from such missions is that WWER-440/230 and 440/213 plants (and also RBMK plants) do not have inherent structural resistance to the types of load associated with earthquakes (and with similar external events). This is due to the fact that in such a plant only the pressure boundary (i.e. the equipment that operates under pressure) is designed to withstand extreme loads; the superstructures housing the reactor, turbines and emergency diesel generators are designed as normal industrial buildings with large spans and very little cross-bracing to take lateral (i.e. earthquake-induced) loads and are constructed in such a way that they have relatively low ductility. When the seismic

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[1] A list of the missions completed and still to be carried out is given on pages 13 and 14 of the Appendix to this document.

acceleration to be allowed for is low (e.g. ~ 0.1 g), minor structural strengthening may be sufficient; when it is even only slightly higher (0.2-0.3 g), however, complex and expensive structural upgrading becomes necessary.

The seismic upgrading of NPPs[2]

6. Following seismic safety review missions, the seismic upgrading of structures, systems and components at the Kozloduy NPP (Bulgaria), the Bohunice NPP (Slovakia) and the Paks NPP (Hungary) is under way. In Armenia, the seismic hazards associated with the site of the Medzamor NPP - shut down after the 1988 Spitak earthquake - are being reassessed and, if the results of the reassessment are satisfactory, the plant will go back into service after the completion of the seismic upgrading started before the earthquake.

7. As to NPPs not of Soviet design, seismic upgrading is in progress at the Karachi NPP, Pakistan, which went into service in 1972. Also in Pakistan, a seismic design review is being conducted of the 300-MW(e) NPP under construction at Chashma, use being made of the experience gained in seismic reassessments of various existing NPPs.

Hazards associated with volcanoes

8. A number of reviews have been performed of hazards associated with volcanoes. One related to site investigations for an NPP to be built on the Muria Peninsula in Indonesia and another to the seismic reassessment being carried out of the Medzamor NPP site in Armenia (see para. 6 above).

Related activities

9. A database is being established for information on NPP sites and the possible external events associated with them. A data collection questionnaire is being prepared in this connection.

10. Eighteen institutions in eleven countries are participating in a benchmark study connected with the seismic analysis and testing of WWER-type NPPs for which one of the units at the Paks NPP is serving as the prototype for WWER-440/213 plants and two units at the Kozloduy NPP are serving as the prototypes for WWER-1000 plants.

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[2] At a conference on structural mechanics in reactor technology held in Stuttgart, Germany, last year, there were a considerable number of presentations on the seismic upgrading of NPPs, and at a subsequent seminar hosted by the Agency in Vienna the seismic upgrading of NPPs in Eastern Europe was a major topic.

THE INTEGRATED SAFETY ASSESSMENT OF RESEARCH REACTOR (INSARR) SERVICE

Background

1. In 1972, the Agency began to review the safety of research reactors in Member States by means of INSARR-type missions, both pursuant to its statutory rights and responsibilities under project and supply agreements and in response to requests from Member States. In 1987, it launched the INSARR service on the basis of the experience thus gained.

2. As of the end of July 1994, a total of 118 reviews had been conducted at operating research reactors in 37 Member States, in 23 of them pursuant to project or supply agreements with the Agency (see the table on page 15 of the Appendix to this document).

3. The reviews address mainly the general operational safety of research reactor facilities. Upon request, they may also address a variety of specific issues such as seismic conditions, the obsolescence of equipment and documentation, the ageing of equipment, major modifications, licensing, commissioning and decommissioning.

INSARR missions

4. INSARR missions are carried out by teams normally consisting of two to five members - experts from Member States and Agency staff. The teams carry out comprehensive, independent assessments of research reactor facilities in the light of the relevant Agency safety standards.[1] Also, they exchange experience with reactor personnel. The duration of a mission depends on its objective and scope; a mission may last as little as three working days (at the site) if sufficient information is provided in advance.

5. The information normally required relates to nuclear safety and radiation protection aspects of the operation of the reactor; it is obtained from the operating organization by means of a questionnaire. In some cases, however, additional information may be required - such as:

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[1] The "Code on the Safety of Nuclear Research Reactors: Design" and the "Code on the Safety of Nuclear Research Reactors: Operation" - Safety Series No.35-S1 and 35-S2.

(a) information on the structure of the administrative organization set up by the Member State for dealing with safety matters and on the national licensing process, including evaluation procedures, record-keeping, inspections and supervisory examinations; and

(b) the safety analysis report (or a similar document prepared for the same purpose), containing information on such matters as siting, the conduct of operations, quality assurance, radiation protection, waste management, and emergency planning and preparedness.

6. At the site, the team:

(a) examines the safety documentation of the reactor facility;
(b) reviews the operational status of the reactor, if possible observing operations such as start-up and shutdown; and
(c) discusses technical details with the responsible personnel.

7. At the end of the mission, the team conveys its preliminary conclusions and recommendations to the relevant authorities (the operating organization and the regulatory body) at a final meeting. Soon afterwards, a mission report is submitted through official channels to the Member State concerned.

8. INSARR missions are an Agency service normally provided cost-free to those Member States which are developing countries. The question of payment for INSARR missions requested by Member States which are not developing countries and for special INSARR missions dealing with issues other than the ones normally dealt with is settled on a case-by-case basis with the requesting Member State.

INSARR mission findings

9. In the course of the missions carried out by them, INSARR teams have found strong and weak points. Among the weak points found have been: poor documentation; documentation not properly updated; the lack of a quality assurance programme; poor implementation of the quality assurance programme; incomplete written procedures for operation, maintenance, testing, inspection, emergencies and radiation protection; and poor record-keeping. In extreme cases (e.g. safety systems not working properly), the mission report to the Member State has been followed by a written request from the Agency that the RAPAT team's recommendations be implemented and by a further mission to check on their implementation.

THE INDIVIDUAL DOSE MONITORING SERVICE

1. The Agency provides radiation safety services in support of its own operations, including safeguards and technical co-operation activities. The services include monitoring of the occupational exposures of individuals, as required by applicable radiation safety standards.

2. The Agency has been providing this service also in support of operations conducted by a number of Member States and the World Health Organization (WHO).

3. By the end of 1993, the occupational exposures of almost 600 persons (Agency staff and outside experts) had been determined by the Agency within the framework of this service.

