Nuclear Safety Review for the Year 2009

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Nuclear Safety Review
For the Year 2009

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Foreword

The *Nuclear Safety Review for the Year 2009* contains an analytical overview of the status of worldwide efforts to strengthen nuclear, radiation, transport and radioactive waste safety and emergency preparedness. The analytical overview is supported by two Appendices: Safety Related Events and Activities Worldwide during 2009 (Appendix 1) and The Agency's Safety Standards: Activities during 2009 (Appendix 2).

A draft version of the Nuclear Safety Review for the Year 2009 was submitted to the March 2010 session of the Board of Governors in document GOV/2010/4. The final version of the *Nuclear Safety Review for the Year 2009* was prepared in light of the discussions held during the Board of Governors.

Executive Summary

The global nuclear community is experiencing a period of dynamic change. The introduction of new nuclear power plants, the rapid expansion of existing nuclear power programmes and the wider use of radioactive sources and ionizing radiation in general highlight the need for continued and improved international cooperation to address the associated challenges. The increasingly multinational nature of today's nuclear business and activities underscores this need. In this context, it is particularly important to note that the establishment of adequate safety infrastructure and capacity cannot be left to fall behind.

The safety performance of the nuclear industry has remained at a high level. Various safety performance indicators, such as those related to unplanned reactor shutdowns, safety equipment availability, radiation exposures to workers, radioactive waste management and radioactive releases to the environment have shown steady improvement over the past two decades, with some levelling off in recent years. Nevertheless, it is necessary to avoid complacency and to continuously improve and strengthen the existing global nuclear safety and security regime so that nuclear technologies can be introduced or their use expanded in a safe and secure manner to meet the world's needs for human well-being and socio-economic development. The Agency continues to support and promote increased participation in the global nuclear safety and security regime as a framework for achieving high levels of safety in nuclear activities worldwide.

Through consideration of the global trends, issues and challenges observed in 2009, four key themes in global nuclear safety were identified: 1) continuing international cooperation and emerging coordination for new and expanding nuclear power programmes; 2) improving the long term management of radioactive and nuclear materials; 3) capacity building for sustainable nuclear safety; and 4) strengthening global and regional networking activities.

A growing number of Member States are considering or have expressed interest in developing nuclear power programmes for the first time. Several countries have also embarked on ambitious plans for expanding their current programmes. The Agency's latest projections for the future of nuclear power by 2030 are higher than they were last year.

Emerging international cooperative efforts in support of new and expanding nuclear power programmes have focused on many key issues. Such issues include gaps in national safety infrastructures, safety and security synergy and integration, and safety responsibilities and capacities for the various participants in a nuclear power programme, which include operators, regulators, government, suppliers, technical support organizations and relevant international organizations. Continued focus on cooperation for new and expanding nuclear power programmes is underscored by the fact that in some cases plans for nuclear programme development are moving faster than the establishment of the necessary safety infrastructure and capacity. Therefore, it is important that those countries of new and expanding nuclear power programmes actively participate in the global nuclear safety and security regime.

As a result of the increasingly multinational nature of today's nuclear business and activities and associated technical and economic benefits, suppliers, operators, regulators and experts communities are making significant efforts towards the standardization and harmonization of equipment, components, methods and processes. As an example, the adoption by the European Union of a nuclear

safety directive that refers to the Agency's Safety Fundamentals and peer reviews is a significant step towards a harmonized approach to sustainable nuclear safety infrastructure worldwide. Similarly, international cooperation through conventions and codes of conduct, including associated peer review mechanisms, also provide for harmonized approaches to safety.

Establishing and maintaining a regulatory body which is effectively independent in its decision making continues to be essential. Clear separation from organizations or bodies charged with responsibilities for the promotion or application of nuclear or radiation related technologies is vitally important. When embarking on developing a nuclear programme in line with the Agency's safety standards, a country should ensure that the independence of the nuclear regulatory body is provided through the legal framework, along with the necessary human and financial resources. It is important that nuclear regulators have adequate regulatory decision making capacity that optimizes the balance between safety and other socio-economic considerations.

In addition to the large number of countries considering the implementation of new nuclear power programmes over the next decade, there is also strong interest among countries currently operating nuclear power reactors to maintain their reactors in operation and extend their licenses. This challenge requires enhanced and continuing attention to safety and the assurance of sustainable human competency and capacity among suppliers, operators and regulators worldwide.

Long term operation (LTO) and ageing management are important issues in many nuclear power plants. As of the end of 2009, of the 437 nuclear power plants operating in the world, 127 had been in operation for more than 30 years, and 338 for more than 20 years. The number of NPPs that are eligible for an extension of their operating life is growing and hence the LTO issue is becoming very important and deserves to be systematically addressed and integrated in all aspects relevant to safety.

During recent years, a number of severe natural events, such as earthquakes and tsunamis, have affected various part of the world. In 2009, an earthquake affected the Hamaoka nuclear power plant in Japan causing the automatic shutdown of two reactors without noticeable damage. Lessons learned from all these events continue to be analysed in order to better understand the issues and concerns related to the evaluation of such external hazards and the associated margins in the design of nuclear installations.

Research reactors around the world continued to be operated safely in 2009 and there were no serious incidents. There remains a need for improving ageing management programmes and ensuring availability of well-trained and competent staff for both operating organizations and regulatory bodies in many Member States, improving operational radiological safety and emergency preparedness, and developing decommissioning plans for many research reactors. Many facilities worldwide are still in 'extended shutdown' with no clear plans for their future utilization or decommissioning. Several Member States are considering constructing their first research reactor as a tool to develop the necessary national technical and safety infrastructures for embarking on a nuclear power programme.

Occupational radiation protection is well managed in most nuclear installations around the world. However, exposures of workers in the medical field and in non-destructive assays have increased at high rate. More than half of all radiation exposed workers are now in the medical field, and this ratio is expected to increase over the next few years. New challenges in occupational radiation protection of medical workers have appeared due to the new techniques of medical imaging. Therefore, adequate and continuous training is crucial in the use of radioactive sources and ionizing radiation in the medical and industry fields.

More sophisticated and wider use of radioactive sources and radiation related technologies can be found throughout the world. The world's annual per capita effective dose is increasing rapidly, nearly exclusively due to increasing medical exposures, to the extent where it is now equal to or exceeding

that from natural background in some countries. While much of this increase reflects positive developments, e.g. improved access to medical procedures using ionizing radiation, there is evidence that many diagnostic imaging procedures are unnecessary and many procedures are lacking in optimization including radiotherapy. This highlights the need to strengthen international cooperation and ensure mutual learning from experience.

While in a limited number of applications, radioactive sources are being replaced with other technologies, such as particle accelerators, in many cases, radioactive sources will continue to be used in medical, industrial and academic applications. Although all Member States recognize the importance of ensuring that radioactive sources are under regulatory control, maintaining a national register and ensuring regulatory control throughout the entire life-cycle of sources remains an issue in many Member States. Many Member States are incorporating the provisions of the Code of Conduct on the Safety and Security of Radioactive Sources into their national legislation. However there is a strong need to further strengthen international cooperation to improve the registering and monitoring of radioactive sources from cradle to grave. In particular, disused sources tend to be left unattended. This is a significant problem that must be urgently addressed through enhanced national and international efforts.

The long term safety of radioactive and nuclear materials continues to be a challenge for the international nuclear community. In particular, spent fuel and radioactive waste management issues are faced by new and existing nuclear power countries and are a prime concern of the public. This is especially relevant since the lifetime of a nuclear power programme can be up to 100 years or more and the need for adequate management of spent fuel and radioactive waste goes well beyond 100 years. Projects to develop geological disposal facilities for high level radioactive waste have been under development in several countries for the past few decades. Only few countries have made good progress with both the technological development and public acceptance to the extent that licence applications are now being prepared and submitted to national regulatory authorities.

Decommissioning and cleanup of the global civil nuclear legacy represents a massive managerial, technological, safety and environmental challenge for those countries engaged in nuclear decommissioning across the world. Hundreds of nuclear power plants worldwide will require decommissioning over the next 40 to 60 years. In addition to power reactors, decommissioning and cleanup needs are identified in the areas of prototype, test and research reactors together with other areas of the other fuel cycle facilities such as fuel fabrication facilities across the world.

The international nuclear community has continued to focus on capacity building for sustainable nuclear safety. The availability, retention and continuous improvement of qualified personnel are building blocks for organizational, institutional and national capacity. They are vital to the development of an adequate and sustainable nuclear safety and security infrastructure. For this reason, it remains a top priority for the international nuclear community to develop the skills, knowledge and expertise of individuals across many disciplines, such as scientists, radiation and nuclear technology experts, legislators, regulators, administrators, and emergency response personnel. Capacity building is a key issue not only for countries embarking on nuclear power for the first time, but also a major challenge for all countries with nuclear power.

Global and regional knowledge networks, such as the International Regulatory Network (RegNet), Response Assistance Network (RANET), the Asian Nuclear Safety Network (ANSN), the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies and the recently established Forum of Nuclear Regulatory Bodies in Africa (FNRBA) are being increasingly used by Member States. Continuous improvement of such networks through more use, more interaction and more feedback should be further promoted for maintaining high level of safety and capacity. The Global

Nuclear Safety and Security Network (GNSSN) is currently being developed by the Agency as the global network to more effectively support regional and thematic networks and the national capacity building of Member States on a global scale.

The ability to adequately respond to a nuclear or radiological emergency remains a central element of international nuclear safety. Member States are working with the Secretariat to improve local, national, regional and international preparedness to respond to emergencies. However, many States do not meet international safety requirements for emergency preparedness and response. Although further capacity building efforts in this area are required, experience shows that countries, which were involved in a response coordinated by the Agency's Incident and Emergency Centre (IEC), improved their emergency response capabilities in a sustainable manner.

The International Expert Group on Nuclear Liability (INLEX), established by the Director General in 2003, continues to serve as the Agency's main forum dealing with questions related to nuclear liability and aims at contributing towards a better understanding of, and adherence to, the international nuclear liability instruments. The Agency continued its efforts to promote adherence to the various applicable international legal instruments adopted under the auspices of the Agency, in particular with respect to the Convention on Supplementary Compensation for Nuclear Damage (CSC). In this connection, the Director General sent letters to all Member States encouraging their respective governments "to give due consideration to adhering to the CSC and thus contributing towards strengthening the global nuclear liability regime."

Denials and delays of shipment of radioactive materials continue to occur in all parts of the world. The reduction of available transportation routes seems to be a precursor to denials and delays of shipments, but it continues to be difficult to monitor and measure this owing to commercial sensitivities. It remains clear that effective communication with transport personnel, whose main activity is not handling radioactive material, is essential in order to combat undue denials and delays. The promotion of communication and training is the focus of the current phase of the action plan of the International Steering Committee on Denials of Shipment of Radioactive Material that is currently being implemented and is nearing completion. Another continuing challenge is to improve cooperation and interfaces with other United Nations bodies associated with the transport of dangerous goods.

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Analytical Overview

A. Introduction

1. The global nuclear community is experiencing a period of dynamic change. The introduction of new nuclear power plants, the rapid expansion of existing nuclear power programmes and the wider use of radioactive sources and ionizing radiation in general highlight the need for continued and improved international cooperation to address the associated challenges. The increasingly multinational nature of today's nuclear business and activities underscores this need. In this context, it is particularly important to note that the establishment of adequate safety infrastructure and capacity cannot be left to fall behind.

2. The safety performance of the nuclear industry has remained at a high level. Various safety performance indicators, such as those related to unplanned reactor shutdowns, safety equipment availability, radiation exposures to workers, radioactive waste management and radioactive releases to the environment have shown steady improvement over the past two decades, with some levelling off in recent years. Nevertheless, it is necessary to avoid complacency and to continuously improve and strengthen the existing global nuclear safety and security regime so that nuclear technologies can be introduced or their use expanded in a safe manner to meet the world's needs for human well-being and socio-economic development. The Agency continues to support and promote increased participation in the global nuclear safety and security regime as a framework for achieving high levels of safety in nuclear activities worldwide.

3. The global nuclear safety and security regime (Figure 1) is comprised of the institutional, legal and technical frameworks for ensuring the safety and security of nuclear facilities and activities worldwide in a more internationally coordinated and cooperative manner. At the foundation of this

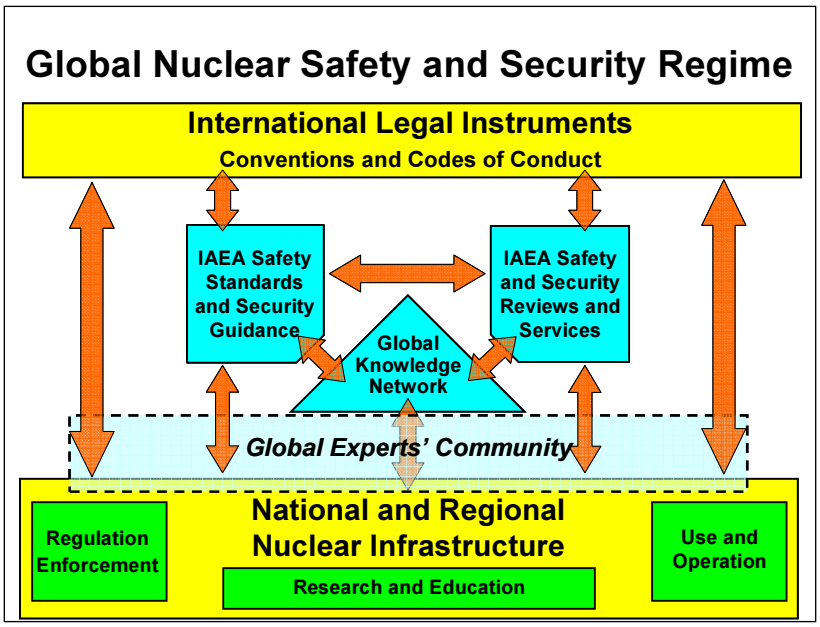

Figure 1: The Global Nuclear Safety and Security Regime

global regime are the strong national infrastructures of the countries that actively participate in the international efforts to continuously improve nuclear safety and security. The other major elements of

the global regime that work together in synergy are the international legal instruments, safety standards, security guidelines, peer reviews, advisory services and knowledge networks that support and strengthen existing national and regional infrastructures, thereby helping to prevent another serious nuclear accident or terrorist incident, or to better respond to one should it occur.

4. The *Nuclear Safety Review for the Year 2009* presents an overview of worldwide trends, issues and challenges in nuclear, radiation, transport and radioactive waste safety and incident and emergency preparedness, highlighting developments in 2009. This overview is supported by more detailed Notes[1]. For the purposes of this document, when the term nuclear safety is used, it encompasses nuclear installation safety, radiation safety, transport safety and the safety of spent fuel and radioactive waste management. This report also discusses nuclear security, but only as far as it relates to nuclear safety. A separate report in September 2010 will cover nuclear security as a whole.

B. Global nuclear safety trends, issues and challenges

5. Through consideration of the global trends, issues and challenges observed in 2009, four key themes in global nuclear safety were identified: 1) continuing international cooperation and emerging coordination for new and expanding nuclear power programmes; 2) improving the long term management of radioactive and nuclear materials; 3) capacity building for sustainable nuclear safety; and 4) strengthening of global and regional networking activities.

B.1. International cooperation and emerging coordination for new and expanding nuclear power programmes

B.1.1. Introduction

6. A growing number of Member States are considering or have expressed interest in developing nuclear power programmes for the first time. Several countries have also embarked on ambitious plans for expanding their current programmes. The Agency's latest projections for the future of nuclear power by 2030 are higher than they were last year. The low projection foresees an installed global nuclear power capacity of about 511 gigawatts-electric in 2030, a 40% increase over the roughly 370 gigawatts-electric currently installed today. The high projection foresees about 807 gigawatts-electric, which more than doubles the current capacity. This is indeed a significant safety challenge to the world nuclear community.

7. Emerging international cooperative efforts in support of new and expanding nuclear power programmes have focused on many key issues. Such issues include gaps in national safety infrastructures, safety and security synergy and integration, and safety responsibilities and capacities for the various participants in a nuclear power programme, which include operators, regulators, government, suppliers, technical support organizations and relevant international organizations. However, in some cases plans for nuclear programme development are moving faster than the establishment of the necessary safety infrastructure and capacity. Therefore, it is important that those

[1] *Safety Related Events and Activities Worldwide during 2009* (document 2010/Note 4) and *The Agency's Safety Standards: Activities during 2009* (document 2010/Note 5).

countries with new and expanding nuclear power programmes actively participate in the global nuclear safety and security regime.

B.1.2. Establishment of national nuclear safety infrastructures

8. As the number of countries exploring the option of nuclear power for future supply of energy increases, there is a need to ensure that effective national safety infrastructures are in place to support the development of this option. Such a national infrastructure consists of the institutional, organizational and technical elements and conditions established to provide a foundation for ensuring a sustainable high level of nuclear safety. The Agency has consolidated its safety standards and guidance in this area and produced a draft safety guide, DS424, *Establishing a Safety Infrastructure for a National Nuclear Power Programme*, to serve as a 'road map' to apply the entire set of the Agency's safety principles and requirements progressively during the initial three phases of infrastructure development, which are consistent with the phases described in the Agency's publication entitled *Milestones in the Development of a National Infrastructure for Nuclear Power*.

9. The Agency already offers to its Member States a comprehensive suite of peer reviews and advisory services based on well-established Agency safety standards and evolving security guidelines. The Agency is continuing its efforts to tailor and improve its existing peer reviews and advisory services, such as the Integrated Regulatory Review Service (IRRS) and the Integrated Nuclear Infrastructure Review (INIR)[2], to help newcomers apply the Agency's safety standards and security guidelines.

B.1.3. International standardization and harmonization efforts

10. As a result of the increasingly multinational nature of today's nuclear business and activities and associated technical and economic benefits, suppliers, operators, regulators and expert communities are making significant efforts towards the standardization and harmonization of equipment, components, methods and processes. Standardization refers mainly to the application of the same design and practices for nuclear power plants. Harmonization is broader and refers to how different countries can adopt more consistent and coherent approaches to safety. As an example, the adoption by the European Union of a nuclear safety directive that refers to the Agency's Safety Fundamentals and peer reviews is a significant step towards a harmonized approach to sustainable nuclear safety infrastructure worldwide. Similarly, international cooperation through conventions and codes of conduct, including associated peer review mechanisms, also provide for harmonized approaches to safety.

11. The Agency has developed a Generic Reactor Safety Review (GRSR) process and service to provide Member States with an early safety evaluation of new reactors against the Agency's safety standards and to support building safety assessment capacity. The GRSR methodology is being used to review safety case documentation to examine and evaluate the comprehensiveness and the completeness of the supplier's safety claims in relation to the IAEA Safety Standards. The GRSR service provides an early harmonized appraisal of the safety case as a potential basis for an individual evaluation or the licensing process, which remains a fundamental responsibility of the Member States. Expert consultants, from a variety of Member States, bring to the service state–of-the-art knowledge, methods and approaches. The experience from the six reviews performed so far has been utilized to

[2] GOV/INF/2009/11

develop a training programme that is primarily offered to countries developing safety infrastructure for a new nuclear power programme.

12. To further support the harmonization of safety approaches for new and expanding nuclear power programmes the Agency participates in the Multinational Design Evaluation Programme (MDEP) to increase cooperation and enhance convergence of regulatory requirements of national safety authorities who will be tasked with the review of new reactor power plant designs. Additionally, standardization and harmonization of education and training based on Agency's safety standards is currently under development in the Safety Assessment Education and Training (SAET) Programme.

13. The European nuclear community has been particularly active with standardization and harmonization efforts. In particular, the European Nuclear Safety Regulators Group (ENSREG) and Western European Nuclear Regulators' Association (WENRA) have both taken steps to better achieve standardization and harmonization of nuclear safety activities.

B.1.4. Regulatory effectiveness and independence

14. Establishing and maintaining a regulatory body which is effectively independent in its decision making continues to be essential. Clear separation from organizations or bodies charged with responsibilities for the promotion or application of nuclear or radiation related technologies is vitally important. When embarking on developing a nuclear programme in line with the Agency's safety standards, a country should ensure that the independence of the nuclear regulatory body is provided through the legal framework, along with the necessary human and financial resources. It is important that nuclear regulators have adequate regulatory decision making capacity that optimizes the balance between safety and other socio-economic considerations.

15. Self-assessments and peer reviews play important roles in continuous knowledge sharing and mutual learning regarding regulatory practices and policies. Particularly important opportunities are provided through the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, which oblige the Contracting Parties to submit their national reports for peer review. It is widely agreed that self-assessment and peer review activities based on Agency standards and guidelines are valuable tools for sharpening expertise and enhancing technical, managerial and policy capacity. Active participation in such conventions and the Agency's peer reviews such as the IRRS is a primary mechanism for nuclear regulatory bodies throughout the world to work together cooperatively to enhance their effectiveness and independence.

B.1.5. Nuclear power plant life extension and decommissioning

16. In addition to the large number of countries considering the implementation of new nuclear power programmes over the next decade, there is also strong interest among countries currently operating nuclear power reactors to maintain their reactors in operation and extend their licenses. This challenge requires enhanced and continuing attention to safety and the assurance of sustainable human competency and capacity among suppliers, operators and regulators worldwide.

