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MEASURES TO STRENGTHEN INTERNATIONAL CO-OPERATION IN MATTERS RELATING TO NUCLEAR SAFETY

(a) REPORT ON THE IMPLEMENTATION OF RESOLUTION GC(XXXIII)/RES/508

The following report by the Board of Governors and the Director General is being submitted to the General Conference pursuant to a request made by the Conference last year in resolution GC(XXXIII)/RES/508.

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Contents

	Page
I. INTRODUCTION	1
II. THE SAFETY BASE: PRESENT SITUATION	2
II.1 Safety Standards	2
II.2 Nuclear Safety Services	3
II.3 Radiation Protection Advisory Services	4
II.4 Waste Management Advisory Services	5
II.5 International Agreements	5
III. FUTURE CHALLENGES AND INTERNATIONAL RESPONSES	8
III.1 Perspective	8
III.2 Strategic Responses	9
IV. ELEMENTS OF THE STRATEGY FOR ENHANCED INTERNATIONAL CO-OPERATION	12
IV.1 Advancing Operational Safety	12
IV.2 Reviewing Safety Issues	14
IV.3 Applying Safety Assessment Techniques	18
IV.4 Promoting Regulatory Consistency	20
IV.5 Defining Safety Requirements for Future Nuclear Installations	21
IV.6 Strengthening Radiation Protection Infrastructures	22
IV.7 Managing and Disposing of Radioactive Wastes	24
IV.8 Improving Public Understanding of Radiation Risks	26
V. CONCLUSION	28

I. INTRODUCTION

1. In 1989, in resolution GC(XXXIII)/RES/508, the General Conference reaffirmed

"the vital necessity to continue to promote the highest level of nuclear safety worldwide and to strengthen international co-operation in the field of nuclear safety and radiological protection";

invited the Board and the Director General

"to maintain the emphasis given to nuclear safety and radiological protection, to review the results of the Agency's activities in this area so far and to consider what further measures should be taken to enhance international co-operation in nuclear safety and radiological protection";

and requested the Board of Governors and the Director General to report on the implementation of the resolution at the Conference's thirty-fourth session.

2. In response to this resolution, those activities of the Divisions of the Department of Nuclear Energy and Safety which relate to nuclear safety^{*/} were reviewed in conjunction with the work on formulating the Agency's draft programme for 1991-92 and the general direction of activities in subsequent years.

3. The Director General's report on this review was considered by the Board in June. The Board decided that the report, amended to reflect comments made during the Board's discussion, should be submitted to the General Conference as the report of the Board and the Director General pursuant to the request of the Conference referred to in paragraph 1 above. The matter of liability for nuclear damage was also addressed in resolution GC(XXXIII)/RES/508; this will be dealt with in a separate General Conference document.

^{*/} In this report, the term "nuclear safety" is generally used to cover the safety of nuclear installations, protection against ionizing radiation and the disposal of radioactive waste.

II. THE SAFETY BASE: PRESENT SITUATION

4. For over 30 years the Agency has served as an important instrument for helping Member States establish and apply a technical base for the safety of the more than 400 nuclear power plants in the world today and the several hundred thousand installations using nuclear technologies in industry, medicine, research and agriculture.

5. For this, the Agency has a mandate to promote nuclear safety internationally by establishing standards, encouraging research and development, rendering services, fostering the exchange of scientific and technical information, encouraging the exchange and training of scientists and experts, and providing technical assistance.

6. The 1980s saw rapid growth in the Agency's safety activities. Nevertheless, nuclear safety and waste management, respectively, account for only 6% and 2% of the Regular Budget and 12% and 5% of technical assistance funds.

II.1 Safety Standards

7. During the first three decades of its existence, with its widely adopted Regulations for the Safe Transport of Radioactive Material as a model for successful co-operation, the Agency concentrated on building an international consensus on standards for nuclear safety. The Basic Safety Standards for Radiation Protection (last issued in 1982 by the Agency, the International Labour Organisation (ILO), the World Health Organization (WHO) and the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (NEA-OECD)), together with over 50 associated Safety Series publications, serve as an authoritative guide in international radiation safety matters. The recently revised NUSS Codes of Practice for governmental organization, siting, design, operations and quality assurance and the set of 55 supplementary Safety Guides, together with the International Nuclear Safety Advisory Group's (INSAG's) forward-looking Basic Safety Principles for Nuclear Power Plants, constitute an internationally recognized frame of reference for the safety of nuclear power plants.

Although the NUSS Codes are not binding, Member States have used them extensively in elaborating national regulations. Twenty-six Member States have responded to an Agency inquiry about the applicability of the revised Codes, and their replies indicate general consistency of the national regulations in these countries with the Codes. **(Further information on these replies will be provided to the General Conference in another document.)** The updating of the Agency's safety documents to reflect current international safety thinking is a continuing activity, and the development of a set of overriding "international nuclear safety fundamentals" comprising basic objectives, concepts and principles to ensure safety has been initiated.

8. International consensus has been achieved on radioactive waste management, as is reflected in the more than 30 Agency documents on principles, criteria and methodology. For Member States with advanced waste management programmes, the documents are an international reference for assessing whether existing national standards and guidance require updating. For Member States in the early phases of formulating waste management programmes, the documents can guide the establishment of national regulations and codes of practice. The recent publication "Safety Principles and Technical Criteria for the Underground Disposal of High Level Radioactive Waste" provides a basis for the development of detailed, quantitative performance criteria at the national and the international level.

II.2 Nuclear Safety Services

9. While the primary responsibility for safety rests with national authorities, the Agency's safety evaluation and information exchange services for nuclear power and nuclear research installations have demonstrated their usefulness in complementing national safety efforts. The emphasis on the complementary nature of these services is important: these services are not intended to compete with or replace exhaustive assessments of overall safety by national authorities, nor are they intended as international regulatory inspections or checks on whether a plant is complying with safety regulations; the ultimate objective is to facilitate the exchange of information on accident prevention among the specialists involved. The

service programmes are designed to enable the Agency to respond flexibly to Member States' expressed need for a specific type of international expert assistance. Since the mid-1980s, there has been a rapid development of new and a strengthening of existing service programmes in response to requests by Member States and to international developments. (See Table 1.)