4. Under technical co-operation projects, the service is provided to some Member States pending the establishment of their own national dosimetry infrastructures; in 1993, it was provided to Cameroon, Niger, Nigeria, Sierra Leone and the United Arab Emirates. In addition, so-called "extremity" - or finger - dosimetry has been performed for Cuba, Panama, Sri Lanka and the United Arab Emirates.

5. Under an agreement concluded by the Secretariat and WHO, the service has been provided to some countries previously assisted by WHO. In 1993, the countries in question were Egypt, Yemen* and Kiribati*.

6. In the light of the experience gained by it in this area, the Secretariat believes that the service, when provided to countries with neither radiation protection regulations nor radiation monitoring infrastructures, should be regarded as a temporary one; such countries should be encouraged to develop their own service.

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* Not a Member State of the Agency.

THE ASSESSMENT OF SAFETY CULTURE IN ORGANIZATIONS TEAM (ASCOT) SERVICE

Background

1. The ASCOT service became available at the beginning of 1993, after the publication by the Agency - in 1991 - of a report of the International Nuclear Safety Advisory Group (INSAG) entitled "Safety Culture".[1] This report contains what is probably the most complete description so far of the "safety culture" concept. Soon after the report had been published, interest was expressed in the possibility of assessing safety culture in particular organizations despite difficulties due to the fact that the required characteristics lie below the surface and even comprehensive checks on equipment, documentation and procedures would not necessarily reveal the strength of safety culture.

2. Through the ASCOT service, safety culture is assessed on the basis of the principles and recommendations set forth in INSAG's report. For this purpose, ASCOT Guidelines have been developed; issued in IAEA-TECDOC-743, they may also be used by any organization wishing to conduct a self-assessment of safety culture.

ASCOT service options

3. The following three options are offered to Member States:

(a) ASCOT reviews conducted as independent exercises by teams of 4-5 experts and normally lasting no more than one week (so as not to be overly disruptive), during which period the team interacts with most of the organizations contributing to safety culture;

(b) ASCOT reviews conducted in conjunction with nuclear-safety-related activities such as ASSET missions, with an ASCOT representative serving as a member of the team in question and drawing safety culture conclusions from his/her own observations and from the findings of other team members who, in addition to carrying out their usual activities, pay attention to safety culture aspects; and

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[1] The report was published as Safety Series document No. 75-INSAG-4.

(c) Two-day ASCOT Seminars at which two ASCOT experts demonstrate - through lectures and in discussion sessions and workshop exercises - basic ASCOT principles and approaches and prepare countries for possible future self-assessments of safety culture and at which a senior regulator or an NPP manager of the host country may well give a lecture on national experience with safety culture initiatives.

Experience to date

4. Since the inception of the ASCOT service, one ASCOT review has been conducted in conjunction with a Pre-OSART mission and one in conjunction with an ASSET mission and 16 ASCOT Seminars have been held.[2] The main purpose of the review conducted (in November 1992) in conjunction with a Pre-OSART mission - to the Sizewell B NPP, United Kingdom - was to test the ASCOT methodology. It resulted in a comprehensive report on safety culture at Sizewell B, identifying a number of good safety culture practices which were highlighted at the ASCOT Seminars held in 1993. The main purpose of the review conducted (in June 1993) in conjunction with an ASSET mission - to the Borssele NPP, Netherlands - was to validate the ASCOT Guidelines. Here again a number of good safety culture practices were identified.

5. In December 1993, the experience gained through the ASCOT Seminars and the ASCOT reviews conducted in conjunction with ASSET missions and other nuclear-safety-related activities was evaluated at a meeting held in Vienna. It was concluded that most of the organizations considered had fairly good safety culture. In all of them, however, there were areas where improvements could be made. A number of organizations had already applied the ASCOT Guidelines or had adopted similar approaches to the assessment and enhancement of safety culture. It emerged that many root causes of problems were related to "intangible" factors such as motivation and attitudes towards safety, the conclusion being that efforts to better understand, promote and enhance safety culture should continue.

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[2] In 1993, ASCOT Seminars were held in Hungary, Finland, the Republic of Korea, Spain, the Czech Republic, Bulgaria, Ukraine, Belgium, South Africa and the United Kingdom. In 1994, ASCOT Seminars are being held in Slovakia, the Russian Federation, Slovenia, the Czech Republic, the Netherlands and Pakistan. Also in 1994, an ASCOT review is being conducted in conjunction with an ASSET mission to the Koeberg NPP in South Africa.

THE INTERNATIONAL REVIEW OF IRRADIATOR SAFETY (IRIS) SERVICE

1. The Secretariat will soon be introducing the IRIS service - a mechanism for the peer review of irradiation plant safety and for the sharing of safety-related knowledge among irradiation plant operators - in the light of the following considerations:

(a) In recent years, there have been a number of serious accidents at industrial irradiation plants, several involving fatalities. They have been analysed in order to determine the causes and see what lessons can be learned from them. From the analyses, it would appear that similar accidents are probably "waiting to happen" as a result of inadequate regulatory controls, poor operational safety (procedures, training, maintenance), poor design of safety systems and inadequate quality assurance during construction.

(b) Of the approximately 160 known large gamma irradiation plants, some 40 were established with Agency assistance. They contain gamma-emitting radionuclide sources and are used mainly for the sterilization of medical products and the preservation of foodstuffs. From information obtained through RAPAT missions and in other ways, it seems that at some irradiation plants - including some which were established with Agency assistance - the radiation safety conditions are poor.

2. The IRIS secretariat will seek and collate data on: irradiator types and locations; irradiator design; radiation sources; national radiation protection programmes; accidents and incidents at irradiation plants; and details of suppliers' warning notices. Also, it will establish and maintain a data bank relating to accidents and incidents (precursor events) at irradiation plants.

3. IRIS teams will examine the regulatory controls in Member States with operating irradiation plants and the way in which they are implemented by the authorities and the procedures of the organizations operating the plants, the focus being on factors known to have caused or contributed to past accidents. The aim will be to ensure that for every irradiation plant there are clear operating instructions, adequate safety systems that have not been modified in an unauthorized manner, proper arrangements for the transport, loading and unloading of sources and adequate emergency response arrangements and training.