17. Continued attention and priority must be given to the safety status of nuclear power plants currently in operation. Many of these plants have been in operation for several decades and are facing ageing phenomena such as material degradation and obsolescence. The Agency, in response to this has developed and recently published a Safety Guide entitled *Ageing Management for Nuclear Power Plants*. Furthermore results of the Agency's safety review services in this area show that the status of development of ageing management arrangements varies among Member States. These reviews, together with discussions with experts concerned confirm the need, and the practical usefulness, of the

development of a consolidated international approach to ageing management programmes and safe long term operation of nuclear power plants, until the final decision on plant decommissioning is taken.

18. Decisions associated with the termination of the operational phase of a nuclear facility need to be supported by a good regulatory infrastructure and technical competencies in performing decommissioning. Currently, of the many large nuclear installations permanently shut down, only a fraction have been or will be in the near term totally dismantled and decommissioned. A trend towards immediate dismantling seems to be emerging in some countries, but this appears to be due to country-, site- or plant-specific conditions of limited generic applicability. As a result of international efforts, the situation is evolving, and provisions and infrastructures including funding are being established to cope with decommissioning challenges.

19. However, the worldwide overview of decommissioning strategies does not offer a clear pattern. The conditions of the nuclear industry at large have considerably changed over the past few years and are going to affect decommissioning in the near future. Experience shows that spent fuel management may strongly affect the selection of a decommissioning strategy. In particular, facilities to store, dispose of or reprocess spent fuel may not be readily available and the fuel may have to remain in the reactor facility. Additionally, the lack of a transfer route for spent fuel may force some licensees into a safe enclosure strategy with spent fuel in the facility.

B.2. Long term management of radioactive and nuclear materials

B.2.1. Introduction

20. More sophisticated and wider use of radioactive sources and radiation related technologies can be found throughout the world. This can be seen particularly in the field of medicine and industry, where advanced radiation techniques are being more widely introduced. For many countries there is a strong need to improve the registering and monitoring of dangerous radioactive sources from cradle to grave. In particular, disused sources tend to be left unattended. This is a significant problem that must be urgently addressed through enhanced national and international efforts.

21. Spent fuel and radioactive waste management issues are particularly challenging tasks faced by new and existing nuclear power countries and are a prime concern of the public. This is especially relevant since the lifetime of a nuclear power programme can be up to 100 years or more and the need for adequate management of spent fuel and radioactive waste goes well beyond 100 years. While prospective new nuclear power programmes receive much attention, the expansion of existing programmes is far more substantial in terms of the total size of the development. In addition to new reactor units, there is an increasing number of reactor units being replaced and/or decommissioned that further contribute to the amount of spent fuel and radioactive waste that will need to be safely and securely managed.

B.2.2. Long term management of radioactive sources

22. The safety and security of radioactive sources can only be ensured by commitment to and application of continuous control of radioactive sources at every stage of their life cycle. Complete life cycle management has never been considered systematically as many countries are still faced with finding a solution for the disposal of disused sealed radioactive sources (DSRSs). Few countries have licensed and operate disposal facilities accepting DSRSs. It is necessary that countries address the long term management of DSRSs, particularly for disposal, in their national policies and strategies for

radioactive waste management and that implementation of DSRS disposal should be encouraged to increase the sustainability of sealed radioactive source usage.

23. The Agency has issued a number of safety standards and publications emphasizing the necessity of national systems for ensuring the safety of sources in its Member States. These safety standards, incorporated into national legislation and regulations and supplemented by international conventions and detailed national requirements, establish a basis for long term management of radioactive sources. In addition, an increasing number of countries have made a political commitment to use the Code of Conduct on the Safety and Security of Radioactive Sources as guidance in the development and harmonization of their policies, laws and regulations. However there is a strong need to further strengthen international cooperation focusing on wider and fuller use of the Code of Conduct on Safety and Security of Radioactive Sources.

B.2.3. Spent nuclear fuel and radioactive waste management

24. The importance of the safe management of spent fuel and radioactive waste for the protection of people and the environment has long been recognized, and considerable experience has been gained in this field. Although significant progress has been made by Member States in managing their radioactive waste safely, efforts are still needed in a number of countries to develop a national strategy up to the disposal step and to strengthen the national infrastructure accordingly.

25. The average annual global disposal rate for all waste classes combined is approximately 2.8 million m^3 per year, primarily low level or very low level waste. These wastes are managed in a variety of storage and disposal facilities. Storage and disposal of low level radioactive waste is a well established practice worldwide. Storage of spent nuclear fuel and high level waste is also a well established practice. Disposal of spent nuclear fuel and high level waste, while at a mature stage of conceptual development, remains to be implemented. Licensing of geological disposal was identified as a new venture with its own unique challenges. The countries currently moving towards the licensing of geological disposal facilities and some others with less advanced programmes have come to a collective realization of the potential benefits of having an internationally harmonized approach to the licensing process to facilitate public acceptance.

26. During the third review meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management in May 2009 in Vienna, all Contracting Parties present recognized that safety of spent fuel and radioactive waste management is a crucial and difficult topic, and that there are considerable areas for improvement. Despite a large diversity of national situations, all Contracting Parties present shared the view that progress has been made both in building and maintaining legislative and regulatory frameworks and in practical implementation. Moreover, in recognition of the countries that are considering launching a national nuclear power programme, the review meeting participants strongly recommended that the safety of spent fuel and radioactive waste management be taken into account from the very beginning of such considerations. It is still the case today that almost all Member States use radioactive materials, yet less than one third are contracting parties to the Joint Convention. The international nuclear community needs to continue its efforts to promote increased participation in the Joint Convention and to strengthen the linkages between the Joint Convention and safety standards and codes of conduct so that they are all applied in a strategic and synergistic manner.

B.3. Capacity building

B.3.1. Introduction

27. The international nuclear community has continued its focus on capacity building for sustainable nuclear safety. Capacity building in this sense is much broader than traditional education and training. It includes human resource development to equip individuals with the knowledge, skills and access to information that enables them to perform effectively; organizational development to implement effective management structures, processes and procedures, not only within organizations but also between the different organizations and sectors; and institutional and legal framework development to establish legal, regulatory and administrative systems that enable organizations and institutions at all levels and in all sectors to maintain and enhance their capacities.

28. The availability, retention and continuous improvement of qualified personnel are building blocks for organizational, institutional and national capacity. They are vital to the development of an adequate and sustainable nuclear safety infrastructure. For this reason, it remains a top priority for the international nuclear community to develop the skills, knowledge and expertise of individuals across many disciplines, such as scientists, radiation and nuclear technology experts, legislators, regulators, administrators, and emergency response personnel. Strengthening human, managerial and technological capabilities worldwide will further enable the development of sustainable institutional and national capacities. While this is a key issue for countries embarking on nuclear power for the first time, it also remains a major challenge for experienced nuclear power countries to maintain and continuously improve their own capacities.

29. It is very important to pay careful attention to the overall capacity of relevant organizations and national infrastructures. The results of education and training for organizational capacity and performance can differ significantly. Organizations need to be mindful that even the best people require continuous learning and updating of their expertise and, moreover, they tend to be recruited by outside entities for better conditions in the competitive market.

B.3.2. Education and training

30. With the increasing interest in nuclear programmes, international efforts are needed to help ensure that qualified expertise is available for the regulation and operation of nuclear and radiation activities and facilities. In addition, the advancing nuclear and radiation technologies as well as the wider use of such technologies has also resulted in the need to train and maintain adequate staffing and competence levels to ensure the safety and security of these applications.

31. The establishment of strong education and training programmes to maintain qualified experts and further develop skills and competence is needed to ensure that the necessary experience levels are commensurate with the pace of development and expansion of nuclear programmes. Efforts are needed at the national, regional and international levels. In particular, it is vitally important that Member States establish and maintain self-reliant education and training programmes rather than continuously outsourcing these activities. While human resources development including education and training is a vital and primary function of Member States, the Agency has been playing an important role in supporting them to establish and maintain competent and sustainable human resources required for the safe, secure and peaceful use of atomic energy. It is therefore important to further strengthen cooperation in this area using bilateral, regional and international activities, particularly through knowledge networking.

B.4. Strengthening of global and regional networking activities

B.4.1. Introduction

32. Knowledge networks, when adequately developed and utilized, are highly effective mechanisms for the sharing, management and creation of nuclear safety and security knowledge. For this reason, knowledge networks and the associated community of global experts are key components of the global nuclear safety and security regime. Global and regional knowledge networks, such as the International Regulatory Network (RegNet), Response Assistance Network (RANET), the Asian Nuclear Safety Network (ANSN), the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies and the recently established Forum of Nuclear Regulatory Bodies in Africa (FNRBA) are being increasingly used by Member States. Continuous improvement of such networks through more use, more interaction and more feedback should be further promoted for maintaining high level of safety and capacity. The Global Nuclear Safety and Security Network (GNSSN) is currently being developed by the Agency as the global network to more effectively support regional and thematic networks and the national capacity building of Member States on a global scale.

B.4.2. Global and regional networking

33. The GNSSN is being developed as the set of existing networks and information resources to ensure that critical knowledge, experience, and lessons learned about nuclear safety and security are exchanged as broadly as they need to be. It is designed based on the structure of the Agency's safety standards and security guidance.

34. A prototype of RegNet has been established. RegNet will be considered as a human network for technical experts from the international nuclear regulatory community. Furthermore, RegNet will provide a flexible means for exchange and cooperation between regulators. Under RegNet, several thematic elements are being developed including elements for Integrated Regulatory Review Service (IRRS) activities, country nuclear regulatory profiles, and generic safety issues.

35. In 2009, the ANSN developed a vision for the ANSN by the year 2020. In particular, the ANSN is aiming to develop the three pillars of its regional capacity building system, which will include a virtual centre for regional education and training, a pool of qualified experts, and a virtual technical support organization to provide technical advisory service for new and creative knowledge. ANSN countries have been actively working for the improvement of organizational and institutional infrastructure for nuclear safety to address the challenges in their capacity building, including human resource development. The third annual meeting of the ANSN Nuclear Safety Strategy Dialogue will be held in April 2010 in Indonesia.

36. From 22 to 26 June 2009, the meetings of the committee and the plenary of the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies were conducted. The Forum's plenary agreed to cooperate with the Agency in high level seminars to share policies, strategies and lessons learned in order to improve the regulatory efficiency in the Ibero-American region. It also agreed to provide expertise and assistance toward capacity building in the other countries in the region and is ready to discuss ways of interaction with other networks to obtain the maximal mutual benefit.

37. From 23 to 27 March 2009, the leadership of nuclear regulatory bodies in the continent of Africa met in Pretoria, South Africa, to launch the FNRBA. The Meeting was organized by the Agency in cooperation with the Government of South Africa. The purpose of FNRBA is to provide for the enhancement, strengthening and harmonization of radiation protection, and nuclear safety and security regulatory infrastructure and frameworks among the members of FNRBA and to provide mechanisms

for the FNRBA for the exchange of regulatory experiences and practices among the nuclear regulatory bodies in Africa.

B.4.3. European Union directive for a framework on nuclear safety

38. The European Union (EU) broke new ground in setting up a common legal framework for nuclear safety based on the Agency's main safety standards for nuclear installations and obligations under the Convention on Nuclear Safety. The EU is the first major regional body to adopt a binding legal framework on nuclear safety and the pioneering action is considered an important step that will help to strengthen cooperative safety efforts worldwide.

39. The Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations provides binding legal force to the main international nuclear safety standards, namely the *Fundamental Safety Principles* established by the Agency and the obligations resulting from the Convention on Nuclear Safety, including a regular peer review process. The Directive also reinforces the independence and resources of the national competent regulatory authorities.

40. The Directive of the EU which applies Agency safety standards to nuclear installations states that member States shall arrange for periodic self-assessments of their national framework and competent regulatory authorities at least every ten years and invite an international peer review of relevant segments of their national framework and/or authorities with the aim of continuously improving nuclear safety.

C. Incident and emergency preparedness and response

C.1. Trends, issues and challenges

41. The ability to adequately respond to a nuclear or radiological emergency remains a central element of international nuclear safety. Member States are working with the Secretariat to improve local, national, regional and international preparedness. However, many States do not meet international safety requirements for emergency preparedness and response. Although further capacity building efforts in this area are required, experience shows that countries, which were involved in a response coordinated by the Agency's Incident and Emergency Centre (IEC), improved their emergency response capabilities in a sustainable manner. Subsequent events were reported in a more timely manner and the response was conducted independently and successfully. If the events required international assistance, these countries knew well the procedures to activate an international response.

42. In 2009, many Member States worked to improve the legislative and regulatory underpinnings of their emergency systems, and tested their preparedness through exercises based on a wide range of scenarios. In 2009, ten Member States informed the Agency that they had carried out, and/or invited the Agency to observe national exercises intended to determine the strengths of their response systems areas in need of improvement.

43. The Agency is informed of nuclear and radiation related incidents and emergencies around the world through its different official reporting channels and by monitoring news media. During 2009, the Agency was informed or became aware of 211 events involving or suspected to involve ionizing radiation. In the majority of these events it was determined that no Agency action was required. In 22

events the Agency took action, such as authenticating and verifying information with national competent authorities, exchanging official information or offering the Agency's services.

C.2. International activities

44. By the end of 2009, 16 Member States had registered a number of assistance capabilities with the Agency's Response Assistance Network (RANET). While this is an improvement over last year, RANET requires greater commitment by Member States in order to fully function as an effective and reliable assistance tool. Certain capabilities are yet to be registered (see Figure 2).

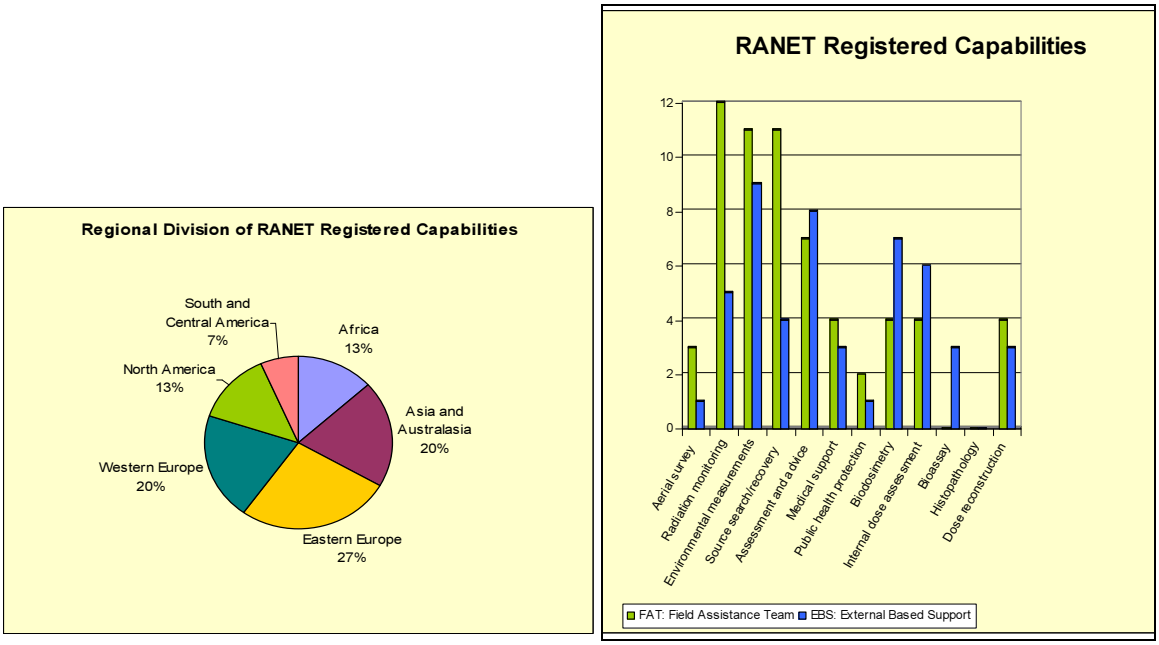

Figure 2: RANET registered capabilities by region and RANET registered capabilities

45. The ShipEx-1 (2009) exercise tested current capabilities for the safe and expeditious international transport of samples subjected to biological dosimetry assessment. This exercise was also a good test of RANET and international assistance cooperation, and the conclusions drawn in the exercise will contribute to the enhancement of the capability to properly ship biological samples in a timely manner in international assistance missions.

46. In response to a request by the Agency's General Conference for a review of the mechanisms for reporting incidents and emergencies, the Secretariat is developing a unified reporting system that will replace the Agency's current Early Notification and Assistance Conventions Website (ENAC) and the Nuclear Events Web-based System (NEWS). A preview version of the system was made available for test use by contact points at national authorities in 2009. The system is foreseen to be launched in 2010.

47. The Competent Authorities identified under the Convention on Early Notification of a Nuclear Accident (Early Notification Convention) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention) met in Vienna from 7 to 10 July 2009. During the meeting, the Competent Authorities developed a mandate and methods of work for formal ongoing Competent Authorities meetings.

48. In addressing Member States' needs, the Agency initiated the development of generic procedures for response to emergencies at research reactors (threat categories II and III). The generic procedures are separated into a set for low power research reactors — those which do not present a risk to the population beyond the reactor site — and a second set of procedures for higher power level research

reactors, which can affect the population beyond the site boundary. A workshop with participants from nine Member States with low power research reactors was organized in order to obtain feedback on the draft procedures, which are planned to be published in 2010.

D. Civil liability for nuclear damage

D.1. Trends, issues and challenges

49. The importance of having effective civil liability mechanisms in place to insure against harm to human health and the environment as well as actual economic loss caused by nuclear damage, continues to be the subject of increased attention among States, especially in light of the renewed interest in nuclear power around the world.

50. The International Expert Group on Nuclear Liability (INLEX), established by the Director General in 2003, continues to serve as the Agency's main forum dealing with questions related to nuclear liability and aims at contributing towards a better understanding of, and adherence to, the international nuclear liability instruments.

51. The Agency continued its efforts to promote adherence to the various applicable international legal instruments adopted under the auspices of the Agency, in particular with respect to the Convention on Supplementary Compensation for Nuclear Damage (CSC). In this connection, the Director General sent letters to all Member States encouraging their respective governments "to give due consideration to adhering to the CSC and thus contributing towards strengthening the global nuclear liability regime."

D.2. International activities

52. INLEX held its 9th meeting from 24 to 26 June 2009 at Agency Headquarters in Vienna. Major topics discussed included the status of ratification of the international nuclear liability conventions, the European Commission impact assessment on the Convention on Third Party Liability in the Field of Nuclear Energy (Paris Convention), proposals by Germany to allow contracting parties to exclude certain small research reactors and nuclear installations being decommissioned from the scope of application of the Vienna Convention on Civil Liability for Nuclear Damage (and possibly also the CSC), and future INLEX outreach activities.

53. Regarding the status of ratification of the international nuclear liability conventions, the INLEX members reaffirmed their support for working towards establishing a global nuclear liability regime and in that connection provided some insight on the latest efforts made at the national level towards reaching this objective.

54. With respect to the European Commission impact assessment, INLEX noted that it had been reclassified by the European Commission as a 'legal study' with no anticipated proposals for legislative action. INLEX recalled the concerns it had expressed during last year's session about the various options considered by the European Commission, especially the concern that Euratom may act in a way which may impair treaty relations between EU and non-EU States. INLEX encouraged the European Commission to continue to look at all the possible avenues available, including those that

would contribute to strengthening the global nuclear liability regime including the CSC or the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention.

55. With respect to the proposals by Germany, INLEX took note of the fact that on 6 June 2009 the German delegation submitted to the Secretariat a further explanatory note in support of its proposals. The note elaborated on the technical background of the proposals and was forwarded as in the past to the competent Agency Safety Standards Committees (the Radiation Safety Standards Committee and the Waste Safety Standards Committee) for their technical assessment, prior to their consideration by INLEX.

56. On the Group's outreach activities, INLEX took note of the preparations which were under way for organizing the fourth workshop on liability for nuclear damage for countries that have expressed an interest in embarking on a nuclear power programme, held from 9 to 11 December 2009 in Abu Dhabi, United Arab Emirates. In addition, INLEX discussed further outreach activities and suggested that the fifth workshop be held in the Russian Federation in 2010 for countries in Eastern Europe and Central Asia.

E. Nuclear power plant safety

E.1. Trends, issues and challenges

57. Nuclear power plant safety performance has remained at a high level. Performance indicator information collated by the World Association of Nuclear Operators (WANO) shows that the number of unplanned automatic scrams in 2008 was 0.5 per 7000 hours critical (Figure 3). This has been fairly consistent since 2000 after a substantial decrease from a value of 1.8 in 1990. Similar trends exist for the other measured indicators including unit capability factor, collective radiation exposure and safety system performance.