10. For nuclear power installations, growing use has been made of the Operational Safety Review Team (OSART) and the Assessment of Safety Significant Events Team (ASSET) programmes for reviewing operational safety. Most Member States operating or constructing nuclear power reactors have participated in one or both of these programmes. In line with growing interest in Member States in conducting a probabilistic safety assessment (PSA), the Agency initiated the International Peer Review Service (IPERS) programme. The Engineering Safety Review Service (ESRS), the most recent addition, is being developed to bring requested international expertise to the process of reviewing safety issues associated with the siting, design and construction of nuclear installations.

11. For more than 15 years the Agency has assisted Member States in safety matters relating to many of the 323 research reactors now operating in 54 countries. Also, the Agency has monitored the observance of safety measures at 27 research reactors under Agency project agreements with 23 countries. Through the Integrated Safety Assessment of Research Reactors (INSARR) programme, safety reviews are performed periodically at research reactors set up with Agency assistance and, upon the request of Member States, at other research reactors. More than 50 safety reviews in 23 countries were performed during the 1980s.

II.3 Radiation Protection Advisory Services

12. With the expanding use of nuclear technologies in non-energy applications throughout the developing world, the Agency has offered international expertise to help Member States develop radiation protection infrastructures and strengthen those already in place. Since the Radiation

Protection Advisory Team (RAPAT) programme began, late in 1984, there have been almost 50 missions, identifying infrastructural needs for enhanced radiation protection and recommending areas for priority attention. (See Table 1.)

II.4 Waste Management Advisory Services

13. Since 1987, the Waste Management Advisory Programme (WAMAP) has provided assistance to developing Member States wishing to establish national waste management programmes based on sound safety principles and practices. WAMAP missions have visited 25 countries and assisted with the safe management of radioactive wastes arising from nuclear fuel cycle operations, nuclear research and applications. The Waste Management Assessment and Technical Review Programme (WATRP) is a new Agency service being offered to Member States with well-established waste management programmes. WATRP formalizes the mechanism by which the Agency has been offering technical assessments and peer reviews of national waste management policies, concepts and programme activities. (See Table 1.) The recently established International Radioactive Waste Management Advisory Committee (INWAC) advises the Agency on waste management activities.

II.5 International Agreements

14. International co-operation in nuclear safety has resulted in a wide range of international agreements under which the Agency is responsible for information exchange and for promoting and co-ordinating assistance. Binding international conventions are now in place on the early notification of nuclear accidents and on emergency assistance, on civil liability for transboundary damage due to nuclear accidents and on the physical protection of nuclear material. The Agency's around-the-clock Emergency Response System became operational in 1988, and it is continuously being monitored for its readiness to transmit information rapidly to Member States. The Agency's response to requests for assistance during the radiological emergencies in Goiânia, Brazil, and - more recently - El Salvador has underscored the importance of an international focal point that countries can turn to during such emergencies.

TABLE 1: IAEA SAFETY EVALUATION AND INFORMATION EXCHANGE SERVICES
(1986 - to 31 July 1990)

	1986	1987	1988	1989	1990 (up to 31 July)
INSARR (Integrated Safety Assessment of Research Reactors) (Est. 1972)	Total: 12 Chile, Greece, Indonesia (2), Jamaica, Malaysia, Mexico (4), Spain, Turkey	Total: 5 Colombia, Finland, Norway, Peru, Thailand	Total: 5 Iraq (2), Rep. Korea, Norway, Venezuela	Total: 2 Hungary, Viet Nam	Subtotal: 3 Isl. Rep. Iran, USSR (2) For Total see Table 2
OSART (Operational Safety Review Team) (Est. 1983)	Total: 6 Finland, FRG, Rep. Korea, Netherlands, Mexico, Sweden	Total: 7 Canada, FRG, Italy, Mexico, Netherlands, Spain, USA	Total: 7 France, Hungary, Italy, Japan, Sweden (2), USSR	Total: 11 Brazil, China, Czechoslovakia, Italy, Rep. Korea, Pakistan, Poland, Sweden, USSR, UK, USA	Subtotal: 4 Bulgaria, Czechoslovakia, Spain, USSR* For Total see Table 2
ASSET (Assessment of Safety Significant Events Team) (Est. 1986)	Total: 1 Yugoslavia	--	Total: 1 Brazil	Total: 3 Pakistan (2), USSR	Subtotal: 3 GDR(2), France** For Total see Table 2
RAPAT (Radiation Protection Advisory Team) (Est. 1984)	Total: 11 Dominican Republic, Ecuador, Egypt, Iceland, Kenya, Mexico, Panama, Portugal, Venezuela, Zaire, Zambia	Total: 8 Colombia, Jordan, Rep. Korea, Peru, Philippines, Sudan, Syrian Arab Rep., United Rep. Tanzania	Total: 12 Bangladesh, Costa Rica, Côte d'Ivoire, Ethiopia, Greece, Guatemala, Indonesia, Jamaica, Madagascar, Nigeria, Senegal, Viet Nam	Total: 10 Cameroon, Cuba, Dem. PR Korea, El Salvador, Ghana, Isl. Rep. Iran, Mongolia, Morocco, Thailand, Zimbabwe	Subtotal: 4 Bolivia, Libyan Arab J., Sri Lanka, Uruguay For Total see Table 2

TABLE 1: IAEA SAFETY EVALUATION AND INFORMATION EXCHANGE SERVICES (cont'd.)