4. Priority in meeting requests for reviews will be decided in the light of the existing knowledge - obtained through RAPAT missions and in other ways - about the safety infrastructures in the requesting countries, account also being taken of whether the irradiator has features associated with serious accidents that have occurred in the past, whether the design complies with recommendations made in relevant Agency Safety Series documents and whether the irradiator was obtained with Agency assistance.

THE TRANSPORT SAFETY ASSESSMENT REVIEW TEAM (TRANSART) SERVICE

1. The Secretariat is establishing the TRANSART service - through which reviews will be conducted of the status of radioactive material transport - in the light of the following considerations:

(a) An aspect of radiation safety that interests all Member States is the safety of radioactive materials during transport. Even countries which do not have nuclear energy programmes themselves feel affected by the presumed risks of radioactive material shipments, many of which take place through major transport interchanges. These are within - and subject to the jurisdiction of - individual States, but their importance in the transport system is regional rather than national, and shippers and receivers also have an interest in their safety.

(b) An area in which the Agency has led the world for many years is the provision of model Regulations for the Safe Transport of Radioactive Materials (the Transport Regulations). In a recent Agency survey, however, a significant number of countries expressed a need for assistance by the Agency in the implementation of the Transport Regulations. Also, although the survey demonstrated that the Transport Regulations are being applied extensively in many countries, the number of countries that did not respond to the survey questionnaire was nevertheless about 50. Most of these countries are either in Eastern Europe and the former Soviet Union or in Africa. Shipments of radioactive materials are known to occur in or through many of these countries, but little or no information is available on the countries' regulatory regimes and transport practices.

2. TRANSART reviews will focus on major transport interchanges (especially seaports, airports and canals) serving regions rather than individual countries. The main purposes of the reviews will be to determine the types and numbers of radioactive material shipments taking place and whether the applicable parts of the Transport Regulations are being fully implemented - and, if not, to advise on how this could be achieved.

3. The Secretariat will approach Member States where the service is deemed to be most urgently needed, especially where there is a major transport interchange. Alternatively, Member States are encouraged to contact the Secretariat and request a TRANSART mission if an independent examination of the situation regarding implementation of the Transport Regulations is thought to be useful.

ESTABLISHMENT OF SAFETY STANDARDS

1. The Agency is authorized to establish or adopt, in consultation and collaboration with specialized agencies of the United Nations, standards of safety for the protection of health. A large number of standards have been established and issued in the Agency's Safety Series, and they represent an important element in strengthening international co-operation in nuclear safety and radiological protection. The standards most relevant in this context are the Agency's basic radiation safety standards (the so-called BSS) and the nuclear safety standards issued as NUSS documents.

BSS

2. Since the 1993 session of the General Conference, a Technical Committee with 127 experts from 52 countries and 11 organizations has endorsed new BSS - International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, jointly sponsored by FAO, ILO, NEA/OECD, PAHO, WHO and the Agency (referred to last year in General Conference document GC(XXXVII)/1077). The new BSS will be before the Board, for approval, at its September meetings ahead of the General Conference's 1994 regular session.

NUSS

3. The top-level NUSS document ("Safety Fundamentals - The Safety of Nuclear Installations", Safety Series No. 110) was published last year after approval by the Board of Governors. The safety principles set out in the document served as a basis in the formulation of the technical obligations arising out of the Convention on Nuclear Safety (see Annex 1 to the present document).

4. In April 1994, the Nuclear Safety Standards Advisory Group (NUSSAG) decided to become more active in the development of NUSS documents. It created a sub-group for supervising NUSS document development and formulating a logical programme of further Agency work and a sub-group on the main safety issues to be faced by regulators (with a view to the development of further NUSS documents). It is expected that NUSSAG's recommendations to the Agency in this area will have been formulated by the end of 1994. Meanwhile, a complete revision of the NUSS documents on quality assurance is under way, and it is expected that revised publications will begin to be issued in 1995.

Work in other areas

5. Collaboration between the Agency and the International Maritime Organization (IMO) in the area of radioactive material transport culminated, on 4 November 1993, in the adoption of the Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High Level Radioactive Waste in Flasks on Board Ships (see document GC(XXXVII)/INF/325) by IMO's Assembly. The Code sets minimum safety standards for vessels carrying material of the kinds covered by it and complements the package performance standards contained in the Agency's Regulations for the Safe Transport of Radioactive Material (which are currently undergoing comprehensive revision).

6. In the area of research reactor safety, two codes (one on design and the other on operation[1] were issued in 1993. Further guides and practices are being developed.

7. The development of codes, guides and practices in the area of radioactive waste management is proceeding according to plan and is reported on separately (see document GC(XXXVIII)/7).

Development of a common basis for safety assessments

8. In the nuclear field, as in any other technological field, technical advances and new experience lead to new requirements and more stringent standards. Thus, there is a need to judge the safety status of existing nuclear power plants (NPPs) in relation to current safety practices and to determine whether safety upgrades are required. INSAG is preparing a report on this subject, and it is expected that the recommendations made in the report - once adopted - will become the standing international guidance for judging retrospectively the safety of existing NPPs.

9. Meanwhile, in the context of the assistance related to the countries of Eastern Europe and the former Soviet Union (see Annex 5), the Secretariat has formulated preliminary recommendations regarding periodic safety reviews of operational NPPs. The document in question describes the types of analysis which might need to be performed.[2] In addition, a document outlining a common basis for the judgements which need to be made is expected to become available this year. The document will present a logical framework for the judgement process as a structured approach to decision-making. The approach is being tested in practical safety cases, and the results will be appended to the document.

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[1] See footnote 1 in Attachment 9 to Annex 2.

[2] The experience gained in Member States shows that, owing to plant-specific differences, it is not possible to specify a minimum level of safety for all NPPs as a reference point.

PROVISION OF TECHNICAL ASSISTANCE

1. The Agency's technical assistance activities represent an important means of strengthening international co-operation in nuclear safety and radiological protection. In this area, the activities are covered through the Agency's regular and Technical Co-operation (TC) programmes, through extrabudgetary resources and also jointly with UNDP.

2. Document GC(XXXVIII)/INF/3 contains an overview of the Agency's 1993 TC activities in all areas, including radiation protection and nuclear safety. An indication of the scope of the Agency's TC activities in this area during the past five years is given by the following bar graphs.