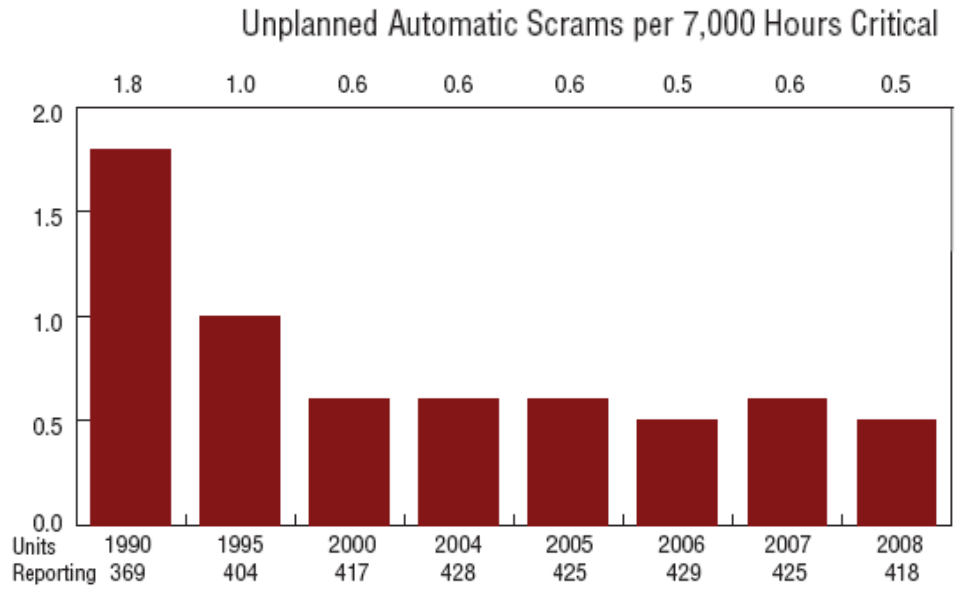

Figure 3: Unplanned automatic scrams per 7000 hours critical (source: 2008 Performance Indicators World Association of Nuclear Operators)

58. Many countries have expressed a desire to consider establishing nuclear power programmes or reviving dormant programmes. This has led to requests for the Agency to provide clear and practical guidance for the establishment of nuclear power programmes. The international community also recognizes that a considerable period of time is necessary to acquire the required competences and to develop an appropriate safety culture that will assure and sustain a safe nuclear power programme. In order to further meet Member State requests and needs, the Agency has developed a draft Safety Guide, DS424, *Establishing a Safety Infrastructure for a National Nuclear Power Programme*, to provide guidance on the implementation of safety elements necessary to develop a safe, sustainable nuclear programme infrastructure. The guide consists of a proposed 'road map' of safety related actions from the existing suite of safety standards, including the phase of development in which the actions should be implemented to achieve maximum benefit for establishing a strong nuclear programme that focuses on safety.

59. With the resurgence of interest in building new nuclear power plants, ways of reducing the period before operation are being sought. Regulators are reviewing their own part in this process. For example, some countries are undertaking generic assessments of designs so that only site specific aspects will need to be addressed later when a request to construct is made. The challenge facing regulatory bodies is to streamline this process whilst maintaining the necessary regulatory rigour and safety judgement capacity.

60. Long term operation (LTO) and ageing management are important issues in many nuclear power plants. As of the end of 2009, of the 437 nuclear power plants operating in the world, 127 had been in operation for more than 30 years, and 338 for more than 20 years. The number of NPPs that are eligible for an extension of their operating life is growing and hence the LTO issue is becoming very important and deserves to be systematically addressed and integrated in all aspects relevant to safety.

61. A full and comprehensive plant-specific safety assessment, systematically conducted on a periodic basis, is one of the key elements for ensuring the fulfilment of the required safety functions throughout the period of LTO. The development and implementation of modern safety assessment tools are essential for conducting such assessments. In connection with this there are challenges related to the establishment of comprehensive ageing management programmes which need to be in place to ensure the fulfilment of the safety functions of all the systems and components which face ageing effects and degradation processes including obsolescence. In addition, the plant-specific safety analyses, for which time-limited assumptions were included in the original design calculations, need to be revalidated with respect to LTO. Therefore, it is important to provide the nuclear industry and regulatory authorities with guidance on recommended proactive plant ageing management programmes. Such information may be used as a source for the development of a harmonized approach to addressing the various degradation mechanisms through the application of recognized ageing management programmes as well as the establishment of consolidated international knowledge in this important area.

62. Operational Safety Review Team (OSART) missions carried out in 2009 found high quality programmes in most of the plants and utilities visited showing that their management is deeply committed to improving operational safety. However, the actual implementation and control of these programmes at the lowest organizational level remains problematic. Even though managers at every level are well motivated and trained to communicate goals and objectives, some managers are not always well understood by their staff, which results in wrong behaviour and poor performance in some areas. This issue is particularly critical at a time when many utilities face a major renewal of their staff owing to new nuclear plant construction programmes and the retirement of the current staff.

63. In 2009, NPP operators continued to show strong nuclear safety performance with no serious accidents or significant radiation exposure to workers or the public. Most utilities have effective operating experience programmes in place, which in some cases include analysis and learning from low level events and near misses. However, the sharing of operating experience information between Member States, and the use of that information is more limited. Some Member States share and use event information in the Incident Reporting System. However, in many Member States lessons learned from information about significant events are not being shared and the use of external information is weak. In addition, low level events and near misses are not generally shared amongst Member States.

64. There is general international agreement, as reflected in various Agency safety standards for nuclear reactor design and operation, that both deterministic and probabilistic analyses provide insights, perspectives, understanding, and balance to nuclear reactor safety. The scope of applications for the integration of these approaches continues to increase. Such applications support design, construction, safety assessment, licensing, operation, and regulatory oversight. There is increasing interest in using a structured framework for optimal decision making, which takes into account deterministic and probabilistic techniques and findings. International coordination efforts are underway to establish good practices on the balance between deterministic approaches, probabilistic safety analysis (PSA), and other factors, in an integrated decision making process for ensuring nuclear reactor safety.

65. During recent years, a number of severe natural events, such as earthquakes and tsunamis, have affected various part of the world. Lessons learned from such events continue to be analysed in order to better understand the issues and concerns related to the evaluation of such external hazards and the associated margins in the design of nuclear installations. The results will be included in the Safety Guides and reports under development on seismic, volcanic, and meteorological and hydrological hazards assessment. In addition, these events emphasized the importance of procedures for the actions that need to be performed after the occurrence of an earthquake on the site of an operating nuclear power plant.

E.2. International activities

66. The 1st Extraordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety (CNS) took place on 28 September 2009 to approve the revision of the Guidelines regarding National Reports under the CNS, and endorse a brochure introducing the CNS as well as its associated Rules of Procedure and Guidelines prepared by the Secretariat for outreach purposes.

67. The 5th Organizational Meeting of the Contracting Parties to the CNS took place on 29 September 2009. The purpose of the meeting was to prepare for the 5th Review Meeting, scheduled to be held from 4 to 14 April 2011. Meeting participants included 46 Contracting Parties. The CNS now has 66 Contracting Parties and 13 Signatory States that did not yet bring the CNS into force. Four countries, namely Jordan, Senegal, the United Arab Emirates and the Libyan Arab Jamahiriya became full Contracting Parties to the CNS in 2009.

68. Since its launch in 2008, many Member States and institutions have begun to participate in the activities of the International Seismic Safety Centre (ISSC) to address the various issues associated with severe natural events. In the framework of the Agency's extra budgetary programme on seismic safety covering 45 institutions in 21 Member States, working groups tackled important issues such as seismic hazard evaluation, benchmark exercises, post earthquake actions and database development. Training courses were organized in Latin America and Africa to share the results of recent activities and findings.

F. Research reactor safety

F.1. Trends, issues and challenges

69. Research reactors around the world continued to be operated safely in 2009 and there were no serious incidents. There remains a need for improving ageing management programmes and ensuring availability of well-trained and competent staff for both operating organizations and regulatory bodies in many Member States, improving operational radiological safety and emergency preparedness, and developing decommissioning plans for many research reactors. Many facilities worldwide are still in 'extended shutdown' with no clear plans for their future utilization or decommissioning. Adequate management of the safety of these facilities, including a lack of financial resources, continues to be an important issue. Several Member States are planning their first research reactor as a tool to develop the necessary national technical and safety infrastructures for embarking on a nuclear power programme. The Agency is addressing this issue and is continuing to respond to the relevant requests from Member States.

70. The current shortage of supply of medical radioisotopes, in particular molybdenum-99, is mainly due to the limited number (five) and ageing of major radioisotope-producing research reactors. The urgent need for producing medical radioisotopes may create a dilemma between meeting reactor safety requirements and meeting societal needs for public health care. This concern highlights the need to establish criteria to achieve balanced considerations for social political, economical and regulatory challenges without compromising safety.

71. The use of existing reactors for the production of molybdenum-99 on a regional basis is a mid-term solution to help smoothly manage any unexpected shutdown of major producing reactors. This requires special attention to be given to the development of the necessary human resources, including the technical and safety capacities, and harmonization of regulatory requirements and licensing processes. All these issues were addressed during a panel briefing and discussion organized by the Agency in the margin of the 53rd session of the General Conference in September 2009, with the participation of 76 delegates from 34 Member States.

F.2. International activities

72. From 2 to 5 June 2009, the Agency held a meeting on the safety of research reactors under project and supply agreements, with the participation of delegates from 17 Member States. The meeting recommended that Member States with research reactors under project and supply agreements should join the Agency's follow-up system for these reactors, in particular to continue the use of safety performance indicator (SPIs), apply the Code of Conduct on the Safety of Research Reactors, apply the IAEA Safety Standards and make use of the Agency's safety review services in accordance with INFCIRC/18/Rev.1, "The Agency's Safety Standards and Measures".

73. From 5 to 9 October 2009, the Agency held a technical meeting on research reactor ageing management, modernization and refurbishment with the participation of 56 delegates from 33 Member States representing operating organizations, regulatory bodies and research reactor suppliers. The meeting identified the current issues and challenges related to ageing, modernization and refurbishment of research reactors and provided recommendations to address them based on the Agency's safety standards.

74. From 16 to 20 November 2009, the Agency held a technical meeting in Petten, Netherlands, on the Incident Reporting System for Research Reactors (IRSRR) with the participation of the national

and local coordinators of 35 Member States. The meeting helped the sharing of operating experience feedback, and ensured that events reported to the IRSRR were properly analysed and the lessons learned from them disseminated to research reactor operators and regulators. The IRSRR was adapted to and integrated in the common platform of the Incident Reporting System (IRS) and the Fuel Incident Notification and Analysis System (FINAS) in November 2009.

75. In relation to the safety issues associated with the production of medical radioisotopes, an international safety review mission was carried out by the Agency to the High Flux Reactor (HFR) in the Netherlands, to provide a peer review on the observed degradation of the primary coolant system. Another safety review mission was conducted to the ETRR-2 reactor in Egypt to review safety aspects of the planned molybdenum-99 production programme.

G. Fuel cycle facility safety

G.1. Trends, issues and challenges

76. Fuel cycle facilities cover a wide diversity of installations, including conversion, enrichment, fuel fabrication, spent fuel storage (including long term storage), reprocessing and associated waste management facilities. These facilities present varying degrees of hazard and the graded approach should be used in applying the safety requirements. Some of the fuel cycle facilities present specific nuclear safety challenges such as criticality control, chemical hazards, and susceptibility to fires and explosions. In addition, many fuel cycle facilities rely heavily on operator intervention and administrative controls to ensure nuclear safety. Events reported to the Fuel Incident Notification and Analysis System (FINAS) indicate that the main root causes of these events are related to organizational and human factors.

77. Improving operational safety through the dissemination of operating experience and good practices, including the reporting of safety related events, their causes and lessons learned, continues to be a challenge. The use by Member States of the Agency's peer review service, Safety Evaluation of Fuel Cycle Facilities During Operation (SEDO), and FINAS remains limited and the Agency will continue to promote the benefits of these services. To support these services the set of Safety Guides to cover all types of fuel cycle facilities needs to be completed.

G.2. International activities

78. The IAEA and the OECD/NEA held a joint meeting of FINAS national coordinators from 7 to 9 October 2009 with 24 participants from 12 countries. The meeting exchanged information on safety related events at fuel cycle facilities and reviewed the causes and lessons learned from the events. The meeting identified that poor safety culture and reliance on manual actions were significant contributing factors to the majority of events. The national coordinators acknowledged the importance of FINAS as the unique international reporting system for fuel cycle facilities and committed to increasing its use.

79. The IAEA held a meeting on the storage of spent fuel from research reactors from 19 to 23 October 2009 with operators and managers of research reactors from 19 countries. The participants reviewed their practices and plans for the management of research reactor spent fuel. The information exchanged at the meeting will be used to develop an IAEA publication to be used by the research reactor community as a guide of good practices for interim storage of research reactor spent fuel.

H. Occupational radiation exposure

H.1. Trends, issues and challenges

80. According to the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the total annual collective dose due to occupational radiation exposure continues to increase.

81. At present, the most significant radiation exposures involve workers handling radioisotopes for non-destructive assays. These overexposures often occur in isolated locations where radiation safety supervision is limited, where safety training is inadequate and where radiation protection programmes and procedures are not well developed. Most nuclear installations have some procedure for reporting and learning from operational experiences, and incidents and accidents. However, industrial radiography workers do not have this feedback resource.

82. More than half of all radiation exposed workers are now in the medical field, and this ratio will increase over the next few years. New challenges in occupational radiation protection of medical workers have appeared due to new medical imaging techniques. These new uses of ionizing radiation improve patient care; but they also create new situations for which new radiation protection techniques have to be planned and implemented. The proper training of medical professionals and the continued use of tools and techniques for radiation protection will continue to ensure occupational radiation safety for medical staff

83. Occupational radiation protection is, however, well managed in most nuclear installations around the world. Furthermore, in 2009, only a very low percentage of workers in these installations received effective doses above the limits established by the respective regulatory authority. Figure 4 shows the trends for total annual collective dose received by nuclear power plant (NPP) workers.

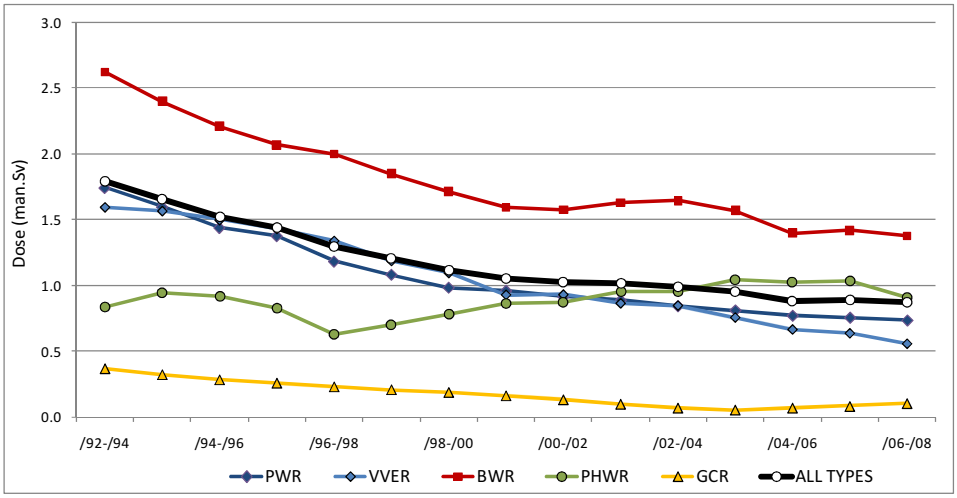

Figure 4: Three-year rolling average collective dose by reactor type for all operating reactors in the Information System on Occupational Exposure (ISOE), 1992–2008 (man·Sv) [pressurized water reactor (PWR); boiling water reactor (BWR); water cooled water moderated power reactor (VVER); pressurized heavy water reactor (PHWR); gas cooled reactor (GCR); light water cooled graphite moderated reactor (LWGR)] Reference: ISOE Occupational Exposure Database 2009, (co-sponsored by the OECD/NEA and IAEA)

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H.2. International activities

84. The 2009 Information System on Occupational Exposure (ISOE) International ALARA Symposium was held in October in Vienna. The Symposium brought together a total of 110 participants from 27 countries to discuss the optimization of occupational radiation protection in nuclear power plants. Also discussed were the processes necessary to ensure that Member States which are considering nuclear power plant programmes for the first time can benefit from the many reactor-years of experience and good practices in occupational radiation protection that have been accumulated by reactor operators all over the world.

85. Existing collaboration with international organizations, such as with the International Labour Organization (ILO) for the Action Plan for Occupational Radiation Protection, or with the OECD/NEA on the joint secretariat for the ISOE, is being maintained in order to improve the harmonized implementation of the Agency's safety standards.

I. Medical radiation exposure

I.1. Trends, issues and challenges

86. The world's annual per capita effective dose is increasing rapidly, nearly exclusively due to increasing medical exposure, to the extent where it is now equal to or exceeding that from natural background in some countries (see Figure 5). Contrary to other exposures to ionizing radiation, such as occupational exposure in nuclear installations, which have remained constant or have decreased over the past decades, medical exposures have increased at a high rate. While much of this increase reflects positive issues, e.g. improved access to medical procedures using ionizing radiation, there is evidence that many diagnostic imaging procedures are unnecessary and many procedures are lacking in optimization.

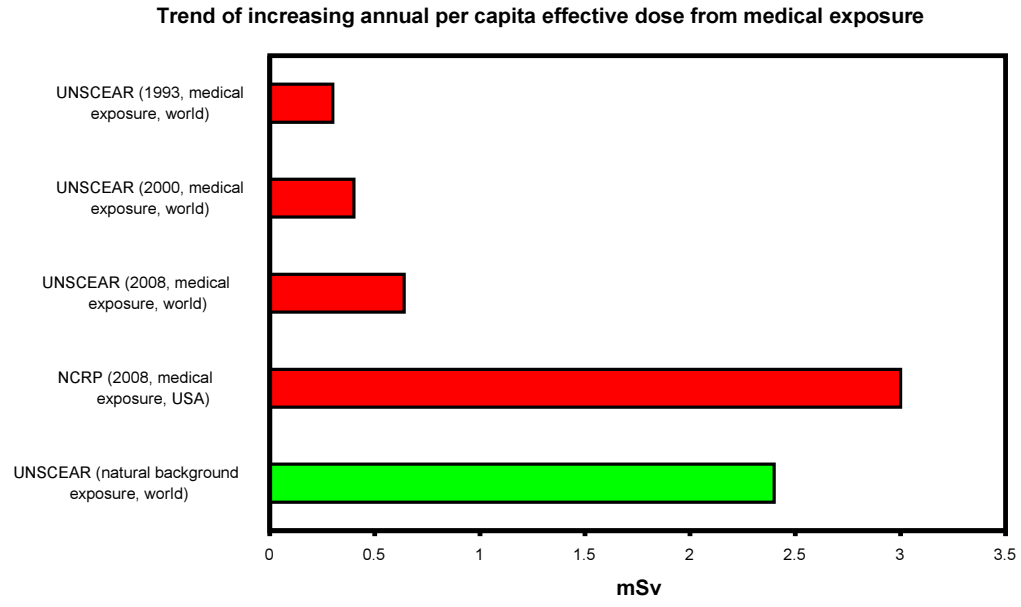

Figure 5: Global annual per capita effective dose from medical exposure, as reported in different years, compared with the same in USA, as well as the global annual per capita effective dose from natural background.

87. Surveys have shown that there is a significant and systemic practice of inappropriate examination in radiology, leading to unnecessary exposures of many patients (ranging from 20% to 50% in local and multi-centre surveys), highlighting the absolute necessity for improvements in justification of medical exposure of individuals.

88. Medical technology using ionizing radiation is continuing to evolve rapidly, with new technology and techniques being introduced at a fast rate. This technology is now also increasingly reaching developing countries with less developed infrastructure. The worldwide annual sales of computed tomography (CT) scanners have more than doubled since 1998 and are predicted to continue to increase at the same pace. CT scanners now account for a very substantial fraction of dose to patients. Recent surveys in large medical centres have found that CT examinations now often account for 25% of all examinations and 60% to 70% of the patient dose received from diagnostic radiology. The number of CT installations, the frequency and type of CT examinations, and the dose per examination are all increasing throughout the world. Moreover, patient surveys reveal a wide range of patient doses for the same examination, highlighting the continued necessity for improvements in optimization of medical exposure.

89. Increasing numbers of procedures are being performed using X-rays to guide interventions in the body, and many of these procedures are performed to replace surgical interventions. Considerable patient exposure can occur in some of these procedures with potential for deterministic injuries, and recent surveys show an elevated risk for deterministic injuries in staff performing such procedures. As a result, further optimization of radiation protection of patients and workers in this modality is increasingly urgent.

I.2. International activities

90. The International Workshop on Justification of Medical Exposure in Diagnostic Imaging, hosted by the European Commission in partnership with the Agency, was held in Brussels, Belgium, from 2 to 4 September 2009. Effective communication about risk, up-to-date referral guidelines, and clinical audit of justification were seen as tools likely to facilitate and enhance justification.

91. The International Symposium on Non-Medical Imaging Exposures was held from 8 to 9 October 2009 in Dublin, Ireland. This symposium, hosted by the European Commission with the participation of the Agency, aimed to review the ongoing situation in human imaging for non-medical purposes, focusing on the ethical, legal, social and technical problems encountered with these practices, in order to provide a starting point for the development of guidance and advice. The differences in approach seen worldwide in this emerging topic indicate the necessity for close international collaboration.

92. In December 2009, the French Nuclear Safety Authority (ASN), in cooperation with the Agency, WHO, the EC and 18 other international and national organizations, organized in Versailles the International Conference on Modern Radiotherapy: Advances and Challenges in Radiation Protection of Patients. Among the conclusions of the conference, it was noted that the lessons learned from accidents in conventional radiotherapy are still valid for newer radiotherapy technologies, and that they should be incorporated into national training programmes and taken into account for procedures in radiotherapy departments. There are, however, new risks with new technologies that should be considered. In order to have a proactive approach to preventing accidents before they occur, proactive methods of safety assessment should be used in radiotherapy, providing a risk-informed and rational choice of safety provisions.