	1986	1987	1988	1989	1990 (up to 31 July)
WAMAP (Waste Management Advisory Programme) (Est. 1987)	--	Total: 4 Bulgaria, Hungary, Portugal, Turkey	Total: 11 Bangladesh, Brazil, China, Columbia, Indonesia, Rep. Korea, Malaysia, Mexico, Peru, Thailand, Zimbabwe	Total: 8 Chile, Egypt, Jordan, Kenya, Philippines, Poland, Zaire, Zambia	Subtotal: 3 Isl. Rep. Iran, Libyan Arab J., Romania
					For Total see Table 2
WATRP (Waste Management Assessment and Technical Review Programme) (Est. 1989)	--	--	--	Total: 1 UK	--
IPERS (International Peer Review Services) (Est. 1989)	--	--	--	Total: 3 China, Netherlands, USSR	Subtotal: 2 Netherlands, Sweden
					For Total see Table 2
ESRS (Engineering Safety Review Services) (Est. 1989)	--	--	--	Total: 2 Rep. Korea, USSR	Subtotal: 3 Czechoslovakia, Iraq, Poland
					For Total see Table 2
IRS (Incident Reporting System) (Est. 1983)	137	140	169	230	72 Total since 1983: 934 reported events

* Follow-up

** Workshop

15. International concern about the possible unauthorized movement and disposal (dumping) of radioactive waste on the territory of developing Member States has led to the drafting of a code of practice for the international transboundary movement of radioactive waste. The code, which provides principles to guide States in developing and harmonizing policies and regulations on the international transboundary movement of radioactive waste, was adopted by an international expert group convened by the Agency in February 1990, with a view to its being submitted through the Board to the General Conference this year (see document GC(XXXIV)/920).

III. FUTURE CHALLENGES AND INTERNATIONAL RESPONSES

III.1 Perspective

16. The international safety measures that have been taken constitute a framework which, when accepted and applied universally by all Member States, will ensure safety excellence worldwide in the use of nuclear technologies. With the accelerating trend towards greater openness and public engagement in deliberations on policies for energy and the environment, the application of this safety base by a Member State has yet another important dimension: to give assurance to a questioning public of the depth of the State's commitment to a safety level commensurate with the best policies and practices worldwide.

17. Thus, the major challenges the international nuclear community will face in the 1990s are:

- to ensure that all nuclear installations worldwide are safe, well-regulated and without significant detriment to human health and the environment
- to demonstrate that safe and reliable technology exists for the disposal of high-level radioactive waste

and, from this basis,

- to build broad public confidence in the safety of nuclear installations and the management of radioactive wastes.

III.2 Strategic Responses

18. It will be necessary to strive for a continuous global record of safe and reliable operation of today's nuclear installations and simultaneously to lay the foundations for the safety excellence of future applications.

19. Efforts to build broad public confidence in the safety of nuclear installations and radioactive waste disposal will have to go beyond these measures in order to properly address the misconceptions that some people have about the human health and environmental impacts of radiation exposures. In effect, the realities of the radiation environment must become part of the public consciousness.

20. These are formidable challenges that require a deepening commitment by all members of the nuclear community to international co-operation.

21. For its part, the Agency will adopt a dynamic approach with respect to the following:

- Advancing operational safety
- Reviewing safety issues
- Applying safety assessment techniques
- Promoting regulatory consistency
- Defining safety requirements for future nuclear installations
- Strengthening radiation protection infrastructures
- Managing and disposing of radioactive wastes
- Improving public understanding of radiation risks.

22. Accordingly, the Agency has defined a strategy for strengthening international co-operation in nuclear safety matters over the period 1991-92 and beyond. Many of the proposals are logical extensions of ongoing efforts, but with the added thrust needed in order to broaden and intensify the Agency's assistance to Member States. Other proposals represent new initiatives, needed for tackling crucial safety issues that will command international attention over the next few years.

TABLE 2: IAEA SAFETY EVALUATION AND INFORMATION EXCHANGE SERVICES
(from August 1990 to 31 December 1992)

	1990 (as of 1 August)	1991	1992
INSARR (Integrated Safety Assessment of Research Reactors)	Subtotal: 4 Argentina ⁺ , Brazil ⁺ , Bulgaria, Romania ⁺ Total: 7 (see Table 1)	Total: 10 Chile ⁺ , Egypt ⁺ , Hungary ⁺ , Pakistan ⁺ , Peru ⁺ , Philippines ⁺ , Portugal ⁺ , Turkey ⁺ , Yugoslavia ⁺ , Zaire ⁺	Total: 7 Czechoslovakia ⁺ , GDR ⁺ , Indonesia ⁺ , Jamaica ⁺ , Malaysia ⁺ , Mexico ⁺ , Poland
OSART (Operational Safety Review Team)	Subtotal: 10 Brazil*, Bulgaria, Canada ⁺⁺ , China*(2), Czechoslovakia*, Finland, Romania, UK*, Yugoslavia* Total: 14 (see Table 1)	Total: 18 Argentina ⁺⁺ , Belgium ⁺ , Bulgaria*(2), Canada ⁺⁺ , China*(2), France ⁺⁺ , FRG, Hungary*, Japan, Mexico, Romania*, S. Africa, Spain*, Sweden*(2), Switzerland ⁺ , USSR*	Total: 16 Belgium ⁺ , Finland*, FRG*, France, GDR*, India ⁺ , Japan*, Rep. Korea ⁺ , Mexico*, S. Africa*, UK ⁺ , USA ⁺ ; 4 (projected)
ASSET (Assessment of Safety Significant Events Team)	Subtotal: 8 Bulgaria, Czechoslovakia, Hungary**, Netherlands***, Pakistan*, Spain**, Spain***, USSR ⁺ Total: 11 (see Table 1)	Total: 11 Argentina ⁺ , Brazil*, Canada ⁺ , GDR ⁺ , Rep. Korea ⁺ , Mexico, Pakistan ⁺⁺ , USSR*, Yugoslavia***; 2 (projected)	Total: 7 (projected)
RAPAT (Radiation Protection Advisory Team)	Subtotal: 4 Algeria ⁺ , Mauritius ⁺ , Romania, Saudi Arabia ⁺ Total: 8 (see Table 1)	Total: 10 (projected)	Total: 10 (projected)
WAMAP (Waste Management Advisory Programme)	Subtotal: 4 Brazil, Guatemala, Nigeria, Pakistan Total: 7 (see Table 1)	Total: 10 Algeria ⁺ , Greece, Iraq, Ireland, Sri Lanka, Yugoslavia; 4 (projected)	Total: 10 (projected)

TABLE 2: IAEA SAFETY EVALUATION AND INFORMATION EXCHANGE SERVICES (cont'd.)