3. A significant development as regards the Agency's TC activities has been the launching of the Model Project concept. An interregional Model Project will aim at upgrading radiation protection infrastructures in selected Member States.[1]

4. Also, the Agency has been engaged in a major assistance effort in the field of radiation protection and nuclear safety in countries of Eastern Europe and the former Soviet Union. This effort has focussed on two main issues:

(i) the safety of nuclear power plants in Eastern Europe and the former Soviet Union; and
(ii) the strengthening of radiation protection and nuclear safety infrastructures in countries of the former Soviet Union.

5. The Agency's assistance related to the safety of nuclear power plants in Eastern Europe and the former Soviet Union - financed mainly through extrabudgetary resources - is reported on in the following Annex.

6. The assistance aimed at strengthening radiation protection and nuclear safety infrastructures in countries of the former Soviet Union is being provided through a joint UNDP/IAEA programme about which the General Conference was informed last year in document GC(XXXVII)/INF/318 (updated in June 1994 in document GOV/INF/747). Unfortunately, UNDP has not yet been able to secure, through donor contributions, the financial resources necessary for full implementation of this programme.

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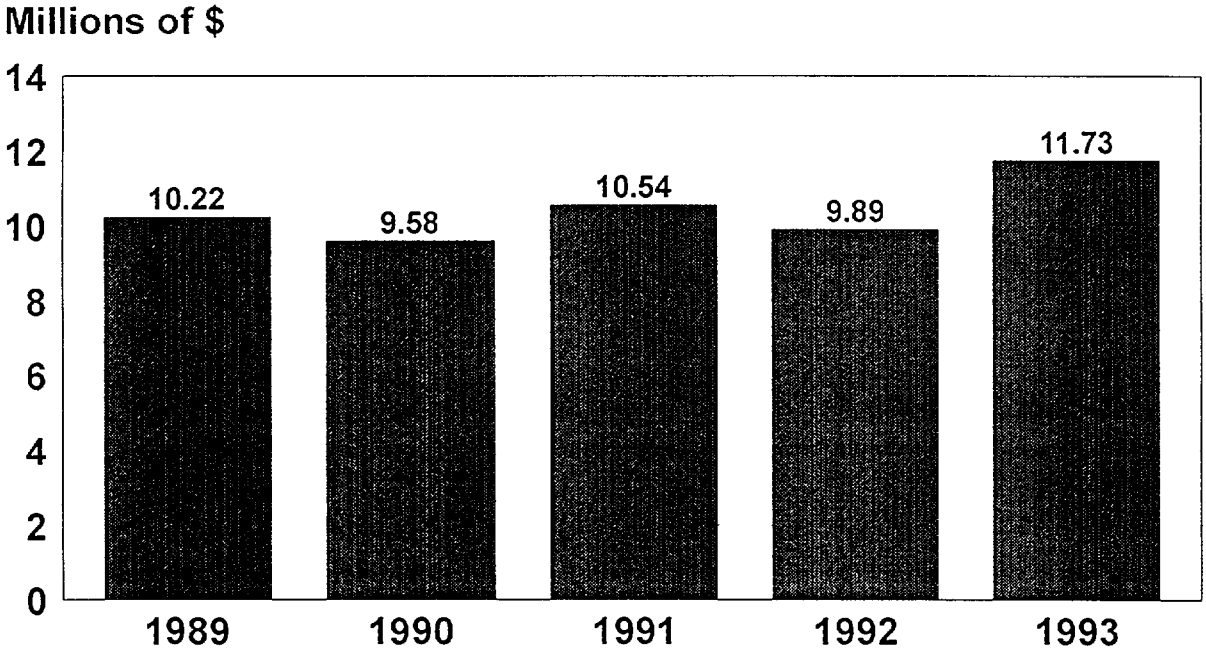
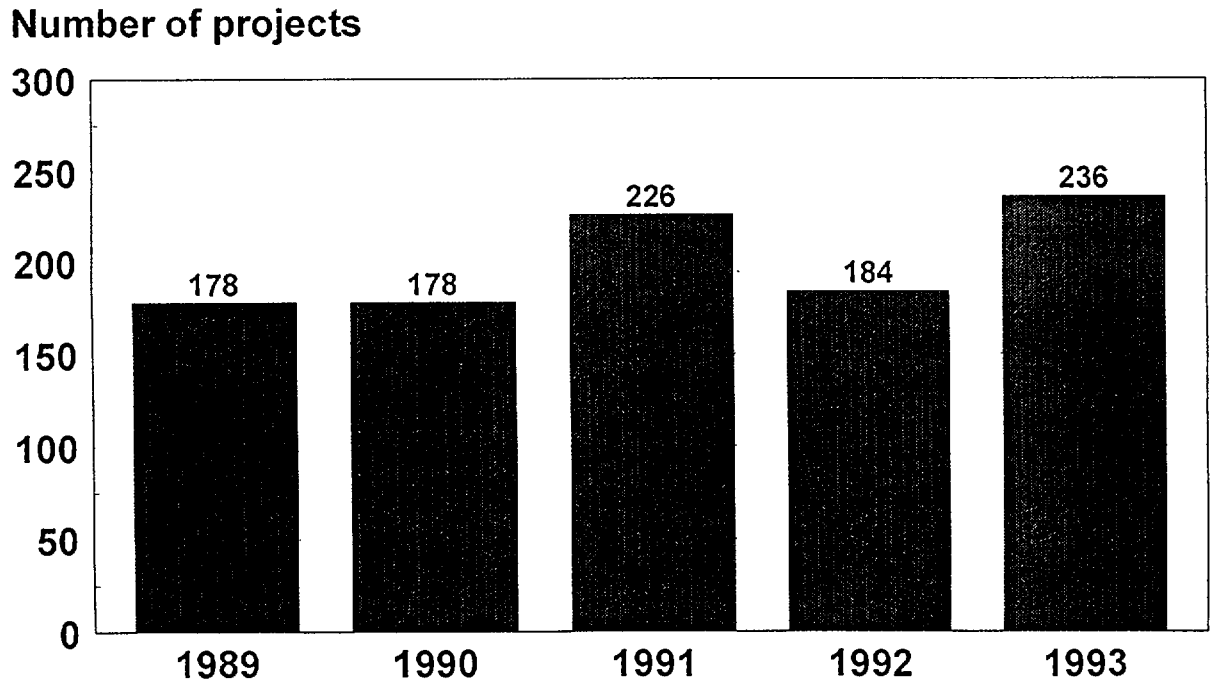
[1] An important finding of RAPAT missions (see Attachment 5 to Annex 2 to the present document) is that a few Member States do not have any radiation safety infrastructures at all and that in several others, although a minimum infrastructure is formally in place, the actual level of radiation safety is inadequate owing mainly to the lack of national radiation protection programme. This situation calls for prompt assistance, and it is expected that this Model Project will help to remedy matters.