J. Radiation protection of the public and the environment

J.1. Natural radioactivity

J.1.1. Trends, issues and challenges

93. There is an increasing awareness of the importance of natural radioactivity as a contributor to the global collective dose. The most recent estimate provided by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) indicates that natural radiation sources contribute 2.4 mSv to a total per capita annual dose of 3.0 mSv. Of this, approximately 1.2 mSv (40% of the total) is attributable to exposure to radon. Not only is radon the major contributor to the collective dose in many countries, it is also one of the few sources of exposure that is amenable to control. While exposure to radon in underground workplaces such as mines has been regulated for many decades, the need to control radon exposure in homes and above-ground workplaces such as offices and commercial outlets is now receiving increasing attention in Member States.

94. Two recent developments in particular have raised public awareness of radon as both a radiation protection and a public health issue. The first is the direct evidence from epidemiological studies showing the increased risk of lung cancer following exposure in the home. While the findings are broadly in line with existing data from miners and others exposed occupationally, attention has been focused on the fact that there is evidence of an increased risk down to concentrations of the order of 150 Bq/m^3, lower than the reference level applied in many countries. The second issue is the strong synergistic relationship between exposure to radon and smoking.

J.1.2. International activities

95. In December 2009, the Agency hosted an international seminar at its Headquarters in Vienna to consider the most recent scientific information on the health risks associated with long term exposure to radon. Over 80 technical experts and policy makers from around the world gathered to hear presentations from UNSCEAR, the International Commission on Radiological Protection (ICRP) and the World Health Organization (WHO). The outcome of the meeting will be taken into account in the revision of the *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources* (Basic Safety Standards), IAEA Safety Series No. 115.

96. Over the next year, the Agency will be developing a programme to inform and assist Member States that wish to develop national programmes to reduce radon exposure in the home. This will be in addition to existing work in relation to both occupational and public exposure. As part of this initiative the Agency will be seeking to maximize cooperation with international organizations with expertise and responsibilities in this field.

J.2. Exposure from releases of radioactive substances

J.2.1. Trends, issues and challenges

97. The practical experience of Member States in the optimization of radioactive discharges resulting from the normal operation of activities and facilities and the setting of authorized limits on discharges to the environment by the regulatory body differs from guidance offered by the Agency's safety standards. Recognizing this, the Secretariat has prepared an IAEA-TECDOC entitled *Setting Authorized Limits for Radioactive Discharges: Practical Issues to Consider, Report for Discussion*. This publication will be used for consultations within Member Sates, as a preparatory step pending the

current process of revision of the Basic Safety Standards issued in 1996 and the subsequent revision of related Safety Guides.

98. The ICRP publication *Environmental Protection: the Concept and Use of Reference Animals and Plants*, issued in 2009, gives new recommendations on issues related to the protection of the environment. It offers a detailed description of a reference approach to estimate exposures to reference animals and plants, and to relate exposures to effects. It also provides initial guidelines related to radiological environmental impact assessments. Further discussion is needed to find a consensus on whether and how to implement radiological environmental impact assessments in the framework of radiation protection to be consistent with the principles of justification, optimization and limitation for the protection.

J.2.2. International activities

99. The Agency's Environmental Modelling for Radiation Safety Programme, EMRAS II, was launched at its first technical meeting, which was held at the Agency's Headquarters in Vienna in January 2009. EMRAS II continues some of the work of previous international exercises and focuses on improving environmental transfer models for reducing associated uncertainties, and developing new approaches to strengthen the evaluation of the radiological impact to man, as well as to flora and fauna, arising from radionuclides in the environment. This programme will last three years until 2011.

100. The International Chernobyl Research and Information Network (ICRIN) project was launched in April 2009. It is part of the IAEA, UNDP, UNICEF and WHO coordinated activities under the framework of the UN Action Plan on Chernobyl to 2016, which was set up during the 62nd UN General Assembly. Two joint IAEA/ICRIN regional workshops on dissemination of Chernobyl-related information were organized in Moscow and Kiev. Furthermore, a workshop was held in cooperation with UNDP, UNICEF and WHO in Kiev for initiating and improving the dialogue of scientists with journalists in order to ensure the provision of unbiased and objective information to the public.

101. The 31st Consultative Meeting of the Contracting Parties to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (the London Convention) was held in London in October 2009. At this meeting, the Agency presented a report on progress at the international level on a more comprehensive system for the protection of the environment, including humans and other species, following international trends in this area and in line with the Agency's Plan of Activities on the Radiation Protection of the Environment. The Agency also presented a proposal for a radiological assessment procedure based on the current level of scientific knowledge which considers human and non-human species in a consistent manner.

J.3. Exemption and clearance

J.3.1. Trends, issues and challenges

102. Material recycling and reuse is a sustainable practice and is recognized by the nuclear safety fundamental principles. In this field, metal recycling has become an important industrial activity in all Member States. However, material coming from the nuclear industry needs to be cleared from regulatory control before being reused in conventional industry. In addition, radioactive material may inadvertently become mixed with scrap metal, potentially causing health, economic and public acceptance problems. There are also increasing problems with the use of the terms "exemption" and "clearance", which are often used interchangeably. Terms such as "special clearance", "conditional clearance" and "unconditional clearance", and "authorized release" are also being used. While some of

these problems are historical in origin others are due to a lack of rigour. The problem is also evident in international documents which might be expected to be setting an example in this context.

103. There are, however, different views as to how strict regulatory enforcement should be. In particular, clearance of metals will not succeed on a large scale if the concerns of the metal industry for a final product being acceptable by the public as non-radioactive are not resolved, especially in view of the recent problems with import of metals. These problems call for an international solution, part of which would be the use of the general clearance levels as default values for international trade. Clearance is now generally implemented and large volumes of building rubble have been cleared and disposed of in conventional disposal facilities. In several Member States, the nuclear industry is using the clearance concept to determine which materials can be released from regulatory control for recycling. To date, most of the released metals have been used in controlled applications or returned for reuse within the nuclear industry. There is however no evidence of a general introduction of these materials into the scrap metal market, only of ad-hoc arrangements.

J.3.2. International activities

104. The Spanish Nuclear Safety Council (CSN), in cooperation with the Agency, organized the International Conference on Control and Management of Inadvertent Radioactive Material in Scrap Metal, which was held in Tarragona, Spain, from 23 to 27 February 2009. The participants of the conference were unanimous in recognizing the potential benefit of establishing some form of binding international agreement between governments to unify the approach to trans-border issues concerning metal scrap containing radioactive material. Certain existing international instruments, for example, the Regulations for the Safe Transport of Radioactive Material, could address some of the trans-border issues. Many of the topics raised by conference participants in this context have been addressed in the recommendations issued by the United Nations Economic Commission for Europe and they could, therefore, be one of the starting points for deliberations. The conference also found that the Spanish Protocol for Collaboration on the Radiation Monitoring of Metallic Materials provided a model for national arrangements allocating responsibilities in cases where a source contained in scrap metal, or contaminated material, was discovered.

105. The Sixth International Symposium on Release of Radioactive Materials from Regulatory Requirements — Provisions for Exemption and Clearance was held from 21 to 23 September 2009, in Wiesbaden, Germany. The symposium was organized by TÜV NORD SysTec, Germany, with the support of the Agency, the European Commission, the OECD/NEA and the German–Swiss Radiation Protection Association. In the decade since the first symposium in this series, significant progress has been made in the international harmonization of policies and criteria for exemption and clearance and in the application of the concepts. Although considerable progress has been made towards harmonization, presentations showed that each country still has its own approach to implementing exemption and clearance. Developments in recent years concerning the international harmonization of clearance levels were discussed at the symposium. The symposium participants recommended that in the revision of the Basic Safety Standards consideration should be given to a single table of values based on IAEA Safety Guide No. RS-G-1.7, instead of two tables (for exemption and for clearance). The subject of low level radioactive waste disposal was also addressed during the symposium. A lack of clear guidance was noted with respect to the endpoints for the closure of surface repositories and to the release of sites contaminated with long lived radionuclides.

K. Decommissioning

K.1. Trends, issues and challenges

106. Decommissioning and cleanup of the global civil nuclear legacy represents a massive managerial technological, safety and environmental challenge for those countries engaged in nuclear decommissioning across the world. Over 440 nuclear power plants worldwide will require decommissioning over the next 40 to 60 years. In addition to power reactors, decommissioning and cleanup needs are identified in the areas of prototype, test and research reactors together with other areas of the other fuel cycle facilities such as fuel fabrication facilities across the world.

107. There is general recognition among the experts responsible for the specification and design of new plants, regulators working in this field and experts in decommissioning and waste management that decommissioning should be regarded as an integral phase of the plant life cycle and should be considered from an early stage of design activity. Such an approach offers the prospect of reduced accumulation of waste and reduced time for eventual dismantling. It also normally leads to improved conditions for maintenance work. A particular lesson for assessing the full implications of new builds may be drawn from decommissioning delays in some countries associated with lack of disposal facilities and even, in some cases, lack of any clear policy for disposal.

K.2. International activities

108. Many governments and supporting national organizations are providing technical expertise, allowing visits to their nuclear sites and facilities, and offering training placements for Iraqi staff in order to help build decommissioning and regulatory capability for Iraq's decommissioning programme. In 2009, stages 1 and 2 of the LAMA facility decommissioning were completed and decommissioning of the GeoPilot facility started. Programme status was reviewed, plans for the next period discussed and the needs for further training and support identified at two Agency-coordinated review and planning meetings held in May and November.

109. In October 2009, the European Commission adopted a new proposal for a Council regulation on the extension of financial support to Bulgaria for the decommissioning of units 1 to 4 of the Kozloduy nuclear power plant and for the mitigation of the economical consequences. Financial support for the decommissioning of the Bulgarian nuclear power plant would have ended by December 2009 if no new extension decision had been taken. For Lithuania and Slovakia, which are in a comparable situation with respect to the decommissioning of the Ignalina and Bohunice nuclear power plants, financial support for decommissioning had already been safeguarded up to the end of 2013.

110. The International Decommissioning Network (IDN) assists Member States in the sharing of practical decommissioning knowledge. A number of activities were conducted in 2009, including workshops and training courses on the fundamentals of decommissioning for project managers and planners; on planning and implementation of decommissioning for research reactors and other small facilities; on technologies for characterization, waste management, dismantling and clearance; and on the organization and implementation of decommissioning of multi-facility sites. The annual IDN meeting was held in November 2009 in Vienna. The meeting provided the opportunity to review

national situations, the countries' needs for support from other IDN members, and offers for hosting decommissioning training and workshops. The meeting was followed by a two-day topical training session on a stakeholder involvement in decommissioning.

111. The International Project on Use of Safety Assessment in Planning and Implementation of Decommissioning of Facilities using Radioactive Material (FaSa) is assisting Member States with the development, review and implementation of safety assessments and decommissioning plans in accordance with good practice worldwide and international safety standards. FaSa activities in 2009 were organized within three working groups and four supporting test cases and were reviewed and integrated at the main meeting held in Bonn, Germany, in December 2009.

L. Remediation of contaminated sites

L.1. Trends, issues and challenges

112. The need for the remediation of legacy sites resulting from nuclear weapons testing, nuclear accidents, poor practices and abandoned facilities became evident in the late 1980s. The international community also has a strong interest in sustainable practices for uranium production and the remediation of legacy sites from past production of uranium. The current emphasis is on the remediation of uranium mining and milling legacy sites, in particular in the countries of Central Asia, as many of the old uranium mines were developed with no attention given to the residues left behind or the damage inflicted on the environment.

L.2. International activities

113. The International Conference on Remediation of Land Contaminated by Radioactive Material Residues was organized by the Agency and held in Astana, Kazakhstan, from 18 to 22 May 2009. The conference supported a strategy for avoiding future legacy sites through proper life cycle planning and good operating practices, and through the promotion of an environmental protection culture among mining companies. It was also recognized that much could be achieved by establishing appropriate regulations and a strong regulatory body in those countries in which mining operations are conducted.

114. To raise international awareness of the uranium mining legacy in Central Asia, a forum was organized by the United Nations Development Programme (UNDP) in Geneva, Switzerland, in June 2009. As a follow-up to this event, the Agency is coordinating the development of a baseline document on uranium legacy sites in Central Asia. This document will present a portfolio of projects ranked on the basis of risk, which could be supported by donors in the future. A technical meeting. involving a number of organizations active in the region such as the EBRD, the EC, OSCE, UNDP, UNEP and the World Bank was held to review the baseline document.

115. As remedial actions are more likely to be implemented with appropriate planning and assistance, the interaction of experienced and less-experienced countries, facilitated by the Agency, may lead to better conditions for the implementation of projects. The Agency's Network of Environmental Management and Remediation (ENVIRONET), which as announced during the General Conference in 2009, is intended to facilitate these interactions. The objectives of ENVIRONET are to coordinate international support programmes; offer training and demonstration activities with a regional or thematic focus; facilitate sharing and exchange of knowledge amongst organizations with advanced

environmental management and remediation programmes; and create a forum in which expert advice and technical guidance may be provided.

M. Safety of radioactive waste management and disposal

M.1. Trends, issues and challenges

116. For the past few decades, a number of countries have implemented projects to develop geological disposal facilities for high level radioactive waste. So far, the activities have focused on investigating the suitability of different host geologies and conceptual designs for disposal facilities and on finding host communities for such facilities. These technological and socio-political aspects have progressed and many lessons have been learned, such as the need for well founded scientific investigation together with open and transparent dialogue between all interested parties. A number of countries have made good progress with both the technological development and public acceptance to the extent that licence applications are now being prepared and submitted to national regulatory authorities. Licence applications are scheduled for 2010, 2012 and 2014 in Sweden, Finland and France, respectively.

117. There has also been international debate on safety standards for geological disposal and demonstrating safety for several years and a large measure of consensus has been achieved. Nevertheless, as the detailed process of compiling safety cases and licence applications for geological disposal facilities progresses and the regulatory authorities prepare for and embark on their review, many details still need to be resolved. In view of the growing worldwide interest in this topic, international forums have been established to provide for exchange of experience, notably a round-table forum was organized in the margins of the 53rd session of the Agency's General Conference in 2009 by the Swedish Radiation Safety Authority and under the Agency's Programme for Radioactive Waste Management, and this was followed by an international workshop in Cape Town, South Africa, in December 2009. Whilst considerable experience has been developed in licensing nuclear facilities, to date these have been facilities with a finite lifetime and under operational control. The long time frames over which confidence in the safety of geological disposal facilities must be established present a new challenge.

M.2. International activities

118. As part of a trilateral agreement between the Government of Ukraine, the European Commission and the Agency, a review of the safety of all operating nuclear power plants took place during 2008 and 2009. This was the first time that a national nuclear programme, inter alia, had subjected its waste management and decommissioning activities to such a comprehensive peer review and also the first time that the new safety requirements on the predisposal of radioactive waste had been used as a basis for such a review. In view of efforts to harmonize the safety of disposal of radioactive waste and the demonstration of safety and related regulatory control, this was considered to be a significant development. A number of lessons arose from the exercise, particularly related to the need for a holistic approach to be adopted that recognizes the interdependence between the various steps of radioactive waste management from generation to disposal. The importance of comprehensive characterization of waste to ensure compatibility with disposal options was evident, as was the need for comprehensive consideration of clearance of material from regulatory control. The need to develop comprehensive decommissioning plans at a sufficiently early stage and to confirm the adequacy of

funding was also highlighted. Finally, the importance of a comprehensive safety case addressing all the safety arguments in respect of waste management and decommissioning was recognized.

119. A European Union (EU) peer review of the processes of Finland's Radiation and Nuclear Safety Authority (STUK) for regulating radioactive waste management activities was carried out in November 2009. The first joint European Review Team identified a number of good practices and made recommendations and suggestions where changes are desirable for continuous improvement and as guidance for other EU States. The Review Team was already familiar with STUK's self-assessment based on the Agency's safety standards. The main emphasis of the review was on Posiva's project for the final disposal of spent nuclear fuel; the proposed spent fuel repository at Olkiluoto; and the construction of the associated rock characterization facility ONKALO, which is planned to become an integral part of the repository. The team concluded, inter alia, that STUK needs to review its guides and regulations, which are currently targeted at NPPs to ensure that they are sufficiently clear for the purposes of regulating waste management and to ensure greater transparency of requirements to stakeholders.

120. In September 2009, the Texas Commission on Environmental Quality issued a licence for Waste Control Specialists LLC to build and operate a new LLW disposal facility at its site in Andrews County, Texas. This facility, expected to begin operating in 2010, will accept Class A, B and C low level radioactive waste from Texas and Vermont, as well as from the US Federal Government. In the USA there are currently three disposal facilities that accept commercial low level radioactive waste; these are at Barnwell, South Carolina, and Richland, Washington, which are both licensed to receive Class A, B and C waste, and at Clive, Utah, which is licensed to accept Class A waste.

N. Radioactive source safety and security

N.1. Trends, issues and challenges

121. High activity radioactive sources are widely used around the world. Reliable information about the number of sources in use is not currently available. However, a 2007 report of the US Nuclear Regulatory Commission which estimated that there are 53 700 Category 1 and 2 sources in use in the USA alone, is indicative of the number of sources worldwide. While in a limited number of applications, radioactive sources are being replaced with other technologies, such as particle accelerators, in many cases, radioactive sources will continue to be used in medical, industrial and academic applications. Although all Member States recognize the importance of ensuring that radioactive sources are under regulatory control, maintaining a national register and ensuring regulatory control throughout the entire life cycle of sources remains an issue in many Member States.

122. An increasing number of countries recognize the importance of the Code of Conduct on the Safety and Security of Radioactive Sources and many Member States have made a political commitment to use the Code of Conduct as guidance in the development and harmonization of their policies, laws and regulations. Most Member States use a graded approach, as recommended by the Code of Conduct, for the management of radioactive sources and an increasing number of Member States are using the Code of Conduct's supplementary Guidance on the Import and Export of Radioactive Sources.

123. Every year, radioactive sources that are not under regulatory control (orphan sources) are discovered at ports of entry and metal recycling facilities around the world. The safety concerns and

security threat should always be considered following the discovery of an orphan source, and such discoveries should be reported to the relevant authorities. Many Member States do not have sufficient expertise or resources to characterize radioactive material that is found and to re-establish regulatory control over orphan sources.

124. As a result of continued international efforts, there is good control of radioactive sources. However, sources become more vulnerable when they reach the end of their useful life. Although the Code of Conduct on the Safety and Security of Radioactive Sources and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management establish principles and objectives for the safe management of disused radioactive sources, encouraging all possible alternatives (recycling, reuse, repatriation to country of origin, storage and disposal), many countries have not yet defined a proper strategy to manage their current and future disused radioactive sources (Figure 6). This issue is of particular importance for countries that have a low volume of radioactive waste and no nuclear programme.

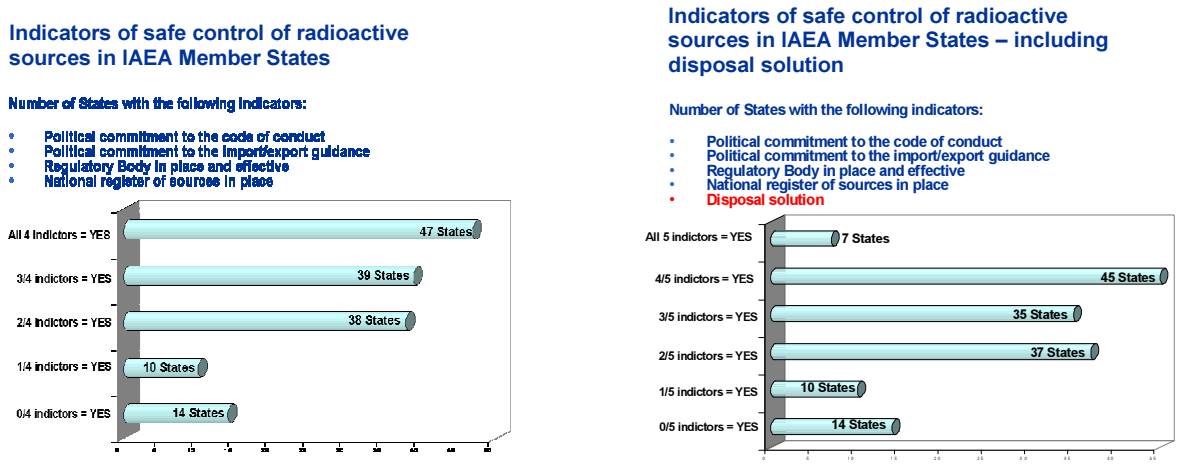

Figure 6: Indicators of safe control of radioactive sources in Member States

N.2. International activities

125. In June 2009, the Agency held an open-ended meeting in Vienna of technical and legal experts to share information on the implementation of the Code of Conduct on the Safety and Security of Radioactive Sources with regard to long term strategies for the management of sealed sources. The meeting discussed all possible strategies, particularly those encouraging States to facilitate the return of disused sources to suppliers or to develop central storage or disposal facilities for disused or orphan sources which cannot be returned to suppliers. The meeting also discussed information sharing between those Member States implementing the Code of Conduct and Contracting Parties to the Joint Convention.

126. During the Senior Regulators' Meeting of 2009, a panel session on long term management strategies for disused radioactive sources was organized. Nuclear stewardship issues were discussed in depth, such as, electronic tracking of radioactive sources within and across national borders; sustaining the host country's long-term commitment to safety and security throughout the life cycle of radioactive sources; planning and providing sufficient financing to fund waste disposal; and designating appropriate storage space for nuclear waste and disused sources.

127. To support Member States as they continuously improve their regulatory control and inventory of radiation sources, the Agency has been regularly upgrading the Regulatory Authority Information System (RAIS), taking into consideration Member States' feedback and suggestions. The 'RAIS Web Portal', which was released in 2009, is the next stage of improvement. It provides a web interface for RAIS 3.0, and enables, for example, inspectors in the field, regional offices of regulatory bodies and authorized facility representatives to access facility data.