	1990 (from 1 August)	1991	1992
WATRP (Waste Management Assessment and Technical Review Programme)	--	Total: 5 (projected)	Total: 5 (projected)
IPERS (International Peer Review Services)	Subtotal: 2 Romania, Switzerland Total: 4 (see Table 1)	Total: 7 GDR ⁺ , Hungary ⁺ , Rep. Korea, Netherlands, Switzerland, USSR ⁺ , Yugoslavia ⁺	Total: 8 China ⁺ , India ⁺ , Iraq ⁺ , Rep. Korea ⁺ , Romania ⁺ , Sweden ⁺ , USA ⁺ ; 1 (projected)
ESRS (Engineering Safety Review Services)	Subtotal: 5 Bulgaria (Siting), Bulgaria (Design), Czechoslovakia (Design), Czechoslovakia (Siting), Romania (Design) ⁺ Total: 8 (see Table 1)	Total: 10 Poland (Design) ⁺ , Poland (Siting) ⁺ , USSR (Siting) ⁺ , USSR (Design) ⁺ ; 6 (projected) ⁺	Total: 6 (projected)

- * Follow-up
- ** Workshop
- *** Training
- + Tentative
- ++ Technical exchange

23. Elements of this strategy are highlighted in the following section. The tone of the description is intentionally decisive, with "can" and "will" in evidence in the report. However, full implementation of the strategy is contingent upon the adoption of the measures proposed in Section V, including a substantial increase in resources over the current staffing levels for nuclear safety and waste management.

IV. ELEMENTS OF THE STRATEGY FOR ENHANCED INTERNATIONAL CO-OPERATION

24. This section highlights elements of the strategy for strengthening international co-operation in nuclear safety matters.

IV.1 Advancing Operational Safety

25. Safety Services. There is general consensus on the usefulness of the OSART service for improving operational safety at nuclear power plants. Although national authorities are in no way obliged to act on OSART recommendations, requests for Agency-organized follow-up missions to review corrective measures stemming from such recommendations have become a standard feature of the OSART service. Currently, OSART missions are being implemented at about the rate of one a month.

26. As a complementary activity, ASSETs analyse the root causes of safety-related events at nuclear plants and the effectiveness of steps taken to prevent their recurrence. There has been a growing number of requests for ASSET missions and for follow-up visits to review recommendations and help in their implementation. The ASSET methodology, developed from best international practices, has proven to be a powerful tool for enhancing operational safety, and Agency-sponsored training is facilitating its direct use by operating organizations and regulatory authorities. During 1991-92, there will be up to seven ASSET missions a year. (See Table 2.)

27. The international nuclear community recognizes the advantages to be derived from use of the OSART service, potentially on a regular basis, in keeping with the size, structure and developmental status of nuclear programmes. For the Agency, regular use of the OSART service would enhance its efforts to maintain the highest level of expertise and consistency in the team management.

28. Event Reporting and Communication. Fortunately, the vast majority of safety-related events at operating nuclear installations have no radiological significance and their implications for continued safe operation are minor. Even so, for the media and the public it is difficult to judge the seriousness of such events, particularly if there is a profusion of different types of event reporting. To provide international consistency, the Agency, together with NEA-OECD, has developed the International Nuclear Event Scale (INES). The seven-level scale is a practical means of promptly and consistently communicating the safety significance of reported events worldwide.

29. To promote the proper use of this international scale on the broadest basis, the Agency will provide training for users in Member States. The Agency, together with NEA-OECD and user countries, will monitor progress in the trial use of INES and will make changes as necessary on the basis of feedback from the nuclear community, the media and the public. The scale has been circulated to Member States of the Agency and of OECD, with an invitation to begin using it at nuclear power plants as early as possible. Most participating States are expected to do so by the autumn of this year, for a trial period lasting until late 1991.

30. There will be intensification of efforts to achieve a single intergovernmental system for the collection of nuclear event reports, combining the Incident Reporting System (IRS) of the Agency with that of NEA-OECD. Towards this end, the Agency will refine the reporting criteria and endeavour to increase the accessibility of reports. The lessons learned from analyses of reported events will be broadly disseminated to all plants, for incorporation in accident prevention policies.

31. INES, in conjunction with the combined systems for incident reporting, could become important for the feedback of operating experience and for credible public communication. Realization of this potential will require that Member States commit themselves to open and prompt reporting based on the classification established for INES.

32. INES and the Agency's IRS were designed initially to deal with events reported at nuclear power plants, but their extension to include research reactors and systems for transporting radioactive material will be explored.

33. International Linkages. The recent establishment of the World Association of Nuclear Operators (WANO) reflects the importance attached to international co-operation in operational safety matters. The Agency is working closely with WANO to ensure complementary approaches to maximizing the operational safety of nuclear power plants. The participation of WANO representatives in Agency-organized international reviews and in reporting and communication activities is being encouraged.

34. Collaboration could be enhanced through annual, direct exchanges of information on the safety of future installations as well as on current safety issues between all organizations concerned and between utility representatives, operators, regulators, and the host of other professionals committed to advancing operational safety worldwide. The Agency will pursue the idea of holding such information exchanges annually.

IV.2 Reviewing Safety Issues

35. Member States are showing increasing interest in independent international reviews of crucial safety issues. For Member States with nuclear installations at the planning or construction stage, such reviews can provide useful early insights that enhance the value of national safety assessments and their follow-up. Two recent Agency reviews — one of the safety design concept for a prototype nuclear district heating plant in the USSR and one, in the Republic of Korea, of a design with scaled-down features of larger operating units — have underscored the benefits of timely reviews of the siting, design and construction processes.