Adjusted TC programme relating to radiation and nuclear safety during 1989-1993



Adjusted TC programme: The total value of the TC activities approved for a given calendar year plus all approved assistance brought forward from previous years because it has not yet been implemented.

TC projects dealing with radiation and nuclear safety during 1989-1993



All operational and completed projects during a given calendar year.

PROVISION OF ASSISTANCE RELATED TO THE SAFETY OF NUCLEAR POWER PLANTS IN COUNTRIES OF EASTERN EUROPE AND THE FORMER SOVIET UNION

Introduction

1. Last year the General Conference had before it, in document GC(XXXVII)/1064, an account of work being done under the Agency's nuclear safety programmes for Eastern Europe and countries of the former Soviet Union.

2. This work has since then continued as planned, and the technical results have been reviewed periodically by the two Steering Committees established to advise the Agency on its programmes related to the safety of WWER plants of all types and RBMK plants.

3. The consolidated technical results, with an indication of the expected scope of future activities and of the related budgetary requirements, will be presented by the Secretariat in December 1994 to an Advisory Group which meets biennially to review progress and to advise on future activities and necessary co-ordination. A more detailed - informal - report on programme implementation during the period 1992-94 will be made available to interested delegations at the time of the General Conference's 1994 regular session.

Safety of WWER-440/230 plants

4. There have now been follow-up safety review missions to all plants to assess the status of implementation of recommended improvements. The missions to the Novovoronezh and Kola NPPs confirmed that, as in the case of other plants, significant safety improvements were planned or under way. Financial difficulties continue to be the main obstacles to the implementation of improvements.

5. In addition, there have been ASSET follow-up missions to and ASSET seminars at various NPPs, and also seismic safety review missions to check on seismic upgrading at the Kozloduy and Bohunice NPPs.

6. In July 1993, in response to a request from the Slovak Government, an Agency team reviewed the concept for a major safety upgrading of the two WWER-440/230 plants at the Bohunice NPP. It concluded that the upgrading was technically feasible and could significantly enhance plant safety. Additional work is still required in order to define specific design solutions (for example, improvements in confinement and of emergency core cooling systems).

7. The principal safety concern regarding WWER-440/230 plants relates to the integrity of the reactor pressure vessel (RPV). In some cases there is still insufficient information about RPV embrittlement and RPV re-embrittlement after annealing. An Agency report on the subject was reviewed in May 1994 during an international workshop organized by the Slovak Government in co-operation with the Agency.[1]

8. In April 1993 the Government of Armenia decided to start preparations for the restart of one of the country's two power reactors, which have been shut down since 1989. In response to a request from the Government, the Agency has established a technical co-operation programme focused on:

- strengthening the regulatory body;
- planning safety improvements consistent with the Agency's recommendations relating to WWER-440/230 plants;
- reviewing seismic safety.

Assistance is already being provided in these three areas through Agency missions.

9. An evaluation of the safety impact of the major improvements implemented at and/or proposed for WWER-440/230 plants was initiated by the Agency in November 1993 and is expected to be completed by the end of 1994.

Safety of WWER-440/213 plants

10. Under a programme initiated in 1993, the Agency is identifying the main safety issues associated with WWER-440/213 plants and the priority actions that need to be taken. The results of safety evaluations and backfitting carried out under other programmes - both international and national - are being considered in this connection. In support of the programme, technical staff at the Paks NPP have prepared - under contract to the Agency - a compilation of backfitting and other safety enhancement measures for WWER-440/213 plants on the basis of a list of measures agreed upon by operators of this reactor type. The programme is also benefiting from the results of the Agency regional technical co-operation project "Safety analysis of WWER-type reactors" (RER/9/004).

11. In May 1994, at the request of the Slovak authorities, the Agency reviewed the Mochovce NPP safety upgradings proposed in studies carried out by Slovak, French and German organizations. It concluded that the proposed safety upgradings could be

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[1] Other reports on generic safety issues associated with WWER-440/230 plants prepared within the framework of the programmes under consideration were: "Guidance for the Application of the Leak Before Break Concept", "Improvement of the Confinement Function", "Methodology for Fire Hazard Analysis" and "Instrumentation and Control Design Improvements".

implemented within a time-frame compatible with the plant construction schedule and would substantially enhance plant safety.

12. An overall evaluation of the completeness and adequacy of the backfitting measures proposed for and/or implemented at WWER-440/213 plants is under way. Also, the underlying safety issues are being identified and ranked. A preliminary report prepared in April 1994 will be finalized by the end of 1994 on the basis of - inter alia - the findings of the Agency review carried out at the Mochovce NPP and of one to be carried out in September 1994 at the Bohunice NPP.

13. In addition, there have been ASSET missions to and ASSET seminars at the Paks NPP and the Rovno NPP and seismic safety missions to the Paks NPP and the Mochovce NPP.

14. An important generic safety issue associated with WWER-440/213 plants is the structural integrity and the performance of the bubbler condenser containment, which are being questioned. The deficiencies and the potential solutions, identified initially through investigations within the framework of regional technical co-operation project RER/9/004, were discussed at a meeting in December 1993. In March 1994, following the preparation of a report on the subject, the Secretariat started drafting guidelines to be used in the re-evaluation of the bubbler condenser structure.

Safety of WWER-1000 plants

15. Recently, the Agency started evaluating the completeness and effectiveness of safety upgrading measures proposed for and/or implemented at WWER-1000 plants. Improvement programmes proposed by Russia, Bulgaria, the Czech Republic and Ukraine have been reviewed, and the underlying safety concerns are being identified and ranked. A consolidated report with insights from Agency safety review missions and ASSET missions is due to be issued towards the end of 1994.

16. There have been ASSET missions to and ASSET seminars at the Balakovo and Kalinin NPPs (Russia) and the Khmelnitsky, South Ukraine and Zaporozhe NPPs (Ukraine). In addition, there has been a three-week safety review mission (addressing design and operations questions) to the Zaporozhe NPP.