128. Handling and conditioning of disused sources of high activity in developing countries has always been a problem since they do not have the necessary infrastructure to allow for the handling of high activity sources of cobalt-60 or caesium-137 used in teletherapy devices or irradiators. The Agency, in conjunction with a South African contractor (Necsa), has developed a mobile hot cell (MHC) that has recently been deployed successfully in two African countries. The mobile hot cell was deployed from South Africa to Sudan, where it was assembled. The devices were then loaded into the cell, one at a time, and the sources were extracted, characterized, conditioned and placed in a long term storage shield (LTSS). The LTSS was then placed in safe and secure storage in the country. The MHC was then dismantled and shipped off to the second country, the United Republic of Tanzania, where the same process was repeated. Future operations using this technology are currently in the planning stage. This is a unique technology that provides both safety and security benefits for a country. The LTSS allows further disposition of the sources whether they are to be removed from the country or disposed of in an underground repository. Once conditioning of the sources has taken place, they can also be safely and securely stored for long periods of time in the LTSS if this is the option chosen by the authorities of the country concerned.

O. Safety of transport of radioactive material

O.1. Trends, issues and challenges

129. Denials and delays of shipment of radioactive materials continue to occur in all parts of the world. The reduction of available transportation routes seems to be a precursor to denials and delays of shipments, but it continues to be difficult to monitor and measure this owing to commercial sensitivities. It remains clear that effective communication with transport personnel, whose main activity is not handling radioactive material, is essential in order to combat undue denials and delays. The promotion of communication and training is the focus of the current phase of the action plan of the International Steering Committee on Denials of Shipment of Radioactive Material that is currently being implemented and is nearing completion.

130. Another continuing challenge is to improve cooperation and interfaces with other United Nations bodies associated with the transport of dangerous goods. There are a growing number of cross-cutting issues, such as ship decommissioning and transportable nuclear installations. The transport safety implication of these new concepts is being examined to understand the potential complexities of significant new civilian nuclear technologies and to determine the necessary updating of the relevant safety regulations.

131. The effect of the more stringent requirements for air transport of large sources and nuclear fuel will encourage the use of land transport and will make it necessary to assess the balance of these air transport limitations in the safety requirements with the need for security. The review of the Agency's transport requirements will, of necessity, investigate whether sufficient flexibility is included to ensure the appropriate balance can be reached.

132. As well as being party to international air and sea conventions, many countries with existing nuclear industries also have regional land transport agreements (for the transport of dangerous goods), which facilitate the movement of goods. While the air and sea transport conventions are effectively global in nature, the lack of international land transport agreements could become a problem with an expanding industry base.

O.2. International activities

133. The International Steering Committee on Denials of Shipment of Radioactive Material continues to guide international activities and in 2009 this included regional workshops with a view to establishing regional networks to implement regional action plans developed during the workshops, including elaboration and delivery of a communication strategy to promote awareness among decision makers and other parties. There has been a move from the development phase (based on Secretariat-led work) towards a delivery phase (led by the regional coordinators and national focal points). The international emphasis will be on the promotion of national solutions, facilitation of regional solutions and coordination of international solutions. The Steering Committee has overseen the establishment of a database for denials of shipment which has registered more than 200 denial reports by the end of 2009.

134. In 2009, the Transport Safety Standards Committee (TRANSSC) decided that there were sufficient safety-related issues to require an update to the Regulations for the Safe Transport of Radioactive Material. This is mainly in response to work on the development of new fissile-excepted material requirements, as requested by the General Conference, for the transport of radioactive materials. This revision is expected to be completed around 2012–2013, and until that time further reviews of the Transport Regulations are suspended.

135. In September 2009, a group of coastal and shipping States held, with Agency participation, a fifth round of informal discussions in Vienna with a view to maintaining dialogue and consultation aimed at improving mutual understanding, confidence building and communication in relation to the safe maritime transport of radioactive material.

136. The initiative to form the Association of European Competent Authorities for Transport of Radioactive Material in 2008 followed the successful implementation of the memorandum of understanding between the competent authorities of France and the United Kingdom, which proved to be very effective. After an initial development stage, the Association has become an effective network for competent authorities in Europe to discuss issues of common interest, exchange information and best practices, exchange guidance material and work together towards common guidance documents on topics where a common position would be beneficial.

Appendix 1
Safety related events and activities worldwide during 2009

A. Introduction

137. This report identifies those safety related events or issues during 2009 that were of particular importance, provided lessons that may be more generally applicable, had potential long-term consequences, or indicated emerging or changing trends. It is not intended to provide a comprehensive account of all safety related events or issues during 2009.

B. International instruments

B.1. Conventions

B.1.1. Convention on Nuclear Safety (CNS)

138. The 1st Extraordinary Meeting of the Contracting Parties to the CNS took place on 28 September 2009 to approve the revision of the Guidelines regarding national reports, and endorse a brochure on the CNS and its associated rules of procedure and guidelines prepared by the Secretariat for training purposes.

139. The 5th Organizational Meeting of the Contracting Parties to the CNS took place on 29 September 2009. The purpose of the meeting was to prepare for the 5th Review Meeting to be held 4-14 April 2011. A total of 46 out of 66 Contracting Parties participated in the meeting.

140. The Convention has now 66 Contracting Parties and 13 Signatory States that have not yet ratified the Convention. In 2009, four countries, namely Jordan, Libyan Arab Republic, Senegal, and the United Arab Emirates became Contracting Parties to the Convention.

B.1.2. Convention on Early Notification of a Nuclear Accident and Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Early Notification and Assistance Conventions)

141. In 2009, the Libyan Arab Jamahiriya, Mozambique and Oman acceded to the Convention on Early Notification of a Nuclear Accident.. There are now 106 Contracting Parties to this Convention.

142. Mozambique and Oman acceded to the Convention for Assistance in Case of a Nuclear Accident or Radiological Emergency in 2009, bringing the total to 104 Contracting Parties to this Convention.

143. Senegal acceded to both conventions in December 2008 but the respective accessions entered into force only in January 2009

B.1.3. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention)

144. The third Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management took place in May 2009. Forty-five Contracting Parties participated in the Third Review Meeting, including five new Contracting Parties, i.e., China, Nigeria, Tajikistan, Senegal and South Africa. Throughout the Review Meeting it was observed that the review process is maturing well and more constructive exchanges and more knowledge sharing took place than at previous Review Meetings. Within Country Group sessions, many Contracting Parties reported on their use of the IAEA Safety Standards and on their experiences with the Integrated Regulatory Review Service (IRRS) of the IAEA; other Contracting Parties plan to undergo or to request IRRS missions in the future. Contracting Parties that have not received these missions were encouraged to invite such missions.

145. The Review Meeting emphasized Policy and technical highlights in the Summary Report on: legislative and regulatory framework; disposal of waste, decommissioning, disused sealed sources, past practices, knowledge management, stakeholder involvement and international cooperation. In addition, improvements for future Review Meetings were identified through the deliberations of the Open-Ended Working Group and were approved at the Plenary Session of the Review Meeting.

146. In helping reaching this aim, the Review Meeting agreed that during the period between review meetings, the General Committee of the Joint Convention can encourage the Agency to organize meetings open to all Member States to address specific topics identified at the Review Meeting. Taking into account discussions during the country sessions of the Review Meeting, the following specific topics can be of mutual interest: definition and implementation of a comprehensive national plan for the management of spent fuel and of radioactive waste; management of very low level waste and implementation of clearance thresholds; establishment of national agencies in charge of the management of spent fuel and radioactive waste; and management of graphite waste.

B.2. Codes of Conduct

B.2.1. Code of Conduct on the Safety of Research Reactors

147. The Code of Conduct on the Safety of Research Reactors is now widely known and accepted as a principal source for guidance for management of research reactor safety. Continuous commitment of Member States is central to achieving effective implementation of the Code. The provisions and guidance in the Code have been integrated into appropriate Agency safety review services, technical cooperation projects and extra budgetary programmes. Application of the Code is being accomplished through enhancement and implementation of national safety regulations. The Agency continued to encourage Member States to make full use of the Agency's safety standards relevant to research reactors and the legal and governmental infrastructure for nuclear, radiation, radioactive waste, and transport safety. To support this effort the Agency published in 2009 a Safety Guide on radiation protection and radioactive waste management in the design and operation of research reactors, and made a significant progress in the development of three other Safety Guides on the use of a graded approach in the application of the safety requirements, safety assessment and preparation of safety analysis report, and safety in utilization and modification of research reactors.

148. Following the recommendations of the 2008 International Meeting on the Application of the Code of Conduct on the Safety of Research Reactors, the Agency continued to implement regional activities to examine progress, to promote sharing knowledge and building technical and safety capacities, and to address specific needs of Member States as defined in their self-assessments

presented during the International Meeting. In 2009, these activities focused on promoting performance of periodic safety reviews for research reactors, and improving the capabilities for preparation, review and assessment of research reactor safety documents, as well as on the need to enhance operational radiation protection programmes and emergency planning and preparedness for research reactors.

B.2.2. Code of Conduct on the Safety and Security of Radioactive Sources

149. By the end of 2009, 95 States had expressed their political support and intent to work toward following the Code of Conduct on the Safety and Security of Radioactive Sources and 53 States had expressed support for the Supplementary Guidance on the Import and Export of Radioactive Sources.

150. The provisions and guidance in the Code of Conduct have been integrated into appropriate Agency safety review services, such as the Integrated Regulatory Review Service (IRRS), advisory missions on control of sources, technical cooperation projects and extra budgetary programmes. Application of the Code of Conduct is being accomplished through implementation of national regulations. According to the formalized process established in 2006 for sharing information on implementation of the Code, the next open ended meeting will be held in 2010.

C. Cooperation between national regulatory bodies

151. There are a number of forums in which regulators can exchange information and experience with their counterparts in other countries. Some of these are regional, some deal with particular technology and others are based on the size of the nuclear power programme. All of these forums meet regularly to exchange information of common interest and some are developing exchange mechanisms involving the Internet for more rapid means of communication. Selected safety issues of wide interest to regulators are discussed at a meeting of senior regulators held in association with the Agency's General Conference each year.

C.1. International Nuclear Regulators Association (INRA)

152. INRA comprises the head regulators from Canada, France, Germany, Japan (representatives of both NSC and NISA), Republic of Korea, Spain, Sweden, the UK and the US. There were two INRA meetings in 2009, both hosted by the Republic of Korea. The first was in April, and the second in October. The group has continued to focus on the regulatory challenges relating to the fragility of the supply of medical isotopes, organizational and human resources for current and future nuclear power programs, materials ageing and exchanges about operational experience. The next round of meetings in 2010 will be held in the UK, although the specific dates have not been set.

C.2. G8-Nuclear Safety and Security Group (G8-NSSG)

153. Under the presidency of Italy, the G8-NSSG met three times in 2009. The Agency, the European Commission (EC), the Nuclear Energy Agency of the Organization for Economic Cooperation and Development (OECD/NEA) and the European Bank for Reconstruction and Development (EBRD) also attended the three meetings as observers. The G8-NSSG meetings focused on, inter-alia, the safety upgrading programme of the Armenian Nuclear Power Plant; the Chernobyl Shelter Fund and Nuclear Safety Account managed by the EBRD; the implementation of the EC-Agency-Ukraine Joint Project; the Global Nuclear Safety and Security Network (GNSSN); strengthening of nuclear safety and security activities; the Code of Conduct on the Safety and Security

of Radioactive Sources and its supplementary guidance on imports and exports; the Global Initiative to combat nuclear terrorism; the international initiative on 3S-based (Safety, Security, Safeguards); and the human resources development in the field of nuclear safety and security. In this connection, and as the first concrete step of the Italian presidency towards capacity building including education and training in nuclear safety and security, the International Workshop on Nuclear Safety and Security Education and Training in Countries Embarking on or Expanding Nuclear Programmes was organized by the Italian National Agency for new Technologies, Energy and the Environment (ENEA) in cooperation with the IAEA and the EC. Approximately one hundred participants from twenty eight countries and six international organizations (i.e. Arab Atomic Energy Agency (AAEA), EBRD, EC, IAEA, OECD/NEA and WINS) attended this event.

154. At the last meeting in October 2009, the main themes to be considered by NSSG under the Canadian G8 presidency were introduced. The Canadian delegation reported that the G8 Leader's Summit was scheduled to take place from 25 - 27 June 2010 in Huntsville.

C.3. Western European Nuclear Regulators Association (WENRA)

155. In 2009, WENRA celebrated its 10th Anniversary. It was founded with three main objectives: to develop a common approach to selected nuclear safety and radiation protection issues and regulation, in particular within the EU; to provide the EU with an independent capability to examine nuclear safety and regulation in its candidate/applicant countries and to serve as a network of chief nuclear safety regulators exchanging experience and discussing significant safety issues. In order to achieve the harmonized safety approaches and to continuously improve nuclear safety in the following areas WENRA has established two working groups - the Reactor Harmonization Working Group (RHWG) and the Working Group on Waste and Decommissioning (WGWD).

156. The RHWG has already fulfilled its original mandate (harmonization of requirements for existing reactors which are based mainly on the Agency’s safety standards and best regulatory practice/experience from WENRA countries) and as its follow-up it will regularly revise the safety reference levels according to the latest development in the field of international standards. Within its new task, the RHWG is working on a report on safety objectives for new power reactors which will be published in early 2010.

157. The WGWD is continuing to develop safety reference levels for radioactive waste and spent fuel storage and decommissioning under its original mandate and in addition is formulating safety reference levels for geological disposal facilities.

158. In its ten years history, WENRA has become a credible and well recognized organization. It has enlarged to the current 17 members, heads of nuclear regulatory authorities of European countries having at least one nuclear power plant, and most recently also to eight observers – five from European Economic Area countries without nuclear power programme (Austria, Ireland, Luxembourg, Norway and Poland) and three from non-EU European countries with operating nuclear power plants (Armenia, the Russian Federation and Ukraine). Besides this new cooperation launched in 2009, WENRA is considering also possible new tasks and challenges.

C.4. The Ibero-American Forum of Nuclear and Radiological Regulators

159. The Ibero American FORO started sharing its experiences and the results of technical projects with other countries in form of seminars with the occasion of IRPA 12 Congress in 2008. In 2009, the FORO, in cooperation with the Agency, provided assistance and expertise on risk analysis in radiotherapy. A similar approach is planned in the areas of continuous improvement of the regulatory control of medical exposure. At the IAEA General Conference in 2009, the FORO made a

presentation at a round table discussion on the activities of the Asian Nuclear Safety Network in order to share its experiences and policies with other regions.

C.5. Cooperation Forum of State Nuclear Safety Authorities of Countries which operate WWER[3] Reactors

160. The 16th Annual Meeting of the State Nuclear Safety Authorities of the Countries Operating WWER-type Reactors (WWER Regulators Forum) was hosted by the Bulgaria Nuclear Regulatory Agency (BNRA). The meeting was attended by the heads of the regulatory authorities or their representatives of all countries operating or constructing WWER type reactors, namely Armenia, Bulgaria, China, Czech Republic, Finland, Hungary, India, Iran, Russian Federation, Slovak Republic and Ukraine. Observers from the IAEA and the Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) also attended the meeting.

161. Reports were presented on the most important recent national issues and developments in the field of nuclear regulation and safety, followed by discussions among the participants. Several working groups have been established and reported on their activities including the regulatory aspects of organizational, management and safety culture related issues of NPPs (work completed); operating experience feedback for improving safety of NPPs; and the regulatory use of Probabilistic Safety Analysis. The working groups will continue their activities into 2010. The next meeting of the WWER Regulators Forum is to be held in Hungary in 2010.

C.6. Forum of Nuclear Regulatory Bodies in Africa (FNRBA)

162. The newly established "Forum of Nuclear Regulatory Bodies in Africa" (FNRBA) had a meeting in Pretoria, South Africa in March 2009, to finalize its charter as a key document governing its operation. FNRBA also identified the main programme areas for the Forum's cooperative activities.

163. The charter was signed on 26 March 2009 by representatives of 24 participating regulatory authorities and following its entry into force, a new Steering Committee was elected for a two years term of office.

164. The Forum benefited from presentations made by partner institutions (US NRC, resource persons from the European Radiation Protection Authorities Network and the Asian Nuclear Safety Network), as well as from the IAEA, on experiences and lessons learned by other regional networks of regulators. This includes the Global Nuclear Safety and Security Network (GNSSN) platform, which is currently being established, as well as the International Regulatory Network (RegNet), which will be linked through the GNSSN.

C.7. Network of Regulators of Countries with Small Nuclear Programmes (NERS)[4]

165. NERS is an international network of nuclear regulators and inspectors who are dedicated to the free exchange of nuclear regulatory information and its dissemination. Country members are Argentina, Belgium, Czech Republic, Finland, Hungary, Netherlands, Pakistan, Slovak Republic, Slovenia, South Africa and Switzerland.

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[3] water cooled, water moderated power reactor

[4] www.ners.info

166. NERS provides a means of communication between regulators of countries with small nuclear programmes. It complements any bilateral engagement or agreements a regulatory body may have. One of its roles is to support the activities of other international organizations such as the IAEA and committees of the OECD-NEA, Committee on Nuclear Regulatory Activities (CNRA) and Committee on the Safety of Nuclear Installations (CSNI). The IAEA supports the formation of such networks as part of its knowledge sharing activities.

167. The 12th meeting of NERS was held in Brussels, from 4 – 5 June 2009. General items discussed included information on regulatory organisation in member countries; rules, regulations and licensing process and operational experience feedback. Specific items were also discussed relating to the licensing and construction of new nuclear power plants, safety assessment of cranes, experiences with licensing of final disposal facilities and methods of calculation of third party nuclear liability insurance. The 13th NERS meeting will be hosted by South Africa with a provisional date of October 2010.

C.8. The senior regulators from countries which operate CANDU-type nuclear power plants

168. The Annual Meeting of Senior Regulators of Countries Operating CANDU-type Reactors took place in Buenos Aires, Argentina, from 26 - 30 October 2009 and was hosted by the Nuclear Regulatory Authority of Argentina. In addition to the seven participating countries (Argentina, Canada, China, India, Republic of Korea, Pakistan and Romania), the representatives of the CANDU Owners Group (COG) were invited to attend, in order to enhance the exchange of information among regulators and COG and identify future areas of cooperation.

169. In addition to the regular topics, which cover presentations of country annual reports, recent developments and exchange of operational feedback, the meeting addressed technical and policy regulatory issues, which includes assessment and licensing of new design, refurbishment and ageing management, risk-informed and its specific application for CANDU safety issues and for regulatory compliance activities. The participants visited Embalse NPP and exchanged information with the Argentinean counterparts on the organization, status of implementation and technical aspects of the Embalse Plant Life Extension Project.

170. The next meeting will be held in Shanghai, China, in the fourth quarter of 2010.

C.9. The International Nuclear and Radiological Event Scale (INES)

171. The International Nuclear and Radiological Event Scale (INES) User's Manual was issued by the IAEA in June 2009. The new manual puts forward a new revised INES, which applies to any event associated with the transport, storage and use of radioactive material and radiation sources, whether or not the event occurs at a facility. The revision is aimed at better addressing areas and activities such as the transport of radioactive material, or human exposure to sources of radiation. It also ensures more consistent terminology and adds more examples of INES rating to the manual.

172. It is anticipated that INES will be widely used by the Members States and become the worldwide scale for putting into the proper perspective the safety significance of nuclear and radiation safety events. Member States demand for the new INES User's Manual was high and the 2000 copies of the INES User's Manual printed in June 2009 were out in less than five months. A second release of additional 1000 copies was issued in October 2009.

173. With a view of promoting the consistent and wide use of INES by all interested Member States, and recalling the IAEA General Conference resolution GC(52)/RES/9 which welcomed the new INES

User's Manual, urged Member States "to designate INES national officers and utilize the scale" and "recognised the efforts of the Secretariat and Member States in implementing the International Nuclear and Radiological Event Scale (INES) and resolution GC(53)/RES/10), the IAEA organized for the first time, a train-the-trainers workshop on INES from 22 to 25 September 2009.

174. The train-the-trainers workshop on INES aimed to present the updated INES rating methodology to INES national officers and, at same time, to encourage Governments to join the system. The train-the-trainers workshop on INES was successfully attended by over 50 participants from 35 countries. The lecturers of the workshop were cost free experts and members of the INES Advisory Committee and the IAEA Secretariat. Participants attended the workshop without financial support of the IAEA confirming the interest of the Member States in the scale. Besides, as a result of this initiative, additional four Member States have recently joined the INES system: Kenya, Latvia, Malaysia and the Philippines. Currently sixty-five countries are members of the INES information system.

D. Activities of international bodies

175. Several international expert bodies issue authoritative findings and recommendations on safety related topics. The advice provided by these bodies is an important input to the development of the Agency's safety standards and other international standards and is frequently incorporated in national safety related laws and regulations. The recent activities of a number of these bodies are reviewed in this section.

D.1. United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

176. The United Nations General Assembly established the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) in 1955 to assess and report levels and effects of exposure to ionizing radiation. The Assembly has designated 21 United Nations Member States to be members of the Committee. The Committee's secretariat, which is provided through the United Nations Environment Programme and based in Vienna, engages specialists to analyse information, study relevant scientific literature and produce scientific reviews for scrutiny at the Committee's annual sessions. Every few years, the United Nations publishes substantive reports, which are recognized as authoritative scientific reviews. These provide the scientific foundation for national and international programmes on radiation risk assessment and management, including for example the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS).