36. For some Member States with operating nuclear power plants, safety concerns may arise that are common to most nuclear power plants at a certain development stage and can best be tackled with the help of analytical skills reflecting current international safety thinking. In the 1990s, many Member States will have to deal resolutely with issues such as the ageing of nuclear power plants and the plant safety implications of fires and external events.

37. In addition, recent deliberations on nuclear safety matters in some Member States have revealed safety concerns that are generic to certain nuclear plant types and could best be resolved within the framework of a coherent international programme.

38. For these reasons, the recently created Engineering Safety Review Service (ESRS) will be strengthened in order to help Member States deal more systematically with specific safety concerns relating to nuclear installations. The Agency is currently considering how best to respond to the numerous requests being received for this type of assistance, particularly from East European Member States. (See Table 2.)

39. Another innovative approach will address the perceived need of a number of Member States for international assistance in resolving safety problems associated with older nuclear reactor designs. Several Member States operating reactors of older design are reassessing their safety and considering the need for modifications in order to comply with current international safety thinking; some are doing so within the framework of bilateral and multilateral projects.

40. Given the increasing number of actions being taken in this sphere, there is a need for a recognized international focal point that would help avoid duplication of effort and promote the broadest possible exchange of information, know-how and technology. This has prompted the Agency to propose an extrabudgetary nuclear safety project through which the Agency would complement national efforts and ensure a consistent approach; the

proposal is awaiting formal approval. The initial focus would be on safety issues associated with the first generation of WWER-440 reactors. The project would involve missions to nuclear plants in order to define needs and priorities, and the provision of expert assistance in carrying out modifications. Regular meetings – within an advisory group framework – with representatives of participating Member States throughout the expected lifetime of the project are envisaged; the first such meeting would take place in Vienna in September 1990.

41. The following list of safety issues regarding which the Agency can provide assistance is in no way exhaustive.

42. Siting. Through site safety missions, the Agency has been increasingly assisting Member States with siting evaluations for nuclear installations, with emphasis on site tectonics, seismicity, seismic qualification of components, and potential safety impacts of airplane crashes and other external events. In the future, some site safety missions will involve reassessments of the adequacy of sites originally evaluated using less stringent criteria than those in use today, the objective being to ensure that the site does not pose an unacceptable safety risk.

43. Safety Aspects of Design. Depending on the expressed needs of Member States, the Agency will conduct design reviews covering broad aspects of design, such as the adequacy of the design concept, or tailored to particular concerns, such as the adequacy of the containment structural design to cope with a hydrogen detonation or with other causes of extensive overpressure.

44. Nuclear Power Plant Ageing. Over the next decade nearly 200 power reactors will pass the 25-year mark, and timely decisions must be taken as to whether plant safety margins can be maintained through surveillance and maintenance, whether plant lifetimes can be safely extended beyond the normally planned 30 to 40 years, or whether some plants should simply be shut down. To compound the problem, in many Member States regulatory policies on nuclear power plant ageing are not fully formulated or documented.

45. The Agency's work on collating information on the largely uncoordinated government and industry studies of ageing mechanisms and their management by surveillance and maintenance will be intensified. Guidance will be provided on data collection and record-keeping for monitoring the ageing of plant components and structures, and on selecting safety-significant plant components and methods for the operational management of critical components. The Agency will seek to catalyse and co-ordinate pilot studies by Member States on ageing management for selected safety-significant plant components. Later, using the knowledge thus gained, the Agency will provide guidance on regulatory policies and requirements for the management of ageing, to ensure safety margins over the plant lifetime.

46. Fire Safety. A large fire at a nuclear facility can affect independent safety-related systems simultaneously and thereby nullify the advantages associated with their independence. Since the Brown's Ferry fire in the USA 15 years ago, fire protection requirements have gradually become stricter. The participants in the International Symposium on Fire Protection and Fire Fighting in Nuclear Installations (held in 1989 with Agency co-sponsorship and the first symposium of its kind) unanimously called for more forceful international measures to improve fire prevention and fire-fighting preparedness, particularly for fires coupled with high radiation fields.

47. The Agency will contribute by holding regular technical meetings to foster the widespread feedback of inspection results and discussion among inspectors, fire insurance firms, representatives of WANO and others concerned with fire safety at nuclear facilities. As a complementary activity to the current review of the Agency's safety guide on fire safety, technical documents will be prepared on advances in analysing fire propagation and the safety implications of fires, plant-specific fire vulnerability, and the optimized selection and location of fire protection devices.

48. Research Reactor Safety. The phenomenon of ageing, with its safety implications, extends also to at least two thirds of the 323 research reactors operating in 54 countries. For many Member States, research reactor modification and decommissioning are crucial issues, whereas other Member States, particularly in the developing world, are concerned with siting,

designing and operating reactors. The fact that at some reactors the equipment is outdated and unreliable and maintenance and operational levels are generally poor underscores the importance of international safety reviews as a sound precautionary measure.

49. The INSARR programme will be strengthened in view of the large number of research reactors set up under project agreements requiring compliance with Agency safety standards and practices. (See Table 2.) INSARR missions will be followed by technical assistance where necessary. The Agency will accelerate the publication of — inter alia — safety standards for research reactor design and operation and guides for carrying out research reactor safety assessments, modifications and experiments and for emergency planning.

IV.3. Applying Safety Assessment Techniques

50. The Agency will assist Member States in the application of safety assessment techniques. The following illustrates the type of assistance that can be provided.

51. Transient and Accident Analyses. Safety assessments of nuclear power plants rely largely on computer codes that simulate plant response under a wide range of transient and accident conditions. Typically, these codes are complex, requiring expertise for their application. With the growing emphasis on safety assessments of operating plants and design reviews of new plants, including analyses of severe accidents, users of these codes are encountering new challenges. For example, to fully exploit the experience gained operationally at power plants, accident precursors need to be analysed as the basis for revised operational procedures.