17. In response to a request from the Government of the Czech Republic, the Agency has reviewed the way in which the leak-before-break concept is applied at the Temelin NPP. The technical programme in place at the Temelin NPP was found to compare favourably with those in place at other NPPs.

18. Two generic safety issues associated with WWER-1000 plants have been identified: steam generator integrity (particularly the cracks which have been observed in the cold collector); and core control and protection problems (particularly the problems experienced

with control rod insertion at operating plants). The Secretariat has, with the help of consultants, prepared reports on these safety issues.

Safety of RBMK plants

19. A report entitled "Safety assessment of design solutions and proposed improvements to Smolensk Unit 3 RBMK nuclear power plant" (IAEA-TECDOC-722) was issued in October 1993. On the basis of the review underlying that report and of insights from other Agency activities, a preliminary prioritization of the safety improvements necessary at RBMK plants was carried out in September 1993. A final prioritization will be carried out in the light of the results of a review of the Ignalina NPP - scheduled for October 1994 - and the results of other international efforts.

20. Two generic safety issues associated with RBMK plants have been identified; they relate to the shutdown system and to multiple pressure tube failures. Technical reports have been prepared with recommendations for resolving the issues.

21. In December 1993 a small Agency Secretariat team visited the Chernobyl NPP site and discussed the safety implications of the decision of the Ukrainian Government to keep the NPP in operation. In March 1994 a team of international experts reviewed, together with the Secretariat, the safety modifications implemented at and proposed for the Chernobyl NPP and the operating conditions there. The mission revealed major safety shortcomings (particularly with regard to Unit 1), problems with the procurement of up-to-date equipment and spare parts, and an unstable personnel situation. In the light of the mission findings, the Agency informed the Ukrainian Government that international levels of safety were not being met at the Chernobyl NPP.[2]

22. The Agency convened - in April 1994 - a meeting of delegates from 12 countries to consider what action could be taken to alleviate the Chernobyl safety situation. There was consensus at the meeting that, because of the many factors involved, there could be no one-step solution. A majority of the delegates called for discontinuation of the operation of the Chernobyl NPP as soon as conditions permit.

Other activities

23. In 1993 and the early part of 1994, workshops were held on NPP maintenance (in Russia), accident management (in Lithuania) and fire hazard evaluation (in Ukraine). Later this year there are to be workshops on accident management (in the Czech Republic) and emergency preparedness, NPP maintenance and accident management (in Ukraine). The workshop programme is being co-ordinated with a United States assistance programme which Argonne National Laboratory is implementing.

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[2] In addition, there was an ASSET mission to Chernobyl in April 1994.

24. The Agency has commissioned a comparative study of Russia's general nuclear safety regulations and the NUSS codes, the aim of the study being to assess the safety implications of differences between the two. The results of the study are being reviewed in July 1994.

25. A regional technical co-operation project (RER/9/020), initiated in 1993, is focusing on the accident analysis of WWER-1000 plants, with Zaporozhe Unit 5 as the reference plant. The project is being closely co-ordinated with various extrabudgetary programme activities.

26. Within the framework of a regional technical co-operation project entitled "Probabilistic safety assessment of WWER-type reactors" (RER/9/005), guidance is being provided for the conduct of probabilistic safety assessments (PSAs). Workshops and expert missions have addressed topics such as reliability data collection, external event analysis, level-2 PSAs, fire hazards and the PSA treatment of shutdown risk. The many reports issued within the framework of this project include one on "Generic initiating events for PSA for WWER reactors" (IAEA-TECDOC-749), which was recently issued in English and is soon to be issued in Russian.

27. The Agency is arranging for peer reviews of PSAs at various stages, and such reviews have been performed for the Paks, Bohunice, Kozloduy, Kola and Rovno NPPs.

28. The Agency, which is participating in the co-ordination mechanism established by the 24 OECD countries (the G-24) in a technical advisory capacity, has been co-operating closely with the G-24 Nuclear Safety Assistance Co-ordination Secretariat in the development of a methodology and procedures for the quality control of data intended for a nuclear safety project database. It has tested the methodology with a data subset and reviewed the technical content of 120 project entries.

29. The Agency database with technical findings and recommendations relating to the safety of WWER-type NPPs in Eastern Europe and countries of the former Soviet Union is being expanded to include RBMK plants. Plant-specific information on backfitting measures is also being collected.

30. In June 1994, the Agency organized a training workshop on the use of its WWER and RBMK databases. The workshop participants were provided with the datafiles, and recommendations were made for further development of the database.

31. Also in June 1994, a workshop on the evaluation and licensing of modifications to NPPs built in accordance with earlier safety standards was held at Obninsk, Russia. Organized by the Agency in co-operation with the Russian nuclear regulatory authority Gosatomnadzor, it provided an opportunity for an international exchange of experience and for the formulation of guidance on regulatory decision-making. The regulators and NPP operators who participated in the workshop found it very useful and requested that assistance in the area concerned be expanded.

Outlook

32. Comprehensive safety analyses, including accident analyses, have been recognized as being of utmost importance in assessing NPP safety and evaluating proposed modifications. The Agency is accordingly developing guidance for the performance of accident analyses for WWER-type NPPs. A document with such guidance will be completed in August 1994.

33. For those plants which continue to be operated, it will be necessary to develop and implement plant-specific safety upgrading programmes. The multimillion dollar projects involved will have to be financed through a combination of national, bilateral and multilateral assistance. For some countries, emphasis will have to be placed on support for self-help and on the creation of the necessary technological infrastructures. This will call for know-how and technology transfer, including the establishment of joint ventures through the G-24 co-ordination mechanism.

34. The Agency will continue to serve as a forum for information exchange and technical reviews with the aim of achieving international consensus on the plant-specific safety upgradings already carried out and still required. The Agency's efforts will focus on selected high-priority areas where measures need to be identified and implemented as a matter of urgency.

35. Extrabudgetary funding will be required so as to ensure that the Agency's assistance continues in 1995 and beyond. Consultations will be initiated with a view to the incorporation of long-term activities into a programme which addresses the safety of the increasing number of older reactors in general and which will be funded from the Regular Budget for 1997-98.