177. During 2009, the United Nations published the second volume of the Committee's 2006 report to the Assembly with scientific annexes, presenting reviews of: non-targeted and delayed effects of exposure to ionizing radiation, effects of ionizing radiation on the immune system, and sources-to-effects assessment for radon in homes and workplaces. A clearer understanding of the risks from radon inhalation has prompted the World Health Organization, the International Commission on Radiological Protection and the International Atomic Energy Agency to take up the matter with respect to protection advice.

178. The fifty-seventh session of UNSCEAR is scheduled to be held from 19 - 23 April 2010 and is expected to discuss the following topics: an assessment of levels of radiation from energy production

and the effects on human health and the environment; uncertainty in radiation risk estimation; attributability of health effects due to radiation exposure; updating the Committee's methodology for estimating exposures due to discharges from nuclear installations; a summary of radiation effects and improving data collection, analysis and dissemination. With regard to the latter, the UNSCEAR secretariat has been liaising with other relevant organizations, such as the World Health Organization, the International Atomic Energy Agency, the Nuclear Energy Agency of the Organization for Economic Cooperation and Development and the European Union, with a view to streamlining the collection of data on radiation exposures of the public, workers and patients and avoiding duplication of efforts.

D.2. International Commission on Radiological Protection (ICRP)

179. ICRP is an independent group of experts that issues recommendations and guidance on the principles of radiation protection. ICRP recommendations have provided the basis for national and international standards on radiation protection in particular the BSS. Appointments to the ICRP and its Committees are made for five years; the current cycle started on 1 July 2009. With the new leadership the ICRP is conducting a review of its mission, mandate and working practices to be prepared for new challenges in radiation safety.

180. The ICRP published the following recommendations in 2009:

- Radiation Dose to Patients from Radiopharmaceuticals (P106)
- Nuclear Decay Data for Dosimetric Calculations (P107)
- Environmental Protection: the Concept and Use of Reference Animals and Plants (P108)
- Application of the Commission's Recommendations for the Protection of People in Emergency Exposure Situations (P109)

D.3. International Commission on Radiation Units and Measurements (ICRU)

181. The ICRU, a sister organization of ICRP, develops and promulgates internationally accepted recommendations on radiation related quantities and units, terminology, measurement procedures, and reference data for the safe and efficient application of ionizing radiation to medical diagnosis and therapy, radiation science and technology, and radiation protection of individuals and populations.

182. The ICRU held its annual meeting from 11 – 16 September 2009 in Dresden, Germany, where topics for potential work for the future were discussed, including functional imaging; harmonization on prescribing, recording and reporting radiotherapy planning; measuring and reporting radon exposure; and operational quantities and units.

183. The ICRU published the following reports in 2009:

- Vol. 9, No. 1, 2009: Report 81, Quantitative Aspects of Bone Densitometry
- Vol. 9, No. 2, 2009: Report 82, Assessment of Image Quality in Mammography

184. In radiation protection, the ICRU has introduced operational quantities and recommendations for their experimental determination. In basic science, the measurement of physical parameters concerning ionizing radiation is improving constantly, and the results must be continuously re-evaluated in order to provide recommendations on reducing the risk of radiation exposure by both the public and radiation workers.

185. In diagnostic radiology and nuclear medicine, developments have been rapid, and the ICRU has expanded its programme related to medical imaging, ranging from fundamental concepts to practical applications involving all types of imaging techniques, and also encompassing specific dosimetric procedures regarding protection.

D.4. International Nuclear Safety Group (INSAG)

186. The International Nuclear Safety Group (INSAG), convened under the auspices of the IAEA, is a group of experts with high professional competence in the field of safety working in regulatory organizations, research and academic institutions and the nuclear industry. INSAG's objective is to provide authoritative advice and guidance on nuclear safety approaches, policies and principles. In particular, INSAG provides recommendations and opinions on current and emerging nuclear safety issues to the IAEA, the nuclear community and the public.

187. Presently INSAG is in the final stage of preparation of two documents that are expected to be issued at the beginning of 2010. The first one deals with the relationship between safety and security and highlights the importance of a coordinated approach to nuclear safety and security. The second one proposes a framework for an integrated risk informed decision making process taking into account deterministic and probabilistic techniques.

188. As in previous years, the INSAG Forum was held in the margins of the 53rd Regular Session of the General Conference. During the Forum, which was dedicated to *Responsibility for Safety in a Globalized Nuclear Environment*, speakers identified challenges which deserve further consideration. These include: states embarking for the first time on a nuclear power programme - the so-called nuclear newcomers; an anticipated flurry in construction occurring simultaneously around the globe and an increasingly globalised nuclear industry; an emerging need for the security regime to match the existing safety regime because of the growing terrorist threat to nuclear material and installations; and a generation of ageing nuclear power plants which could have their life spans extended well beyond 60 years.

E. Activities of other international organizations

E.1. Institutions of the European Union

189. On 25 June 2009 *Council Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations*[5], was adopted by the EU Member States. The Directive creates a solid and flexible legal framework that defines basic obligations and principles governing nuclear safety throughout the EU. By enshrining in its legislation the nuclear safety requirements of the Convention on Nuclear Safety and of the Safety Fundamentals established by the International Atomic Energy Agency (IAEA), the EU has become the first major regional nuclear actor to give binding legal force to these leading international nuclear safety instruments. The underlying principles on which the Directive is built are: national responsibility for nuclear safety and continuous improvement of nuclear safety. In line with these basic principles, the Directive requires Member States to establish and maintain a national legislative, regulatory and organisational framework governing the safety of nuclear installations. It also aims to reinforce the role and the independence of

[5] OJ L 172, 2.7.2009

the competent national regulatory authorities by building on their competencies and acknowledging the fundamental prerequisite that only independent and strong regulators can guarantee the safe operation of nuclear installations in the EU. The prime responsibility of licence holders for nuclear safety is explicitly recognised.

190. In the framework of the continuing positive cooperation with Ukraine on energy and nuclear safety matters, a joint European Commission-IAEA-Ukraine project on the evaluation of the nuclear safety of the Ukrainian Nuclear Power Plants is under way since 2007. First interim reports have been presented by the IAEA in November 2009.

191. In 2009, the European Nuclear Safety Regulators Group (ENSREG)[6], an independent expert body composed of senior officials from the national regulatory or nuclear safety authorities of all the 27 EU Member States, held four meetings. The objective of ENSREG is to further a common approach to the safety of nuclear installations, the safety of the management of spent fuel and radioactive waste and the financing of the decommissioning of nuclear installations. As a main concrete result, the ENSREG work has provided a valuable contribution to the preparation of the Council Directive on nuclear safety. In addition, ENSREG submitted to the Commission its first Activity Report, presenting the Group's discussions and recommendations covering nuclear safety, waste management and transparency aspects[7]. According to the procedure established in the Decision, the Commission has further transmitted this Report to the European Parliament and to the Council.

192. The European Nuclear Energy Forum (ENEF) provides a platform for a broad and transparent stakeholder discussion on the opportunities and risks of nuclear energy, as well as transparency issues. The fourth plenary meeting was held in May 2009 in Prague and gathered more than 250 high-ranking participants from all relevant stakeholders in the nuclear energy field – Governments of all 27 EU Member States, European Institutions, nuclear industry, electricity consumers and the civil society. The ENEF working groups (opportunities, risks and transparency) supported possible initiatives in the area of nuclear safety and waste policies, training, education and transparency. High level interventions from political leaders and from industry have noted that nuclear power is perceived by them as a major contributor to the future low carbon economy, together with renewables. The next plenary ENEF meeting will be held in Bratislava in May 2010.

E.2. Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA)

193. The Nuclear Energy Agency (NEA) is a specialized agency within the OECD maintaining and developing, through international cooperation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy. It operates mainly through a number of committees covering specific areas.

194. The NEA Committee on Nuclear Regulatory Activities (CNRA) established a working group on the Regulation of New Reactors inter alia to develop a database on construction experience (ConEx). The objectives of the ConEx database are to identify the major deficiencies that occurred during the design and construction of nuclear power plants, to assess the adequacy of and supplement if necessary, the current regulatory activities to detect and correct such events and prevent them from remaining undetected until the plant becomes operational and finally to disseminate information to

[6] Set up by the Commission Decision 2007/530/Euratom of 7 July 2007 on establishing the European High Level Group on Nuclear Safety and Waste Management (O.J. L 195/44, 27.7.2007)

[7] The full Report is available at http://ec.europa.eu/energy/nuclear/ensreg/doc/2009_ensreg_report.pdf

ensure appropriate regulatory attention is given to the lessons learned from past events. A CNRA working group on operating experience is discussing safety issues having potential generic importance about control rods (wear, corrosion, manufacturing defects, cracks) recognising an international trend on issues of human factors, quality assurance, vendor oversight and sharing of vendor information internationally, explosive risk for hydrogen carrying pipes and follow-up of the 2006 Forsmark-1 event.

195. Under the auspices of the Committee on the Safety of Nuclear Installations (CSNI) an activity is ongoing to identify the key safety issues and the data needs for specific advanced reactor design concepts, the infrastructure needs for producing the required data, and the role of the regulator, industry and R&D institutions in the development of such infrastructure. The reports related to experimental research need for Gas Cooled Reactors were completed in 2009 and work is under completion for Sodium Fast reactors.

196. The Multinational Design Evaluation Programme (MDEP) is a multinational initiative to increase cooperation and enhance convergence of regulatory requirements of national safety authorities who will be tasked with the review of new reactor power plant designs. The MDEP compared inspection practices and scope, and observed and participated in vendor inspections conducted by other regulators. In the relation to the standards and codes, pressure boundary codes are compared for pressure vessels in coordination with the standard development organizations, who have been encouraged to meet and discuss differences. On instrumentation and control (I&C), an MDEP working group engaged the I&C standards organizations to develop a comparison table, interfacing with equipment designers and manufacturers to draft common positions. In addition, specific working groups address design aspects of EPR and AP1000. To share their results with stakeholders, the MDEP organised a conference with participation of non-MDEP regulators and industry. The main conclusions reached after two days of debates confirmed MDEP's important role as an initiative pooling an effective and efficient expert network from different countries, and requested that the initiative should improve the dissemination of information to a wide group of stakeholders (regulators, new entrants, industry and public).

197. The NEA provides for a number of joint international research projects that cover technical safety areas such as fuel safety, thermal-hydraulics and severe accidents. Two such projects on thermal-hydraulic issues and on fuel cladding reliability (ROSA and SCIP) had been extended, and important data have been achieved from the FIRE and OPDE database projects, respectively on fire incidents and on pipe failure data. A new project on fuel overheating of spent fuel assemblies in storage ponds, subsequent to water loss, has started.

198. The Committee on Radiological Protection and Public Health (CRPPH) provides for an active dialogue between regulators and the scientific community on how scientific developments and their uncertainties are integrated into regulatory processes in radiological protection. Based on case studies, a recent workshop discussed these issues in the context of radon exposure, increasing medical exposures, and of the possibility of radiation-induced cardio-vascular diseases. The Committee's Working Party on Nuclear Emergency Matters (WPNEM) developed a new International Nuclear Emergency Exercise (INEX 4) which will address issues in post-crisis consequence management and the transition to recovery following a malicious act in the urban environment.

199. In the area of waste regulation, the Radioactive Waste Management Committee (RWMC) has taken stock of its initiative on long-term safety criteria in a workshop on Regulating the Long-term Safety of Geological Disposal, providing important insights into current practice in terms of regulating long-term safety, on obligations to future generations, and the need for harmonised safety objectives across countries. The RWMC also launched a project in the field of reversibility and retrievability concerning the final disposal of radioactive waste developing inter alia, a "retrievability scale" as a

tool for informing and dialoguing with the public. The Committee's Forum on Stakeholder Confidence (FSC) continued its work in providing a neutral ground for national stakeholder dialogues by organising a stakeholder workshop in France, at the target region for siting a high-level waste repository.

E.3. World Association of Nuclear Operators (WANO)

200. Every organization in the world that operates a nuclear power plant is a member of WANO. It is an association set up to help its members achieve the highest practicable levels of operational safety, by giving them access to the wealth of operating experience from the world-wide nuclear community. WANO is non profit making and has no commercial ties. It is not a regulatory body and has no direct association with governments. WANO has no interests other than nuclear safety.

201. WANO conducted peer reviews at 36 NPPs during 2009, altogether 420 since the programme began in 1992. WANO's long-term goal is to conduct a WANO peer review of member nuclear stations such that each nuclear unit is reviewed at least once per six years, either as an individual unit or as part of a peer review that includes other units at a station. In addition, each station is encouraged to host an outside review at least every three years (allowing a WANO peer review to count as an outside review.) An outside review would include OSART missions, WANO follow-up peer reviews, and national organizational reviews such as those conducted by the Institute of Nuclear Power Operations (INPO) and the Japan Nuclear Technology Institute (JANTI).

202. WANO continues to emphasize technical support missions, which focus on providing assistance in selected areas, with more than 150 technical support missions undertaken during 2009. Many of these technical support missions included experts from other WANO regions sharing their experiences to support improvements in operational safety.

203. A central operating experience team with representatives from all four WANO regional centres continues to develop operating experience products and information for members. This team produces Significant Operating Experience Reports, Significant Event Reports, and Hot Topics to keep members informed of important events and trends occurring in the industry. In addition, WANO maintains a 'just-in-time' operating experience database that gives plant staff access to relevant operating experience immediately prior to undertaking specific operations and maintenance activities.

F. Safety significant conferences in 2009[8]

F.1. International Conference on Control and Management of Inadvertent Radioactive Material in Scrap Metal

204. Metal recycling has become an important industrial activity in all countries. Radioactive material may become associated with scrap metal inadvertently and if it is melted can cause health, economic and public acceptance problems for the metal industry. In Tarragona, Spain, from 23 - 27

[8] For the 4th Review Meeting of Contracting Parties to the Convention on Nuclear Safety see section B.1.1.; for the open-ended meeting of technical and legal experts for sharing information on lessons learned from States' implementation of the Guidance on the Import and Export of Radioactive Sources see section B.2.2.; for the international meeting on the application of the Code of Conduct on the Safety of Research Reactors see section B.2.1.

February 2009, the IAEA co-organized a conference on the subject together with the Spanish Nuclear Safety Council. The aim of this conference was to share experiences and, if possible, to contribute towards the resolution of the problems caused by the inadvertent presence of radioactive material in scrap metal.

205. Reducing the magnitude of the problem by prevention, detection and subsequent reaction requires the cooperative efforts of all concerned parties, that is, the scrap metal carriers, the scrap metal industry, the steel industry, the national regulators and the radioactive waste management organisations. From the presentations and discussions it is clear that many countries feel that the main problems come from imports from outside their frontiers The participants of the conference were unanimous in recognising the potential benefit that would result from establishing some form of binding international agreement between governments to unify the approach to trans-border issues concerning metal scrap containing radioactive material. This should now be a subject for the international agencies to consider and to determine the most effective mechanism for the purpose.

206. The conference also addressed the issues surrounding the recycling of metals from the nuclear industry. The nuclear industry in several countries is using the clearance concept to determine which materials can be released from regulatory control for recycle. Most of the released metals have so far been used in controlled applications or returned for reuse within the nuclear industry. Generally, the release of cleared metals from the nuclear industry for unrestricted use has not yet gained acceptance. This is a key issue for the future and the determination of an agreement on appropriate acceptance criteria for radionuclides in metal scrap and processed metal would be one step towards its resolution. It is also clear that countries have different acceptance criteria for radionuclides in metal scrap leading to possible acceptance problems at borders.

F.2. 4th International Conference on Education and Training in Radiological Protection

207. This conference, held from 8 - 12 November 2009 in Lisbon, Portugal, and organized in coordination with IAEA, was attended by 124 participants from 27 countries. It addressed a range of people having an interest in education and training in radiation protection, such as policy makers, radiation safety professionals, regulators and representatives from industry, medicine, and research facilities. The conference aimed to reinforce the contacts between various organisations, individuals and networks dealing with education and training in radiological protection.

F.3. International Conference on Remediation of Lands Contaminated by Radioactive Material Residues

208. The need for the remediation of legacy sites resulting from nuclear weapons testing, nuclear accidents, poorly operated practices and abandoned facilities became evident in the late 1980s. Since then, the full extent of the global remediation problem has become clear. In response, the Agency organized several radiological assessments of major affected sites around the world and held a number of international conferences, the last one from 18 - 22 May 2009 in Astana, Kazakhstan. The emphasis was on the remediation of uranium mining and milling legacy sites, in particular in the countries of Central Asia, where many old uranium mines were developed with no attention given to the residues left behind or the damage inflicted on the environment.

209. The involvement in the conference of many international organizations is a reflection of the importance of this issue. The European Bank for Reconstruction and Development, European Commission, North Atlantic Treaty Organization, Organization for Security and Cooperation in Europe, United Nations Development Fund, World Bank, World Health Organization, and the Agency were all represented and made presentations. The aims of most of these organizations are similar in

that they wish to provide assistance in the remediation of uranium mining and milling legacy sites in the countries of Central Asia. All support a regional approach and see the need for a well defined road map before proceeding with any project. The conference showed that there is a need for increased coordination between them. The Agency has formal international responsibilities and specialized knowledge in the areas of radiation protection and radioactive waste management and therefore would be the appropriate organization to coordinate this regional approach.

210. The Conference in Astana recommended that the Agency explore the possibility of negotiating 'memoranda of common understanding(s)' among Member States or another equivalent legal framework, with the aim of ensuring that common and coherent radiation protection criteria be used for the remediation of land with radioactive residues. In the context of regulations, the Conference proposed an International Working Forum for Regulatory Supervision of Legacy Sites, coordinated by the Agency, where regulatory bodies could exchange experiences and knowledge in procedures and regulatory supervision. Draft terms of reference for the Forum were presented at the Conference. The Conference also supported the strategy of avoiding the creation of future legacy sites by proper planning and good operating practices and by promoting an environmental protection culture among mining companies. The Conference also gave strong support to ENVIRONET, a new Agency initiative that has the aim of promoting mutual interests and the sharing of information in the area of environmental remediation.

F.4. International Conference on Modern Radiotherapy: Advances and Challenges in Radiation Protection of Patient

211. This conference was organized by the French Nuclear Safety Authority ASN, in cooperation with the IAEA, WHO, EC and 18 other international and national organizations. It was held in Versailles, France from 2 – 4 December 2009. The event attracted more than 300 participants from many countries.

212. The major objective of the conference was to provide a forum for participants to exchange experience, and to review the actions implemented to improve the radiation safety in radiotherapy at both national and international level. An extensive technical programme was featured, including separate sections on lessons of radiotherapy accidents; safety reporting; individual radiosensitivity; stochastic risks; treatment of complications; quality audits; education and training; and new risks from new technology.

213. Papers were presented and discussions were held, not only from the health professionals' and regulatory authorities' viewpoints, but also from the manufacturers' and patients' perspectives.

214. Among the conclusions of the conference, it was noted that the lessons learned from accidents in conventional radiotherapy are still valid for newer radiotherapy technologies and that they should be incorporated into national training programmes, and taken into account for procedures in radiotherapy departments. There are, however, also new risks with new technologies that should be considered. In order to have a proactive approach to preventing accidents before they occur, proactive methods of safety assessment should be used in radiotherapy, providing a risk-informed and rational choice of safety provisions. The necessity of an international conference with broader scope was supported by the participants.

F.5. International Conference on Nuclear Power Newcomers and international cooperation.

215. More than 120 participants from 49 Member States and some international organizations came to Vienna from 3 - 5 November 2009 to discuss the issues that newcomers are currently facing in introducing their nuclear power programmes in safe and sustainable ways. This conference allowed participants to better understand newcomers' expectations regarding what experienced countries could be doing to support the infrastructure development efforts in countries embarking on nuclear power.

216. Current newcomers' issues, needs and expectations along with the perspectives from vendor countries were presented. Lastly, the roles and responsibilities of both newcomers when developing their nuclear infrastructure; and vendor countries, including government, vendors, manufacturers, suppliers, the regulatory body, TSOs, etc., in providing support to newcomers' organizations to ensure long-term safe and efficient operation, were discussed.

217. It was concluded that newcomers might be expecting too much from the IAEA, EU, vendor countries or other organizations. Strong national commitments and efforts following a robust political decision to introduce nuclear power within the country are essential to succeed in embarking on nuclear power. Newcomers need to be intelligent customers; they need to understand the technology, the process to embark on nuclear power and to be able to coordinate all assistance programmes provided from foreign countries, EU or international organizations to build up their nuclear and safety infrastructure. Such coordination should be enhanced for most newcomers. The main difficulties affecting safety infrastructure building in newcomer countries include:

- Developing human resource and keeping qualified and trained staff (avoiding brain drain). This includes all necessary industrial skills to be used on a large scale industrial project including those of welders, constructers, mechanics, electricians, heavy load transporters, logisticians, technicians and so on. Such a "localization" issue should be anticipated and carefully planned by newcomers in their national strategy when importing nuclear power technology.
- Establishing or consolidating the national newcomers legal and regulatory framework, which may take more time than expected.
- Transparency, openness and involvement of the public and stakeholders in the development of a nuclear power programme. This should be started before the decision to introduce nuclear power is taken and should be carried on with continuity throughout all the NPP lifetime including when dealing with spent fuel and radioactive waste management

218. The IAEA should perhaps facilitate newcomers' efforts to coordinate all assistance programmes and information sharing coming from foreign countries, EU and international organizations. Likewise, vendor countries should also consider coordinating their own nuclear stakeholders for better assistance towards newcomers.