52. To respond to these trends, the Agency will consolidate international experience with computer codes in order to provide practical guidance on their application. A set of authoritative manuals will be developed to define clearly the strengths and limitations of computer codes for specific applications, model the physical phenomena associated with severe nuclear accidents, and describe modelling techniques and parameter selection criteria for computer simulations.

53. Probabilistic Safety Assessment. During the 1980s, there was a growing awareness of the importance of PSA techniques as a tool for assessing plant design and operational safety. The Agency has played a catalytic role in efforts to achieve the worldwide use of PSAs for nuclear power and research installations, particularly in Member States with emerging nuclear programmes. The completion of a PSA for every plant is being encouraged, and efforts to ensure adequate physical and intellectual infrastructures for PSA applications have been intensified.

54. In line with the increasing interest in conducting PSAs at nuclear installations, the IPERS programme will be expanded to include up to seven missions a year. (See Table 2.) The Agency is joining the American Nuclear Society, the European Nuclear Society, the Commission of the European Communities (CEC) and NEA-OECD in sponsoring a symposium on the use of PSAs, to be held in June 1991. To further enhance operational safety, the Agency-developed personal computer software PSAPACK will be further adapted to help operating personnel, regulatory inspectors and others maintain PSAs as "living documents" that can be continuously updated and from which information useful for safety decisions can be easily retrieved.

55. Man-Machine Interface. From discussions at the 1990 International Symposium on Balancing Automation and Human Action in Nuclear Power Plants, held in the Federal Republic of Germany and co-sponsored by the Agency and NEA-OECD, it is evident that the nuclear community must strengthen its efforts to improve the interface between the "nuclear power machine" and the people who operate it. Analyses of safety-related events at nuclear plants repeatedly show that more than half of the root causes of such events can be traced to human performance problems. To broaden the knowledge base, the Agency will co-ordinate the research under way in over a dozen institutions worldwide on how the young science of expert systems, or more precisely knowledge-based systems, could be applied more dynamically in support of operations, maintenance, training and other activities at nuclear power plants. Complementary work will include workshops to demonstrate expert system software, training, and the provision of guidance on expert system development and the licensing of related software.

56. The Agency will also strengthen its support of research on the techniques of human reliability analysis, with a view to achieving a systematic safety assessment approach at nuclear power plants. A co-ordinated research programme will develop human reliability data bases. Related work will focus on developing human performance indicators that can help resolve some of the difficulties faced in quantifying risk and human reliability in safety analyses.

IV.4 Promoting Regulatory Consistency

57. The Chernobyl accident led to widespread recognition of the need to create more effective mechanisms for achieving consistency^{*/} in national regulatory approaches. The Agency has explored several ways of achieving closer interaction among regulatory bodies, including peer reviews of national regulatory bodies and intercomparisons of practices. The results have been interesting but, as national regulatory practices are influenced by often highly diverse systems, this broad type of review has its limitations.

58. A recently initiated series of multilateral peer discussions on specific regulatory topics has shown promise of promoting the desired consistency. Four meetings have taken place, involving groups from 13 countries, and with the emphasis on regulatory approaches to inspection and enforcement in these countries. The result has been a clearer understanding of common features and differences and, from this, a set of recommended good practices for inspection and enforcement which, if universally applied, would foster a consistently high level of regulatory inspection and enforcement worldwide. This could help to increase the confidence of the public and of politicians in the regulatory process by underlining that national approaches are backed by an international consensus, as documented in the Agency's standards.

^{*/} "Consistency" is not the same as "uniformity"; it implies the adaptive use of internationally recognized good regulatory practices within the context of often diverse legal, industrial and social structures.

59. Such discussions will continue, with up to six meetings of small groups of regulators to be held annually on topics such as the regulatory implications of the revised basic recommendations of the International Commission on Radiological Protection (ICRP) and the regulatory approach to the monitoring and refurbishment of ageing nuclear installations. The good practices identified will be documented in the Agency's safety standards programme. The traditional gatherings of regulators during General Conference sessions will provide opportunities for reviewing the results and initiating further steps.

IV.5 Defining Safety Requirements for Future Nuclear Installations

60. There is growing interest in the development of advanced power reactors of evolutionary and innovative types, characterized by standardized and simpler designs, improved fuel cycle systems and strategies, often smaller size, and enhanced safety features that rely more on natural laws to control the fission process and decay heat removal. The question then arises whether existing safety criteria would cover all features of such reactors or whether new criteria will be needed to handle issues raised by these advanced technologies. As a follow-up to its pioneering work of defining basic safety principles for nuclear power plants, INSAG is preparing documentation on the safety of existing and future energy production, including a set of safety goals for advanced reactors. The next logical step will be for the Agency, through INSAG, to define safety criteria for the realization of these goals and, in this way, to help build an international consensus on safety criteria for the design and operation of advanced reactors.

61. Through established mechanisms, such as its International Working Groups on specific types of power reactors, the Agency will promote the widespread exchange of information on advanced reactor concepts, encourage their development, and provide a framework for concept evaluation. Feedback from this activity, together with the input from INSAG on safety criteria, will provide a basis for an annual Agency-organized forum to discuss matters relating to the safety of future nuclear installations.

IV.6 Strengthening Radiation Protection Infrastructures

62. To be effective, radiation safety measures must be established within an adequate national infrastructure that includes legislation, regulatory mechanisms for enforcement (licensing and inspection), and long-term programmes for human and physical resource development. Discussions earlier this year at the Agency-organized International Symposium on Radiation Protection Infrastructure held in the Federal Republic of Germany highlighted the growing concern that many countries do not have the radiation protection capabilities for dealing with an expanding use of radiation sources and practices.