PROMOTION OF EDUCATION AND TRAINING

Background

1. The Agency is authorized to promote education and training related to its objectives, and last year - in response to resolution GC(XXXVI)/RES/584 adopted by the General Conference in 1992 - the Secretariat presented to the Conference the outline of a programme for education and training in radiological protection and nuclear safety (see GC(XXXVII)/1067 and 1067/Corr.1). The progress made since the General Conference's 1993 regular session in implementing the programme is described below.

Educational courses

2. The educational courses planned for 1994 have been completed, are currently in progress or are expected to take place as planned. They are:

- a Regional Post-Graduate Educational Course in Radiation Protection and Nuclear Safety (in Spanish) being held in Buenos Aires, Argentina, from 4 April to 7 October (16 Agency-sponsored participants[1]),

- a pilot Interregional Post-Graduate Educational Course in Radiation Protection (in French) held at Saclay, France, from 2 May to 6 July (25 participants); and

- a pilot Interregional Post-Graduate Educational Course in Radiation Protection (in English) to be held at Argonne, USA, from 19 September to 18 November (24 participants).

3. The Joint Institute for Nuclear Research at Dubna, Russia, has offered to host a nine-week Regional Post-Graduate Educational Course on Radiation Protection (in Russian). It is hoped that financial support for the course will be secured through - inter alia - the UNDP/IAEA initiative aimed at strengthening radiation protection and nuclear safety infrastructures in countries of the former USSR (see document GC(XXXVII)/INF/318, some of the information in which has been updated in document GOV/INF/747) and that the course can take place in 1996.

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[1] Of these 16 participants, nine are participating only in that part of the course which deals with radiation protection (from 4 April to 5 August).

4. A Technical Committee on Programmes for Post-Graduate Educational and Specialized Training Courses in Radiation Protection, meeting in Vienna from 12 to 16 December 1994, is expected to advise on the contents and structure of such training courses in the light of the experience gained from the courses held in 1994, which were based on the Standard Syllabus of Post-Graduate Educational Courses in Radiation Protection set forth in Annex 1 to the Attachment to document GC(XXXVII)/1067.

5. The two educational courses which were last year tentatively foreseen for 1995 (see the table in paragraph 4 of the Attachment to document GC(XXXVII)/1067) have been approved for implementation.

Specialized training courses/Workshops

6. Listed on the following page are the interregional/regional training courses and workshops held during the period 1 October 1993-30 June 1994. In addition, a number of national training courses and workshops took place within the framework of technical co-operation projects.

Other mechanisms

Fellowships and scientific visits

7. About 325 applications for fellowships and scientific visits in radiation protection and nuclear safety were evaluated between the beginning of 1993 and the end of June 1994.

Seminars and similar events

8. In November 1993, a Latin American Informative Seminar on the Application of the New ICRP Recommendations was held in Ecuador and the Second Latin American Congress on Radiation Protection and Nuclear Safety and regional (Latin America) meetings concerned with co-ordinated studies on regulated criteria and with the intercomparison of cytogenic dosimetry were held in Mexico.

9. National seminars on various aspects of nuclear safety were held in Ukraine, Slovakia, Greece, India, Slovenia and the Islamic Republic of Iran.

10. Arrangements are being made for a Regional (Asia & the Pacific) Seminar on Education and Training in Radiation Protection and Nuclear Safety (to be held in 1995) following an offer from the Australian Radiation Laboratory to host it.

	Title	Host Country	Date
Radiation Protection			
1.	Regional (Asia & the Pacific) Workshop on Radon Monitoring	China (RAS/0/015)	October 1993
2.	Subregional (Central America) Workshop on the Control of Radiation Safety	Guatemala (RLA/9/017)	November 1993
3.	Regional (Europe) Workshop on Radiation Protection and Waste Management in Nuclear Medicine	Estonia (RER/9/030)	April 1994
4.	Workshop on Regional Co-operation in Radiation Protection in Africa (Co-ordination Meeting)	Madagascar (RER/9/005)	May 1994
5.	Regional (Middle East & Europe) Training Course on the Safe Transport of Radioactive Material	Germany (RER/9/029)	May 1994
Nuclear Safety			
1.	Regional (Europe) Training Course on the Safety-Related Maintenance of NPPs	Russia (RER/9/026)	October 1993
2.	Interregional Training Course on Expert Systems and their Applications in NPPs	France (INT/9/133)	October/November 1993
3.	Interregional Training Course on the Use of PSA in the Operation of NPPs: Risk-Based Prioritization of Operational Tasks	USA (INT/9/138)	January/February 1994
4.	Regional (Europe) Workshop and Co-ordination Meeting on Strengthening the Regulatory Bodies for Nuclear Power Programmes	Ukraine ((RER/9/023)	April 1994
5.	Interregional Training Course on the Prevention and Management of Accidents in the Operation of NPPs	USA/Canada (INT/9/140)	May/June 1994

Educational and training material

11. Training manuals on the following subjects are due to be published in 1994 in the Training Course Series:

- Safe Transport of Radioactive Material (in Russian and Spanish)[2].

- Safety and Regulation of Radiation Sources (in English).

12. Educational material prepared for the courses referred to in paragraph 2 above has been made available to Member States.

13. Safety-related Agency publications (standards and guides), technical reports, practical manuals and technical documents have continued to be used extensively - together with viewgraphs, slides and video films - at educational courses and specialized training events.

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[2] Already issued in English.

ENCOURAGEMENT OF RESEARCH AND DEVELOPMENT

1. The Agency is authorized to encourage and assist research and development (R&D) related to its objectives, and it does so through co-ordinated research programmes, which have proved to be an effective means of strengthening international co-operation in the area of radiation protection and nuclear safety.

2. In this area, the Agency has, during the past five years, encouraged co-ordinated research covering the following topics:

- Use of chromosomal aberration analysis in radiation protection;
- Dose per unit intake factors for the public;
- Radon in the human environment: instrumentation, modelling, dosimetry and surveys;
- Atmospheric transport model evaluation study (ATMES);
- Radon in the human environment: risk assessment;
- The radiological impact of hot beta particles from the Chernobyl fallout: risk assessment;
- Radionuclide transfer to man in tropical and sub-tropical environments;
- Limitations of radioepidemiological assessments for stochastic radiation effects in relation to radiation protection;
- The radiation protection implications of transport accidents involving radioactive materials;
- Development of probabilistic safety assessment techniques related to the safe transport of radioactive material;
- Assessment of safety of uranium hexafluoride (UF6) transport packages in fires;
- Intercomparison programme for individual monitoring;
- The use of natural materials for dose assessments;
- Radiation doses in diagnostic radiology and methods for reduction;

- Compilation of anatomical, physiological and metabolic characteristics for a reference Asian man - RCA;

- Data collection and analysis for probabilistic safety assessments;

- Reference studies on probabilistic modelling of accident sequences;

- Comparative health and environmental risks of nuclear and other energy systems, using case studies;

- Development of safety-related expert systems;

- Seismic data for the siting and site revalidation of nuclear facilities;

- Data acquisition for research reactor PSA studies;

- Management of ageing of concrete containment building;

- Management of ageing of in-containment instrumentation and control cables;

- Benchmark study for seismic analysis and testing of WWER-type nuclear power plants.