F.6. International Conference on Effective Nuclear Regulatory Systems

219. In 2006, the first International Conference on Effective Nuclear Regulatory Systems was held in Moscow, with a focus on Facing Safety and Security Challenges. This conference brought together senior nuclear safety, radiation safety and security regulators from around the world to discuss how to improve regulatory effectiveness to assure protection of the public and the environment. During the Moscow conference, senior regulators decided that a forum dedicated to discussing regulatory effectiveness was needed every three years. Consequently, a second International Conference on

Effective Nuclear Regulatory Systems was held in Cape Town, South Africa from 14 to 18 December 2009 with a focus on further enhancing the global nuclear safety and security regime.

220. The objectives of this second International Conference on Effective Nuclear Regulatory Systems were to review and assess the effectiveness of the global nuclear safety and security regime, and to propose future actions to further enhance it. A regulatory body is effective when it ensures that an acceptable level of safety and security is being maintained by licensees/operators; when it takes appropriate actions to prevent the degradation of safety and security; when it takes actions to promote safety and security improvements; when it performs its regulatory functions in a timely and cost effective way; and when it strives for the continuous improvement of itself and the industry.

221. The action items resulting from the conference related to strengthening international safety and security cooperation with those countries embarking on new nuclear power programmes, focussing on capacity building; developing the international cooperative agreement to strengthen the safety and security of radioactive sources; enhancing the Global Nuclear Safety and Security Regime (GNSSR) through the promotion of the use of international legal instruments, safety standards, security guidance, peer reviews and knowledge networks; and increasing active participation in the GNSSR by Member States, especially supporting and facilitating the participation of those embarking on new nuclear power programmes.

F.7. International Ministerial Conference on Nuclear Energy in the 21st Century

222. Following the Ministerial Conference held in Paris in March 2005, the International Atomic Energy Agency held the International Ministerial Conference on Nuclear Energy in the 21st Century in Beijing, China, from 20 to 22 April 2009. This conference was designed to allow participants to discuss developments and emerging issues relevant to the role of nuclear power in providing clear and sustainable energy for national and regional development. The Conference was organized by the IAEA in cooperation with the OECD and OECD/NEA and was hosted by the Chinese Government.

223. The objectives of the conference were, inter alia, to recognize the positive momentum towards nuclear power and to further raise the profile of nuclear energy, to provide a forum for discussions between high level participants from a large number of countries about the role of nuclear power in meeting energy demands in a sustainable manner and to discuss the different aspects of, and conditions for, the development of nuclear power in developing and developed countries.

224. The participation of 808 experts from 61 IAEA Member States and seven international organizations, the national presentation on the future of nuclear power by 16 Ministers in person and 13 presentations made on behalf of Ministers demonstrate the timeliness and importance of this Conference. The participation of about 150 press and media people and broad media coverage are further indication of the increasing interest in nuclear energy.

225. The conference provided a platform for discussion of the future role of nuclear power. Many interested Governments and other parties presented and discussed their vision on the future of nuclear energy. It was observed that the interest was more specific during this Conference than during the first Ministerial Conference on nuclear energy in Paris in 2005, although there were no tangible actions such as orders from new countries, or breakthroughs in design or organisation which would make a radical change to future expectations.

G. Safety significant events in 2009

226. Through the various reporting mechanisms, the Agency was informed of 211 safety-related events involving or suspected of involving ionizing radiation. Most of these events were found to have no safety significance and/or no radiological impact to people or the environment. In 22 cases, the Agency took actions, such as authenticating and verifying information, providing official information or assistance to the requesting party, or offering the Agency's good offices.

227. The Nuclear Events Web Based System (NEWS) is a joint project of the Agency, OECD/NEA and WANO that provides fast, flexible and authoritative information on the occurrence of nuclear events that are of interest to the international community. NEWS covers all significant events at NPPs, research reactors, nuclear fuel cycle facilities, as well as occurrences involving radiation sources and the transport of radioactive material. The general public can access information submitted during the previous six months through the Agency's website.[9]

228. Events of interest that were reported to the Agency in 2009 include:

- **Ecuador**, April 2009 – a construction worker picked up a loose Class III 16 Ci (600 GBq) radiography source and kept it on his person for an extended period of time. His overexposure endangered his left leg. The IEC sent a team of international experts (Brazil and France) to investigate. IEC arranged with France for the injured worker to be transported and treated in that country. In September of 2009 the injured worker was released from successful treatment and now lives a normal life.

- **Belgium** experienced two events in 2009. In May, a technician performing measurements in a Co-60 irradiator cell (3,600 TBq) became aware that the irradiation start-up sequence had been initiated without first checking that no human beings were present in the cell. The technician immediately triggered one of the emergency stop systems inside the cell. This emergency stop interrupted the start-up sequence and shut down the installation. During June, a radiopharmaceuticals plant released "less than" 3TBq of radioactive Xenon. Production at the facility has been stopped. No protective actions were taken for the population. The alert was given by the Telerad automatic monitoring network. Measurements and model estimations indicated the order of magnitude of 1 microSv for the dose to the critical individual.

- The **Republic of Georgia** also experienced two events in 2009. In February a container of Cs-137 (radiation levels of 25R/hr) was discovered at the Kopitnari airport outside Kutaisi. Georgian authorities regained control of the sources suspected as being calibration sources left over from the Russian Army. July 2009 also proved eventful for the Georgians as elevated radiation was detected at a scrap metal site, and sources (Sr-90 and Cs-137) were identified as the reason for this. There was some contamination from Cs-137 but the removal of a thin layer was a sufficient measure to remove the contamination. The sources were put into transport containers and were placed in safe storage.

- **Burkina Faso** encountered problems with an aging irradiator used to control the spread of disease by sterilized tsetse flies. While no numbers are available the irradiation source (Cs-137) is still formidable, and interlock safety mechanisms are known to be failing, or circumvented, in order to continue operations. An IAEA internal coordination meeting was held, a message to the

[9] http://www-news.iaea.org/news/default.asp

operator was written to stop the operation until safe operation is guaranteed. Also steps were taken to contact the project counterparts. The stopping of the irradiator had negative impact on the project outcome (control of the flies that are the disease vectors).

- **France** experienced a "Lack of Respect for Safety Criticality at a Nuclear Fuel Facility, INES level 2 (Degradation of Defense-in-depth)" during March 2009. An exceptional operational criticality related event occurred in the laboratory of AREVA Melox facility (MOX plant) in March. The analysis revealed the inadequacy of the introduction procedure that applies to fuel samples coming from other facilities and a failure of the software for fissile material counting dedicated to the mass management of criticality-concerned workstations.

229. The Incident Reporting System (IRS) operated jointly with the OECD/NEA, was set up in 1983 to exchange information on unusual events at NPPs and increase awareness of actual and potential safety problems. Over more than twenty five years the IRS has proved its usefulness as a comprehensive source of information for worldwide operating experience and lessons learned from that experience.

230. The IRS is an essential element of the mechanism for providing feedback of international operating experience for NPPs. It ensures proper reporting and feedback of safety significant events for the international community, so that the causes, the lessons learned and the corrective actions can be disseminated widely. In this way, the IRS plays an important role in contributing to the prevention of occurrence or recurrence of incidents. The information provided through the IRS is also useful for making improvements in design, operational procedures, organizational aspects and human factors in NPPs. Activities within the IRS extend beyond the exchange of IRS reports. The Agency and the OECD/NEA have assigned meetings and working groups of experts who meet regularly and discuss the safety relevance of events, thus contributing to the dissemination of lessons learned to the international community and to the safe operation of NPPs.

231. The 2009 joint Agency – OECD/NEA meeting of the IRS national coordinators which was held this year at the International Energy Agency in Paris, France, discussed corrective actions and lessons learned from 25 recent events which occurred in nuclear power plants. These events were in a wide range of scope and complexity. A second part of the meeting was reserved for the response to two events reported to IRS considered by the IAEA Event Review Group as significant and which were brought to the attention of the IRS community when posted on the WB IRS: one from the US dealing with gas accumulations in different safety and safety related systems (IRS 7950), the other one from France dealing with water-soluble paper used during inert-gas welding (IRS 8014). This was the first time that this kind of response was asked for at an IRS Meeting.

H. Safety Networks

H.1. Asian Nuclear Safety Network (ANSN)

232. In April 2009, the second annual meeting of the Nuclear Safety Strategy Dialogue took place in Seoul, Korea. About 30 participants from the ANSN participating countries discussed broader strategy and policy issues to promote regional cooperation in capacity building in Asia, particularly the vision

for the ANSN by 2020. The participants confirmed the willingness to help to fulfil this vision by enhancing bilateral, regional and international cooperation for capacity building, knowledge and lessons learned sharing, peer review, advisory services and education and training. By the year 2020, the ANSN is expected to provide regional capacity building for all topics of nuclear safety infrastructure.

233. The 9th ANSN Steering Committee meeting was held in May 2009 in Yogyakarta, Indonesia, to review the ANSN activities since October 2008 and to decide on a work plan for the next 6 months based on recommendations made during the second Strategy Dialogue meeting. About 60 follow-up actions related to the vision for the ANSN by the year 2020 were listed and approved with a responsible body and target date for each action. Approval for the concept of a Virtual Technical Support Organisation, creation of a Sitting Topical Group and development of public awareness activities were some important decisions taken during this meeting.

234. A round-table discussion on enhancements of the ANSN took place in September in Vienna during the 53rd IAEA General Conference. Along with participants from ANSN participating countries, there were also participants from Africa and other networks. Discussions on how to improve the ANSN and how to harmonize and optimize its activities with other mechanisms including the Association of South-East Asian Nations (ASEAN) and the Forum for Nuclear Cooperation in Asia (FNCA) took place. Participants shared a view that cooperation among global and regional nuclear safety networks would be mutually beneficial and that ANSN could be a good model for the new networks. Further enhancement of cooperation and coordination among the regional networks (e.g. ANSN, FORO and the Forum of Nuclear Regulatory Bodies in Africa - FNRBA) for information exchange was encouraged by the ANSN member countries.

235. The 10th ANSN Steering Committee (SC) meeting was held in October 2009 in Singapore. Each topical group reported to the SC on the development of their mid-term planning and proposed work plan for 2010 based on the vision for the ANSN by the year 2020. The SC approved the proposal to establish a Capacity Building Coordination Group for coordinating and monitoring the topical group activities, particularly for developing the Regional Capacity Building System in Asia. It was agreed that the Capacity Building Coordination Group would explore appropriate performance indicators for assessing ANSN activities so that these activities will be evaluated based on outcomes rather than on outputs. A decision for the necessary coordination mechanism and management support functions to facilitate steady progress was also taken.

236. The IAEA's ANSN website was further improved in 2009 with the process of Integrated Safety Evaluation made available online. Also the topical group coordinators and ANSN member states can now submit regional as well as national activity requests online. Activity requests were successfully filed in the ANSN website and evaluated during the ANSN Steering Committee meeting.

H.2. Ibero-American Nuclear and Radiation Safety Network (FORO)

237. The 2009 FORO´s annual plenary meeting took place in June, in Argentina, where the presidency was transferred from Argentina to Brazil until June 2010. The plenary reviewed ongoing projects, as well as proposals for new projects.

238. The programme of work for 2009-2011 on integrated information management through the network, and a new project on strategy for the prevention, detection and response to inadvertent radioactive material in metal recycling and associated processes, were approved by the FORO´s plenary at its meeting in June 2009.

239. A project on Nuclear Safety was started in January 2009. The objective is to share experience ageing management and life extension of nuclear power plants in the region and elaborate technical advice to improve regulatory practices on the issue, including safety assessment and licensing.

240. The plenary also discussed the Agency's proposal to enhance FORO´s role in raising the level of safety in the region The FORO´s plenary agreed to increase cooperation with the Agency in organizing high level seminars to share policies, strategies and lessons learned from experience in order to improve the regulatory efficiency in the region. It also agreed to support with expertise and assistance capacity building in the region and is ready to explore interaction with other networks to obtain the maximal benefit worldwide.

241. The FORO´s technical activities are implemented within the Agency's Extrabudgetary Programme on Nuclear and Radiation Safety and Security. After about six years working on the implementation of the programme, it has become apparent that there is a need to consolidate the experience in implementing and administering the programme. To that effect, a written set of procedures are currently being drafted.

242. In 2009, the FORO provided assistance and expertise to the Agency's initiatives to disseminate and apply the knowledge gained with the FORO´s projects on risk analysis in radiotherapy: As many as 18 countries of the region participated. After dissemination, technical cooperation activities were launched to apply this knowledge in practice and to prepare a report in 2010 on the achievements.

243. Since the approval of the two-year programme of activities in June 2009, the FORO has developed a number of guides and procedures to select, optimize the content of the network and upload documents to be shared on the network, as well as a procedure for evaluating the network according to a set of performance indicators, based on the objectives of the network. The objectives are to effectively share information of regulatory interest. It also has carried out the first systematic evaluation of the efficiency of the network against performance indicators and derived a number of recommendations.

H.3. International Decommissioning Network (IDN)

244. In 2007, the IAEA launched a network to provide a continuing forum for the sharing of practical decommissioning experience in response to the needs expressed at the Athens Conference in December 2006 on "Lessons Learned from the Decommissioning of Nuclear Facilities and the Safe Termination of Nuclear Activities". This network is intended to bring together existing decommissioning initiatives both inside and outside the IAEA to enhance cooperation and coordination. The network aims at facilitating direct exchange of information between practitioners, i.e., between and among those with extensive decommissioning experience and those seeking to learn from this experience and to promote application of best practices in decommissioning technology, planning, project management, and the management of nuclear wastes.

245. A number of activities were conducted in 2009, including workshops and training courses on fundamentals of decommissioning for project managers and planners, on planning and implementation of decommissioning for research reactors and other small facilities, technologies for characterization, waste management, dismantling and clearance, organization and implementation of decommissioning on multi-facility sites. The Annual IDN meeting was held in November 2009 in Vienna. The meeting was a possibility for a review of national situations, needs for support from other IDN members and offers for hosting decommissioning trainings and workshops. The meeting was followed by a two days topical training on a decommissioning stakeholder involvement.

H.4. Disposal of low level radioactive waste (DISPONET)

246. Following the growing demand from Member States for assistance in disposal of low level radioactive waste, a network was established in 2009 to increase efficiency in sharing international experience in this area. DISPONET is intended to bring together those planners, developers and operators of disposal facilities who wish to steadily improve international practices and approaches in managing low level waste. The network aims at coordinating support to organizations or Member States with less advanced programmes for disposal of low-level waste, by making available the relevant skills, knowledge, managerial approaches and expertise from Member States with operating disposal facilities and to organize an expanded range of training and demonstration activities with a regional or thematic focus providing hands-on, user-oriented experience and disseminating proven technologies. Topics considered cover the full scope of disposal issues and respect different national approaches, in particular low level and very low level waste, including disused sealed radioactive sources, facilities for surface and subsurface disposal: planning, siting, design, construction, assessment of safety, operation, closure, monitoring and institutional control.

H.5. Global Nuclear Safety and Security Network (GNSSN)

247. The Secretariat has established a prototype of the global nuclear safety and security network (GNSSN), based on the structure of the Agency's safety standards and security guidance. The hardware and software have been selected and the configuration and content management are in process. The GNSSN was presented at the International Conference on Effective Nuclear Regulatory Systems in South Africa in December 2009.

248. The GNSSN is the set of existing networks, such as the Asian Nuclear Safety Network and the Ibero-American Nuclear and Radiation Safety Network, and other internationally accessible information and data sources. The aim of the GNSSN is to ensure that critical knowledge, experience, and lessons learned about nuclear safety and security are exchanged as broadly as they need to be. The GNSSN constitutes the framework for knowledge networks in the global nuclear safety and security regime, related to the sharing of information and knowledge among the global expert community.

249. One section of the GNSSN will be the International Regulatory Network (RegNet). RegNet will serve the specific needs of regulators and relevant international organizations by strengthening and enhancing existing networks. RegNet will include areas for the Integrated Regulatory Review Service, generic safety issues, the Radiation Safety Regulators Network (RaSaReN), and country nuclear regulatory profiles.

H.6. International Regulatory Knowledge Network (RegNet)

250. RegNet was originally initiated at the International Conference on Effective Nuclear Regulatory Systems in 2006 in Moscow. There was strong support by Member States and other international organizations and it was recognized that establishment of regulatory network to share and exchange regulatory information covering the nuclear, radiation, waste and transport safety in a efficient and effective manner is quite urgent and necessary among the regulators. In 2008, IAEA established the RegNet project in the regular budget.

251. In 2009, several meetings were held to further develop the framework and detailed technical aspects for all the designed components of RegNet with the help of German Federal Government (BMU) and its Technical Support Organization (GRS). Prototype platforms for RegNet on the German side have been established, including the IRRS platform, Country Nuclear Regulatory Profiles (CNRP) and Generic Safety Issues (GSI). It is expected that other components of RegNet would be developed by the middle of next year.

252. In session 4 of the conference related to International Safety and Security Cooperation, a specific presentation was made on Global, Regional or Thematic Networks for Regulators. In the presentation itself and during the ensuing discussions, the statement was made that the GNSSN is currently under development and would be made available to Member States during 2010.

Appendix 2
The Agency's Safety Standards: Activities during 2009

A. Introduction

253. Article III.A.6 of the IAEA Statute authorizes the Agency "to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property (including such standards for labour conditions), and to provide for the application of these standards to its own operation as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision; and to provide for the application of these standards, at the request of the parties, to operations under any bilateral or multilateral arrangements, or, at the request of a State, to any of that State's activities in the field of atomic energy." The categories in the Safety Standards Series are Safety Fundamentals, Safety Requirements and Safety Guides.

254. One of the main achievements during the year was the completion of the work of the Commission on Safety Standards (CSS) on the definition of the long term structure of safety standards initiated by the roadmap approved in 2008. This provides for an improved structure and format for the Safety Requirements and a reference set for the collection of Safety Guides.

255. Another main achievement results from the organization in April 2009 of a joint AdSec (Advisory Group on Nuclear Security) and CSS session to exchange on issues relating to safety and security synergies and interfaces, and on the feasibility of working towards the establishment of Nuclear Safety and Security Standards that would cover both nuclear safety and nuclear security.

256. It was agreed to establish a joint task force, to be co-chaired by the Chairman of AdSec and the Chairman of the CSS, with equal participation of members from both groups and with support from the Secretariat. At its first meeting in October 2009, the Task Force finalized its proposed terms of reference, including short and long term objectives. For the short term, the task force will follow the implementation of the measures to strengthen, and ensure the transparency of the process for the review and approval of Nuclear Security Series publications and will propose steps to establish in a progressive manner the necessary interface of nuclear safety and nuclear security related draft publications, including their cross-verification, to ensure their completeness and consistency. For the long term, the task force will study the feasibility of the establishment of a *Nuclear Safety and Security Standards Series* that would cover both nuclear safety and nuclear security.

257. The first two General Safety Requirements of the new structure of safety requirements on Safety Assessment for Facilities and Activities and on Predisposal Management of Radioactive Waste were adopted as Agency standards by the Board of Governors in 2009 and published respectively as GSR Part 4 and GSR Part 5.

258. The draft revision of the Safety Requirements NS-R-2: *Safety of Nuclear Power Plants: Commissioning Operation* was approved by the Safety Standards Committees in 2009 for submission to the Commission on Safety Standards early in 2010. The revision of the Safety Requirements No.

NS-R-1: *Safety of Nuclear Power Plants: Design* was submitted to Member States for comment in 2009.

259. In 2009, the revision of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (the BSS) continued and draft 2.5 was reviewed by the Safety Standards Committees at their meeting in October and November 2009 and approved for submission to Member States for comments.

260. Regarding the processes associated with the safety standards programme, several significant improvements were observed. In particular, these improvements led to increased levels of openness, transparency and quality of the safety standard review process; greater involvement of the users and interested parties, including collaborators in industry; and greater interaction between the Member States, the Committees and the Commission on Safety Standards. In 2009, this was further complemented by the preparation of a strategy paper on stakeholder involvement in the planning, preparation, review and approval of safety standards. Its approval expected in March 2010 will allow its implementation for the fifth term of the Committees starting in 2011. These improvements were facilitated by the use of information technologies and, in particular, the newly established interactive website[10].

261. Since the establishment of the Commission on Safety Standards and the Committees in 1995, 107 standards have been established; of these, 97 (one Safety Fundamentals, 15 Safety Requirements and 81 Safety Guides) have been published; and 51 further standards (five Safety Requirements publications and 46 Safety Guides) are being drafted or revised. A list of published IAEA Safety Standards, indicating their status as of 31 December 2009, is attached as Annex I, and an up-to-date status report can be found on the Agency's website[11]. The full texts of published IAEA Safety Standards are also available on the website through this status report.

B. Commission on Safety Standards (CSS)

262. The CSS met twice in 2009, in April and in October and endorsed the submission to the Board of Governors for approval of two Safety Requirements on Governmental, Legal and Regulatory Framework for Safety, Safety Requirement (DS415) and on Disposal of Radioactive Waste, Safety Requirement (DS354). The CSS also endorsed nine Safety Guides on Schedules of Provisions of the IAEA Regulations for the Safe Transport of Radioactive Material (DS387), Chemistry Programme for Water Cooled Nuclear Power Plants, Safety Guide (DS388), Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants (DS393), Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants (DS394), Deterministic Safety Analyses and their Application for Nuclear Power Plants (DS395), Radiation Safety in Industrial Radiography, Safety Guide (DS408), Radiation Safety of Gamma, Electron and X Ray Irradiation Facilities, Safety Guide (DS409), Ageing Management for Research Reactors (DS412), Licensing Process for Nuclear Installations (DS416) and Seismic Hazards in Site Evaluation for Nuclear Installations (DS422).