63. RAPAT missions have defined and advised on infrastructural problems in nearly 50 developing Member States. Unfortunately, follow-up has generally consisted of only ad hoc technical assistance, rather than co-ordinated elements of a long-term strategy. To overcome this shortcoming, the Agency is considering what changes in policy and procedures are needed in order to achieve effective interdepartmental co-ordination and a more systematic approach to problem definition, technical co-operation project formulation and project implementation. The envisaged long-term strategy will involve more active Agency assistance to developing Member States in formulating technical assistance projects, through the provision of experts to work closely with national authorities in realistically assessing national resources and the assistance available regionally and through the Agency and other international organizations. Measures to enhance project implementation will include project management training courses for those responsible locally for implementing Agency-assisted projects. Priority will be given to licensing and inspection, the limitation of occupational exposures, the control and the safe use of radiation sources, human health and environmental protection, emergency planning, and the treatment of overexposed individuals.

64. Given the large number of Member States needing assistance, the programme requires considerable resources in terms of personnel, material and equipment. Some resources could be made available through the Agency's technical co-operation programme; moreover, additional cost-free experts might be made available to the Agency if Member States were confident that the experts were being used effectively, within the framework of a co-ordinated programme.

65. In March 1990, an Inter-Agency Committee for Radiation Safety was set up, at the initiative of the Agency, to co-ordinate the efforts of its members and promote consistency among organizational policies for radiation safety. At present, the Committee consists of the CEC, the Council for Mutual Economic Assistance (CMEA), ILO, the Agency, NEA-OECD, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and WHO -- as members -- and ICRP, the International Commission on Radiation Units and Measurements (ICRU) and the International Radiation Protection Association (IRPA) -- as observers. High on the agenda of priority issues are the radiation safety implications of the revision of ICRP's basic recommendations and assistance to the Agency in the associated revision of its Basic Safety Standards for Radiation Protection, which are derived from the ICRP recommendations. Subsequently, the Agency will develop practical guidance on and assist in implementing the new recommendations and standards, especially as regards safety criteria for existing (de facto) exposures and intervention levels.

66. The revised ICRP recommendations, and especially changes that may result from revised risk factors for human radiobiological effects, could have major implications for the regulation of occupational exposures in Member States. The Agency will work closely with NEA-OECD, which recently took steps to create an international information system on occupational exposures at nuclear power plants, to be used, for example, in identifying trends and mechanisms for dose reduction. The Agency will extend the data base to include occupational exposures at nuclear power plants in non-OECD countries and occupational exposures resulting from medical irradiation and other non-power nuclear applications. A recently initiated co-ordinated research programme on radiation doses in diagnostic radiology, involving the CEC and over a dozen Agency Member States, could provide input for this data base.

67. Although the applications of radiation technology in medicine, agriculture, industry and research have a good safety record, there is room for improvement, particularly in the use and control of sealed radiation sources, which have accounted for most of the serious radiological accidents recorded to date. The development and provision of practical guidance for handling such sources will have priority. Work will continue on compiling a comprehensive registry of radiation sources supplied by the Agency to Member States. Complementary activities will include identifying the technical assistance a Member State may require in order to use radiation sources safely and setting up a repository of authoritative information on radiological accidents.

IV.7 Managing and Disposing of Radioactive Wastes

68. WAMAP. Feedback from Member States that have experienced a WAMAP review indicates the effectiveness of such reviews in helping with the implementation of waste processing, storage and disposal projects. Under WAMAP, which responds flexibly to demands for assistance, emphasis will continue to be placed on waste management regulations and infrastructures, safety criteria and standards, spent sealed source management, waste processing and disposal, and safety/environmental assessments.

69. With the existing resource base, six or seven WAMAP missions can be carried out each year. Given that the Agency has over 80 Member States using radioisotopes in medicine and other fields, there is considerable potential for expanding the WAMAP programme. Developing Member States with nuclear power programmes may find that they also can benefit from WAMAP missions. The projections in Table 2 reflect an assumed expansion of resources that would allow for ten WAMAP missions a year, in line with the envisaged demand. The co-ordination of WAMAP missions and follow-up activities through technical co-operation projects will be strengthened.

70. WATRP. Through WATRP, the Agency arranges for international peer reviews which provide guidance and advice on national waste management programmes. The aim is to provide greater assurance that national systems (planned or in operation) will perform safely and reliably and meet design criteria and/or performance objectives, thereby enhancing public confidence in national programmes and arrangements. The WATRP service is aimed at Member States with established waste management programmes.

71. Two or three WATRP missions a year are possible with existing resources. Here also, the projections in Table 2 (five WATRP missions a year in 1991 and 1992) reflect an assumed expansion of resources, given the importance of building public confidence in radioactive waste management.

72. RADWASS. The Radioactive Waste Safety Standards programme includes the development of a series of safety documents covering the entire field of radioactive waste management. These documents, which will have a higher visibility and be arranged more logically than the Agency's present safety documents on waste management, will demonstrate the existence of an international consensus on approaches to safety in waste handling, processing and disposal.

73. During the period 1991-94, the Agency will publish a Safety Fundamentals document, together with most of the necessary associated standards and two high-priority safety guides. However, a consultant group has recommended to the Agency that the RADWASS programme be expedited and that 26 documents be completed over a six-year period. To accomplish this, additional resources would be required.

74. Waste Processing. The Agency has established a good reputation for state-of-the-art documentation on safe technology for the treatment and solidification of radioactive wastes. The emphasis has now shifted to meeting the practical needs of Member States that produce radioactive wastes from nuclear energy applications. A series of technical manuals will be published on subjects ranging from waste minimization to the treatment and conditioning of spent ion-exchange resins from research reactors. The manuals will offer practical procedures for conducting waste management exercises, account being taken of the needs and resources of developing Member States. Safe, efficient

and reliable solutions to the problems of waste handling and processing will be the principal element of the programme.

75. WPSF. A reference design will be developed for a waste processing and storage facility (WPSF) for radioactive wastes resulting from research and nuclear applications. The emphasis will be on providing direct and indirect assistance in resolving the problems of conditioning and disposal of spent sealed sources. The magnitude and nature of the problems associated with such sources will be assessed, within the framework of a programme initiated early in 1990.