3. Scientific institutions in the following Member States participated in the co-ordinated research programmes:

Algeria, Argentina, Australia, Austria, Bangladesh, Belarus, Belgium, Brazil, Bulgaria, Canada, Chile, China, Costa Rica, Croatia, Cuba, Czech Republic, Denmark, Ecuador, Egypt, Estonia, Ethiopia, Finland, France, Germany, Ghana, Greece, Hungary, India, Indonesia, Islamic Republic of Iran, Iraq, Ireland, Israel, Italy, Japan, Republic of Korea, Luxembourg, Macedonia (Former Yugoslav Rep. of), Malaysia, Mexico, Netherlands, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Singapore, Slovakia, Slovenia, South Africa, Spain, Sudan, Sweden, Switzerland, Syrian Arab Republic, Thailand, Tunisia, Turkey, Ukraine, United Kingdom, United States of America, (the former) USSR, Viet Nam, Yugoslavia and Zambia.

4. Co-ordinated research programmes to be initiated soon will cover the following topics:

- The use of electron spin resonance for assessment of cumulative dose of the population resulting from the Chernobyl accident;

- Measurement of 131-I intake by the population in regions contaminated by the 1986 Chernobyl accident;

- Accident severity at sea during transport of radioactive material;

- Development of relevant accident data for quantifying risks associated with transport of radioactive material;

- Collection and classification of human reliability data for use in probabilistic safety assessments.

5. In the coming years, the Agency will place emphasis on the encouragement R&D in the following areas:

- Monitoring for the radiation protection of occupationally exposed persons, including physical surveillance of working environments and the development of techniques for the assessment of occupational exposure and, in particular:

  . methods for intake determination with regard to long-life radionuclides;

  . neutron dosimetry (notably in the intermediate energy range);

  . relationships between different dosimetric quantities and the equivalent dose and the effective dose in different exposure conditions;

  . studies of individual dose distribution in various types of occupational exposure and assessments of collective doses for specific types of operations.

- Radiological safety aspects of packaging and transporting radioactive materials, considering phenomena associated with the normal accident transport environments (placing emphasis on individual and collective doses resulting from the transport of radioactive materials and on developing and/or upgrading associated safety standards);

- Biological and medical techniques for the diagnosis, prognosis and treatment of overexposed individuals and, in particular:

  . biological dosimetry with special emphasis on localized exposures, including fixed cell chromosome analysis and studies of vascular changes with - for example - diffusion methods and thermography, and electroencephalographic methods; and

  . treatment (decorporation) or internal contamination, with special emphasis on inhalation of actinides and uranium;

- Analysis of radioepidemiology information available from Member States, considering risks, estimates and results;

- Safety problems associated with the design and useful life of radiation sources, in particular with regard to sources containing corrosive materials and age of the sources;

- The physical phenomena of material and equipment performance degradation of safety-related equipment, the detection of such degradation and identification of corrective measures for the purpose of ensuring a continuously high level of safety during all phases of nuclear facility life;

- Safety aspects of ageing in nuclear power plants and research reactors;

- Safety-assessment-related databases of existing nuclear power plants and research reactors;

- Site re-evaluation of nuclear facilities;

- Quantitative monitoring of operational safety;

- Methods and techniques for incident and accident analysis;

- Human reliability and man-machine interface;

- Modelling of PSA standard problems (benchmarks) to investigate uncertainties and sensitivity of results to model assumptions and data;

- Methods of component reliability data collection and treatment, including methods for continuous updating of data based on operational experience;

- Modelling of off-site consequences of severe accidents including emergency measures;

- Comparative assessment of the ecological impact and effect on climate change of energy sources;

- Case studies to compare health and environmental impacts of energy systems.

SAFETY PRINCIPLES FOR FUTURE NUCLEAR POWER REACTORS

Background

1. The Attachment to document GC(XXXVII)/1076, which was before the General Conference last year, described work being done on the preparation of an IAEA-TECDOC, entitled "Development of safety principles for the design of future nuclear power plants", which would provide a basis for updating the safety objectives and safety principles spelled out in the INSAG document "Basic Safety Principles for Nuclear Power Plants" (INSAG-3).

2. Below is a brief account of work done since the General Conference's 1993 session on the preparation of that and a related IAEA-TECDOC.

Developments since the 1993 session of the Conference

3. As foreshadowed in paragraphs 14 and 15 of the Attachment to document GC(XXXVII)/1076, in November 1993 INSAG reviewed the then current version of the draft IAEA-TECDOC "Development of safety principles for the design of future nuclear power plants". It concluded that the IAEA-TECDOC, when finalized, would be "a useful first step" in the development of such principles but that "wide-ranging discussions and consultations" would be necessary before its finalization. In addition, it recommended further exploration of the "realistically conceivable severe accident" concept.

4. Also in November 1993, a Technical Committee considered that concept and analyzed different approaches to the severe accidents that would have to be addressed in the design of future nuclear power plants. The working material resulting from the Technical Committee's meeting is being used in the preparation of the IAEA-TECDOC referred to at the end of paragraph 13 of the Attachment to document GC(XXXVII)/1076.

5. In April 1994, an Advisory Group prepared a new version of the IAEA-TECDOC "Development of principles for the design of future nuclear power plants", taking into account the comments of INSAG and of experts in various Member States. This new version was distributed on 16 May 1994 to experts in Member States for comments, and it is expected that at the end of September 1994 a group of consultants will review the comments received.

6. It is still expected that the IAEA-TECDOC "Development of safety principles for the design of future nuclear power plants" will be finalized this year.