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[10] http://www-ns.iaea.org/standards/

[11] http://www-ns.iaea.org/downloads/standards/status.pdf

263. CSS also approved in 2009 five Document Preparation Profiles (DPPs) for Safety Guides on Radiological Environmental Impact Analysis for the verification of Radiological Protection (DS427), External Expert Support on Safety Issues (DS429), Design of Electric Power Systems for NPPs (DS430), Design of I&C Systems for NPPs (DS431) and on Volcanic Hazards in Site Evaluation for Nuclear Installations (DS405).

C. Nuclear Safety Standards Committee (NUSSC)

264. NUSSC, chaired by Mr. Geoff Vaughan of the Nuclear Installations Inspectorate of the United Kingdom, met twice during 2009.

265. At its meetings in June and October 2009, NUSSC approved 9 draft IAEA safety standards for submission to the CSS, namely. Storage of Spent Fuel (DS371); Chemistry Programme for Water Cooled Nuclear Power Plants (DS388); Ageing Management for Research Reactors (DS412); Governmental, Legal and Regulatory Framework for Safety (revision of GS-R-1, DS415); Licensing Process for Nuclear Installations (DS416); Evaluation of Seismic Hazard for Nuclear Installations (DS422), Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency (DS44), Storage of Spent Fuel (DS371), and Safety of Nuclear Power Plants: Commissioning and Operation (revision of NS-R-2, DS413).

266. In addition NUSSC reviewed and commented on 7 draft safety standards namely Safety Assessment for Research Reactors and Preparation of the Safety Analysis Report (DS396); Volcanic Hazards in Site Evaluation for Nuclear Installations (DS405); Safety of Nuclear Power Plants: Design (revision of NS-R-1, DS414); Establishing a Safety Infrastructure for a National Nuclear Power Programme (DS424), International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (Revision of the BSS, DS379), Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations (DS417), Use of a graded approach in the application of safety requirements for Research Reactors (DS351), and Periodic Safety Review of Nuclear Power Plants (DS426). In 2009, NUSSC also approved DPPs for 8 new, or revision of safety standards.

267. NUSSC reviewed twice the document *"Strategies and Processes for the Establishment of IAEA Safety Standards (SPESS)",* which describes the strategies, the processes and associated responsibilities for the planning, development, review and revision, approval and establishment of the IAEA safety standards. NUSSC also discussed finally the strategy for the future development and application of the IAEA Safety Standards, in particular the *"Reference Set of Safety Guides for the Long-Term*".

268. The document on *"Stakeholder Involvement in the Establishment of IAEA Safety Standards"* was reviewed and discussed twice. It establishes a clear set of criteria to determine which organizations may be invited at the various stages of development of the IAEA safety standards (e.g. drafting consultancies and NUSSC meetings). It also specifies the expected contribution from these invited stakeholders in the review and approval process, including contributions in terms of feedback from the application of the IAEA safety standards.

D. Radiation Safety Standards Committee (RASSC)

269. RASSC, chaired by Mr. Sigurður Magnusson of the Icelandic Radiation Protection Institute, met in June-July and November in 2009. Both meetings included a joint session with WASSC to discuss issues of common interest, and the June-July meeting included a joint meeting with WASSC and TRANSSC.

270. RASSC reviewed at its meeting in June-July draft 2.0 of the revised International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS). More than 500 written comments were provided, some of which were suggestions to improve the text, while others were of a substantive nature.

271. At its meeting in November, RASSC reviewed and approved for submission to the Member States the draft 2.5 of the revised BSS.

272. In 2009, RASSC also approved for submission to the CSS the draft Safety Requirements Safety of Nuclear Power Plants: Commissioning and Operation (revision of NS-R-2, DS413), Governmental, Legal and Regulatory Framework for Safety (revision of GS-R-1, DS415) and Disposal of Radioactive Waste (revision and combination of WS-R-1 and WS-R-4, DS354) as well as the following Safety Guides, Criteria for use in Preparedness and Response for a Nuclear or Radiological Emergency (DS44), Geological Disposal of Radioactive Waste (DS334), Storage of Spent Fuel (DS371), Chemistry Programme for Water Cooled Nuclear Power Plants (DS388), Radiation Safety in Industrial Radiography (DS408), Radiation Safety of Gamma, Electron and X-Ray Irradiation Facilities (DS409) and Licensing Process for Nuclear Installations (DS416).

273. RASSC also approved for submission to the Member States for comments the draft Safety Requirements Safety of Nuclear Power Plants: Design (revision of NS-R-1, DS414) and the following draft Safety Guides, Near Surface Disposal of Radioactive Waste (DS356), National Strategy for Regaining Control over Orphan Sources and Improving Control over Vulnerable Sources (DS410), Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries (DS411), Establishing a Safety Structure for a National Nuclear Power Programme (DS424) and Periodic Safety Review of Nuclear Power Plantss (DS426).

274. In a number of instances the need for amendment was identified and the approval of RASSC was subject to the document being satisfactorily revised and to approval being received from other Safety Standards Committees and/or their Chairpersons.

E. Transport Safety Standards Committee (TRANSSC)

275. TRANSSC met twice in 2009, in June/July and October. At the June/July meeting there was a joint RASSC/WASSC/TRANSSC session and a WASSC/TRANSSC session.

276. TRANSSC approved for submission to the CSS two draft Safety Requirements publications, Safety of Nuclear Power Plants: Commissioning and Operation (revision of NS-R-2, DS413),

Governmental, Legal and Regulatory Framework for Safety (revision of GS-R-1, DS415) and four draft Safety Guides, Criteria for use in Preparedness and Response for a Nuclear or Radiological Emergency (DS44), Radiation Safety in Industrial Radiography (DS408), Radiation Safety of Gamma, Electron and X Ray Irradiation Facilities (DS409) and Licensing Process for Nuclear Installations (DS416).

277. TRANSSC also approved for submission to Member States for comments two draft Safety Requirement, Safety of Nuclear Power Plants: Design (Revision of NS-R-1, DS414) and the draft 2.5 of the revised BSS. TRANSSC also approved for submission to Member States for comments on two Safety Guides on Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries (DS411) and on Establishing a Safety Structure for a National Nuclear Power Programme (DS424).

278. TRANSSC also approved four DPPs for one Safety Requirement and three Safety Guides. A draft DPP for Safety of Small/Medium, Transportable and Floating Nuclear Power Plants was also reviewed.

279. In 2009 TRANSSC carried out a review of the IAEA transport Regulations and concluded that there were sufficient safety related reasons to initiate a revision of the document. This was mainly based on the need to improve the regulations defining and controlling excepted quantities of fissile material.

F. Waste Safety Standards Committee (WASSC)

280. WASSC, chaired by Mr. Thiagan Pather of the National Nuclear Regulator of South Africa, met twice in 2009, in June/July and November. Both meetings included joint sessions with RASSC to discuss issues of common interest. At the June/July meeting there was a joint RASSC-WASSC-TRANSSC session and a WASSC/TRANSSC session dedicated to discuss the outcome of the WASSC-TRANSC WG meeting, held in March 2009.

281. In 2009, WASSC approved for submission to the CSS three draft Safety Requirements publications Governmental, Legal and Regulatory Framework for Safety (Revision of GS-R-1, DS415), Disposal of Radioactive Waste (Revision of WS-R-1 and WS-R-4, DS354) and Safety of Nuclear Power Plants: Commissioning and Operation (Revision of NS-R-2, DS413). WASSC also approved for submission to the CSS seven draft Safety Guides on: Criteria for use in Preparedness and Response for a Nuclear or Radiological Emergency (DS44), Storage of Spent Fuel (DS371), Chemistry Programme for Water Cooled Nuclear Power Plants (DS388), Licensing Process for Nuclear Installations (DS416), Evaluation of Seismic Hazards for Nuclear Facilities (DS22), Periodic Safety Review of Nuclear Power Plants (DS426) and Geological Disposal of Radioactive Waste (DS334).

282. In addition, WASSC approved for submission to Member States for comments a draft Safety Requirement on: Safety of Nuclear Power Plants: Design (Revision of NS-R-1, DS414) and the draft 2.5 of the revised BSS. WASSC approved as well for submission to Member States for comments eight draft Safety Guides on: National Strategy for Regaining Control over Orphan Sources and Improving Control over Vulnerable Sources (DS410), Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries (DS411), Licensing Process for Nuclear Installations (DS416), Establishing a Safety Structure for a National Nuclear Power Programme (DS424),

International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (revision of the BSS, DS379), Near Surface Disposal of Radioactive Waste (DS356), Volcanic Hazards in Site Evaluation for Nuclear Installations (DS405) and Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations (DS417).

283. WASSC also approved one DPP for the Revision of the Regulations for the Safe Transport of Radioactive Material; and four DPPs for Safety Guides on: External expert support on safety issues, Radiation Protection of the Public and the Environment, Site Survey and Site Selection for Nuclear Installations and Radiation Safety of Radioisotope Production Facilities.

284. During 2009 WASSC members provided additionally feedback on the draft Safety Guide on Monitoring and Surveillance of Radioactive Waste Disposal Facilities, and on the Revision of the Safety Guides on Decommissioning.

Annex I
The published IAEA Safety Standards as of 31 December 2009

A. Safety Fundamentals

SF-1	Fundamental Safety Principles (2006) **Co-sponsorship:** Euratom, FAO, ILO, IMO, OECD/NEA, PAHO, UNEP, WHO

B. Thematic Safety Standards

B.1. Legal and Governmental Infrastructure

GS-R-1	Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (2000) (under revision)
GS-G-1.1	Organization and Staffing of the Regulatory Body for Nuclear Facilities (2002)
GS-G-1.2	Review and Assessment of Nuclear Facilities by the Regulatory Body (2002)
GS-G-1.3	Regulatory Inspection of Nuclear Facilities and Enforcement by the Regulatory Body (2002)
GS-G-1.4	Documentation for Use in Regulating Nuclear Facilities (2002)
GS-G-1.5	Regulatory Control of Radiation Sources (2004) **Co-sponsorship:** FAO, ILO, PAHO, WHO

Two other Safety Guides on licensing process for nuclear installations and on establishing a national nuclear installations safety infrastructure are being developed.

B.2. Emergency Preparedness and Response

GS-R-2	Preparedness and Response for a Nuclear or Radiological Emergency (2002) **Co-sponsorship:** FAO, OCHA, OECD/NEA, ILO, PAHO, WHO
GS-G-2.1	Arrangements for Preparedness for a Nuclear or Radiological Emergency (2007) **Co-sponsorship:** FAO, OCHA, ILO, PAHO, WHO
109	Intervention Criteria in a Nuclear or Radiation Emergency (1994) (under revision)

One Safety Guide on criteria for use in planning response to nuclear and radiological emergencies (replacing 109) is being developed.

B.3. Management System

GS-R-3	The Management System for Facilities and Activities (2006)
GS-G-3.1	Application of the Management System for Facilities and Activities (2006)
GS-G-3.2	The Management System for Technical Services in Radiation Safety (2008)
GS-G-3.3	The Management System for the Processing, Handling and Storage of Radioactive Waste (2008)
GS-G-3.4	The Management System for the Disposal of Radioactive Waste (2008)

GS-G-3.5 The Management System for Nuclear Installations (2009)

B.4. Assessment and Verification

GSR Part 4 Safety Assessment for Facilities and Activities (2009)
GS-G-4.1 Format and Content of the Safety Analysis report for Nuclear Power Plants (2004)

Two Safety Guides on risk informed decision making and on criticality are also being developed.

B.5. Site Evaluation

NS-R-3 Site Evaluation for Nuclear Installations (2003)
NS-G-3.1 External Human Induced Events in Site Evaluation for Nuclear Power Plants (2002)
NS-G-3.2 Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants (2002) (under revision)
NS-G-3.3 Evaluation of Seismic Hazard for Nuclear Power Plants (2003) (under revision)
NS-G-3.4 Meteorological Events in Site Evaluation for Nuclear Power Plants (2003) (under revision)
NS-G-3.5 Flood hazard for Nuclear Power Plants on Coastal and River Sites (2004) (under revision)
NS-G-3.6 Geotechnical Aspects of Site Evaluation and Foundations for Nuclear Power Plants (2005)

B.6. Radiation Protection

115 International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996) **Co-sponsorship:** FAO, ILO, OECD/NEA, PAHO, WHO (under revision)
RS-G-1.1 Occupational Radiation Protection (1999) **Co-sponsorship:** ILO
RS-G-1.2 Assessment of Occupational Exposure Due to Intakes of Radionuclides (1999) **Co-sponsorship:** ILO
RS-G-1.3 Assessment of Occupational Exposure Due to External Sources of Radiation (1999) **Co-sponsorship:** ILO
RS-G-1.4 Building Competence in Radiation Protection and the Safe Use of Radiation Sources (2001) **Co-sponsorship:** ILO, PAHO, WHO
RS-G-1.5 Radiological Protection for Medical Exposure to Ionizing Radiation (2002) **Co-sponsorship:** PAHO, WHO
RS-G-1.7 Application of the Concepts of Exclusion, Exemption and Clearance (2004)
RS-G-1.8 Environmental and Source Monitoring for Purposes of Radiation Protection (2005)
RS-G-1.9 Categorization of Radioactive Sources (2005)
RS-G-1.10 Safety of Radiation Generators and Sealed Radioactive Sources (2006) **Co-sponsorship**: ILO, PAHO, WHO

Two Safety Guides on protection of the public against exposure to natural sources of radiation, including NORM and on justification of practices are being developed.

B.7. Radioactive Waste Management

GSR Part 5 Predisposal Management of Radioactive Waste (2009)
WS-G-1.2 Management of Radioactive Waste from the Mining and Milling of Ores (2002) (under revision)
WS-G-2.3 Regulatory Control of Radioactive Discharges to the Environment (2000)
WS-G-2.5 Predisposal Management of Low and Intermediate Level Radioactive Waste (2003)
WS-G-2.6 Predisposal Management of High Level Radioactive Waste (2003)

WS-G-2.7	Management of Waste from the Use of Radioactive Materials in Medicine, Industry, Agriculture, Research and Education (2005)
WS-G-6.1	Storage of Radioactive Waste (2006)
111-G-1.1	Classification of Radioactive Waste (1994) (under revision)

One Safety Guide on safety assessment is being developed.

B.8. Decommissioning

WS-R-5	Decommissioning of Facilities Using Radioactive Material (2006)
WS-G-2.1	Decommissioning of Nuclear Power Plants and Research Reactors (1999) (under revision)
WS-G-2.2	Decommissioning of Medical, Industrial and Research Facilities (1999) (under revision)
WS-G-2.4	Decommissioning of Nuclear Fuel Cycle Facilities (2001) (under revision)
WS-G-5.1	Release of Sites from Regulatory Control on Termination of Practices (2006)
WS-G-5.2	Safety Assessment for the decommissioning of Facilities Using Radioactive Material (2008)

B.9. Remediation

WS-R-3	Remediation of Areas Contaminated by Past Activities and Accidents (2003)
WS-G-3.1	Remediation Process for Areas Affected by Past Activities and Accidents (2007)

TS-R-1	Regulations for the Safe Transport of Radioactive Material 2009 Edition (2009)
TS-G-1.1 Rev1	Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (2008)
TS-G-1.2	Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material (2002)
TS-G-1.3	Radiation Protection Programmes for the Transport of Radioactive Material (2007)
TS-G-1.4	The Management System for the Safety Transport of Radioactive Material (2008)
TS-G-1.5	Compliance Assurance for the Safe Transport of Radioactive Material (2009)

One Safety Guides on schedule of provisions is being developed.

C. Facility Specific Safety Standards

C.1. Design of Nuclear Power Plants (NPPs)

NS-R-1	Safety of Nuclear Power Plants: Design (2000) (under revision)
NS-G-1.1	Software for Computer Based Systems Important to Safety in Nuclear Power Plants (2000)
SSG-2	Deterministic Safety Analysis for Nuclear Power Plants (2009)
NS-G-1.3	Instrumentation and Control Systems Important to Safety in Nuclear Power Plants (2002)
NS-G-1.4	Design of Fuel Handling and Storage Systems for Nuclear Power Plants (2003)
NS-G-1.5	External Events Excluding Earthquakes in the Design of Nuclear Power Plants (2004)
NS-G-1.6	Seismic Design and Qualification for Nuclear Power Plants (2003)
NS-G-1.7	Protection against Internal Fires and Explosions in the Design of Nuclear Power Plants (2004)
NS-G-1.8	Design of Emergency Power Systems for Nuclear Power Plants (2004)

NS-G-1.9	Design of the Reactor Coolant System and Associated Systems in Nuclear Power Plants (2004)
NS-G-1.10	Design of Reactor Containment Systems for Nuclear Power Plants (2004)
NS-G-1.11	Protection against Internal Hazards other than Fires and Explosions in the Design of Nuclear Power Plants (2004)
NS-G-1.12	Design of the Reactor Core for Nuclear Power Plants (2005)
NS-G-1.13	Radiation Protection Aspects of Design for Nuclear Power Plants (2005)
79	Design of Radioactive Waste Management Systems at Nuclear Power Plants (1986)

Three Safety Guides on safety classification of structures, systems and components, on development and application of level 1 and level 2 PSA are being developed.

C.2. Operation of NPPs

NS-R-2	Safety of Nuclear Power Plants: Operation (2000) (under revision)
NS-G-2.1	Fire Safety in the Operation of Nuclear Power Plants (2000)
NS-G-2.2	Operational limits and Conditions and Operating Procedures for Nuclear Power Plants (2000)
NS-G-2.3	Modifications to Nuclear Power Plants (2001)
NS-G-2.4	The Operating Organization for Nuclear Power Plants (2002)
NS-G-2.5	Core Management and Fuel Handling for Nuclear Power Plants (2002)
NS-G-2.6	Maintenance, Surveillance and In-Service Inspection in Nuclear Power Plants (2002)
NS-G-2.7	Radiation Protection and Radioactive Waste Management in the Operation of Nuclear Power Plants (2002)
NS-G-2.8	Recruitment, Qualification and Training of Personnel for Nuclear Power Plants (2003)
NS-G-2.9	Commissioning for Nuclear Power Plants (2003)
NS-G-2.10	Periodic Safety Review of Nuclear Power Plants (2003) (under revision)
NS-G-2.11	A System for the Feedback of Experience from Events in Nuclear Installations (2006)
NS-G-2.12	Ageing Management for Nuclear Power Plants (2009)
NS-G-2.13	Evaluation of Seismic Safety for Existing Nuclear Installations (2009)
NS-G-2.14	Conduct of Operations at Nuclear Power Plants (2008)
NS-G-2.15	Severe Accident Management Programmes for Nuclear Power Plants (2009)

One Safety Guide on chemistry is being developed.

C.3. Research Reactors

NS-R-4	Safety of Research Reactors (2005)
NS-G-4.1	Commissioning of Research Reactors (2006)
NS-G-4.2	Maintenance, Periodic Testing and Inspection of Research Reactors (2006)
NS-G-4.3	Core Management and Fuel Handling for Research Reactors (2008)
NS-G-4.4	Operational Limits and Conditions and Operating Procedures for Research Reactors (2008)
NS-G-4.5	The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors (2008)
NS-G-4.6	Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors (2008)
35-G1	Safety Assessment of Research Reactors and Preparation of the Safety Analysis Report (1994) (under revision)
35-G2	Safety in the Utilization and Modification of Research Reactors (1994) (under revision)

Three Safety Guides on radiation protection and waste management; use of graded approach, Safety in the Use and Modification of Research Reactors and ageing management are being developed.

C.4. Fuel Cycle Facilities

NS-R-5	Safety of Nuclear Fuel Cycle Facilities (2008)
116	Design of Spent Fuel Storage Facilities (1995) (under revision)
117	Operation of Spent Fuel Storage Facilities (1995) (under revision)

Six Safety Guides on: safety of uranium fuel fabrication; MOX fuel fabrication; conversion facilities; reprocessing facilities; fuel cycle R&D and storage of spent fuel are being developed.

C.5. Radiation Related Facilities

107	Radiation Safety of Gamma and Electron Irradiation Facilities (1992) (under revision)
RS-G-1.5	Radiological Protection for Medical Exposure to Ionizing Radiation (2002) (under revision)
RS-G-1.6	Occupational Radiation Protection in the Mining and Processing of Raw Materials (2004)

Six Safety Guides on industrial radiography, on national strategy for regaining control over orphan sources, on orphan radioactive sources in the metal recycling industry, on radiation safety in well logging and on radiation safety for nuclear gauges are being developed.

C.6. Waste Treatment and Disposal Facilities

WS-R-1	Near Surface Disposal of Radioactive Waste (1999) (under revision)
WS-R-4	Geological Disposal of Radioactive Waste (2006) (under revision)
WS-G-1.1	Safety Assessment for Near Surface Disposal of Radioactive Waste (1999) (under revision)
111-G-3.1	Siting of Near Surface Disposal Facilities (1994) (under revision)
111-G-4.1	Siting of Geological Disposal Facilities (1994) (under revision)
SSG-1	Borehole Disposal Facilities for Radioactive Waste (2009)

One other Safety Guide on monitoring and surveillance of disposal facilities is being developed.