76. Safety Assessment. Efforts to develop safety criteria and safety assessment methodologies for the near-surface disposal of low- and intermediate-level wastes will be intensified. Two co-ordinated research programmes on near-surface repositories – one dealing with engineered barriers and the other with safety assessment – will commence late in 1990. Through continuing work on environmental radionuclide modelling, the Agency – in co-operation with other international organizations – will help assess the radiological and environmental impacts of radioactive waste repositories.

IV.8 Improving Public Understanding of Radiation Risks

77. Many people, including some scientists and engineers, lack an awareness of radiation as an inherent part of life – an awareness that encompasses patterns and magnitudes of radiation exposure, levels of human health and environmental risk, and the adequacy of radiation safety measures.

78. An important way of achieving a comprehensive perspective on radiation risks is to analyse the consequences of radiological accidents scientifically and authoritatively. Following analyses of the consequences of the radiological accidents in Brazil and El Salvador mentioned in paragraph 14 above, the Agency has embarked on a major assessment of the radiological consequences of the Chernobyl accident at the request of the Soviet Government.

79. Since the Chernobyl accident, the most serious radiological emergency mankind has experienced, numerous analyses have provided useful technical information about the causes and the various phases of the accident. Now, in response to a request from the USSR, the Agency -- with the participation of the CEC, the United Nations Food and Agriculture Organization (FAO), UNSCEAR and WHO -- is carrying out a large-scale project designed to comprehensively assess the radiological consequences of the Chernobyl accident in the Soviet Union. Initiated early in 1990, the project involves some 100 experts who are assessing medical, environmental and agricultural conditions in specific localities and evaluating measures taken by Soviet authorities to protect people and the environment.

80. The Agency will publish the final report, prepared by an International Advisory Committee under the chairmanship of Dr. Itsuzo Shigematsu, Director of the Radiation Effects Research Foundation in Hiroshima, Japan; the Committee comprises members from Austria, the Byelorussian SSR, Canada, Finland, France, Japan, the Ukrainian SSR, the United Kingdom, the United States, the Soviet Union, the CEC, FAO, UNSCEAR, WHO and the Agency. Subsequently, the Agency will convene meetings in the Soviet Union and elsewhere in order to permit an open discussion of the findings and to stimulate feedback regarding the next steps that the Agency and its Member States could take for promoting radiation acceptability.

81. To clarify the realities of the radiation environment and to place them in perspective, the Agency's comparative risk assessment programme will provide a reliable and authoritative body of information on the health and environmental risks posed by the total cycle of the global energy system. Another important step will be to contribute to an international consensus on policies and practices for limiting the environmental and health effects of electricity generation, and it is expected that the 1991 Agency co-sponsored

International Senior Expert Symposium on Electricity and the Environment will be useful in this respect. The Agency will collaborate with other international agencies in assessing the health and environmental risks associated not only with power generation but also with other complex industrial systems. These activities are expected to yield a scientific base for discussion at the United Nations Conference on Environment and Development, to be held in Brazil in 1992.

82. An advisory group composed of credible scientists and scientific communicators will be set up – inter alia – to openly explain the significance of risk-related statistics. It is hoped that the group's work will help lay the foundations for a major international conference on radiation, health and society, now envisaged for 1992.

V. CONCLUSION

83. During the 1990s, the international nuclear community will be faced with the task of ensuring that all nuclear installations are safe, well-regulated and environmentally sound and that firm plans are in place for the disposal of radioactive wastes. From this basis, it will have to build broad public confidence in the safety of nuclear installations and the management of radioactive wastes. These formidable challenges can be met only through a deepening commitment on the part of Member States to international co-operation in matters relating to nuclear safety. The 1991 conference on nuclear safety proposed by the Member States of the European Community will provide an opportunity for the international community to define the nuclear safety agenda for the decade.

84. A strategy has been defined for advancing operational safety, reviewing safety issues, applying safety assessment techniques, promoting regulatory consistency, defining safety requirements for future nuclear installations, strengthening radiation protection infrastructures, managing radioactive waste, and improving public understanding of radiation risks.

85. The General Conference is invited to consider this strategy, the elements of which have been described in the present report.

86. The General Conference is also invited to note that the Board of Governors has agreed to the proposal concerning the convening of a conference on nuclear safety in 1991, on the understanding that the necessary voluntary financial contributions will be forthcoming, and requested the Director General to proceed with the planning of the conference.

87. Further, the General Conference is invited to consider the following high-priority measures which need to be taken in the interest of the effective implementation of the Agency's proposed strategy for enhanced international co-operation in nuclear safety matters.

Strengthening the Agency's Safety Services

Resources should be substantially increased so as to enable the Agency's safety services (e.g. the OSART, ASSET, ESRS, IPERS, RAPAT, WAMAP and WATRP services) to respond to the growing demand from Member States.

Promoting a Single Intergovernmental System for Nuclear Event Reporting and Communication

The Incident Reporting Systems of the Agency and NEA-OECD should be integrated and used together with the International Nuclear Event Scale classification to promote operating experience feedback and credible public communication.

Establishing Nuclear Safety Fundamentals and Promoting their Universal Application

The development of a set of nuclear safety fundamentals should be expedited. Their universal application should then be promoted on the basis of States' recognition that it is in their interest to respect and rely on such internationally recognized safety fundamentals.

Creating an International Mechanism for Information Exchange on the Safety of Future Nuclear Installations

An international forum should be created for the annual exchange of information on safety matters related to future nuclear installations.

Establishing Technical Co-operation Programmes for Strengthening Radiation Protection and Waste Management Infrastructures

Technical co-operation programmes for strengthening radiation protection and waste management infrastructures in requesting Member States should be implemented on the basis of recommendations made by RAPAT and WAMAP missions.

88. Through the combined efforts of Member States, the Agency has served as an instrument by means of which international co-operation on nuclear safety matters has been encouraged and strengthened for more than three decades. The Agency has the expertise and technical capability to organize and carry out a more dynamic nuclear safety programme shaped to the longer-term needs of its Member States. However, such a programme can yield optimum results only if there is a substantial increase in the Agency's financial and human resources.