Nuclear Safety Review for the Year 2008

GC(53)/INF/2

Nuclear Safety Review
For the Year 2008

IAEA/NSR/2008

Printed in the IAEA in Austria
July 2009

Foreword

The *Nuclear Safety Review for the Year 2008* 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 2008 (Appendix 1) and The Agency's Safety Standards: Activities during 2008 (Appendix 2).

A draft version of the Nuclear Safety Review for the Year 2008 was submitted to the March 2009 session of the Board of Governors in document GOV/2009/2. The final version of the *Nuclear Safety Review for the Year 2008* was prepared in the light of the discussions in the Board of Governors.

Executive Summary

Nuclear technologies are increasingly seen as important solutions for meeting a number of challenges. Enabling the peaceful use of nuclear technology to support global energy demands and other human needs must be accompanied by deliberate, internationally-coordinated actions to minimize the potential for nuclear accidents and terrorism. While in recent years, the safety performance of the nuclear industry has been good, it is important to avoid any complacency. The Agency continues to support and promote the global nuclear safety and security regime as a framework for worldwide achievement of high levels of safety and security in nuclear activities.

In 2008, three general themes can be observed from the global trends, issues and challenges in nuclear safety: the continuous improvements in strengthening safety worldwide through international cooperation; an expected increase of new entrant nuclear power programmes and the expansion of existing programmes; and safety and security synergy. Regarding continuous improvements to strengthen safety worldwide, the focus was on operating experience feedback and knowledge networking; and self-assessment and peer review. In the areas of new entrant nuclear programmes and expansion of existing nuclear programmes, activities centred on national safety infrastructures; human resources and capacity building; regulatory independence; nuclear incident and emergency preparedness and response; spent fuel and radioactive waste management; and multinational aspects of nuclear activities. In the area of safety and security synergy, in 2008 there was increasing awareness that processes need to be in place to ensure that safety activities do not compromise security and vice versa.

As outlined in Safety Fundamentals No. SF-1, the prime responsibility for safety must rest with the person or organization responsible for facilities and activities that give rise to radiation risks. An effective legal and governmental framework for safety, including an independent regulatory body, must also be established and sustained. The development of a national safety infrastructure and relevant capacity building are complex undertakings that take significant time and resources. Safety infrastructure is particularly important for nuclear power programmes. From site selection through to eventual decommissioning, the lifetime of a nuclear power plant can exceed 100 years. A growing number of Member States are considering a nuclear power programme for the first time. These new entrants may have an adequate safety infrastructure for their current nuclear applications, but do not yet have an adequate infrastructure for the implementation of a nuclear power programme.

The nuclear industry is becoming increasingly multinational in nature. In the nuclear power sector, there are a large number of nuclear power plant component suppliers and service providers. To provide assurances that these suppliers, particularly those that supply major components, are meeting the high standards of quality required, oversight audits are conducted. Through careful coordination of effort, there is an opportunity for suppliers, utilities and regulatory bodies to enhance the efficiency and effectiveness of this oversight. There is general international understanding that suppliers of nuclear technology have to assist new entrant countries in the development of the appropriate national safety infrastructure.

In the area of incident and emergency preparedness and response, there continues to be a need to establish clear communication procedures in response to any type of radiation incident or emergency to ensure that the public is well informed. There is also a need to increase the number of drills and exercises in incident and emergency response at all levels, as well as expanding their scope to include both safety and security aspects and initiators. By the end of 2008, 14 Member States had registered a number of expert capabilities with the Agency's Response Assistance Network. In July 2008, an emergency exercise, hosted by Mexico and known as ConvEx3 (2008), tested the international response to a simulated accident at a nuclear power plant. The Agency used its Incident and

Emergency Centre to act as the global focal point for international communication and response during the exercise.

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, receives continued attention among Member States. The deposit by the USA of its instrument of ratification of the Convention on Supplementary Compensation for Nuclear Damage (CSC) marked an important milestone towards bringing the entry into force of the CSC. The International Expert Group on Nuclear Liability (INLEX) continues to serve as the Agency's main forum dealing with questions related to nuclear liability. In 2008, INLEX discussed, inter alia, outreach activities and the ongoing European Commission's impact assessment on nuclear liability.

Nuclear power plant operators continued to show strong safety performance in 2008, with no serious accidents or significant radiation exposure to workers or the public to report. During the Agency's International Conference on Topical Issues in Nuclear Installation Safety, held in Mumbai, India in November 2008, participants concluded that an integrated nuclear safety approach based on the defence in depth principle and deterministic criteria, when properly applied and complemented with probabilistic analyses and operational experience feedback, continues to be successful. The re-evaluation of the integrity of existing nuclear installations, taking into account the increased magnitude observed during recent severe earthquakes and extreme natural events, has begun. At the request of Member States, the Agency has conducted generic reactor safety reviews to assess new nuclear power plant designs for consistency with the Agency's safety standards.

In April 2008, Contracting Parties to the Convention on Nuclear Safety held their 4th Review Meeting. The Meeting concluded that all Contracting Parties in attendance were in compliance with the requirements of the Convention. Contracting Parties also noted that a number of challenges remain, including effective regulatory separation and independence, and new reactor licensing.

Research reactors around the world continued to be operated safely in 2008 and there were no serious accidents. More Member States are using the Code of Conduct on the Safety of Research Reactors to guide their research reactor activities. The loss of experienced staff due to retirement continues to be compounded by the difficulty of recruiting new personnel and is still a critical issue in some research reactor facilities. While many Member States are aware of the need for preliminary decommissioning plans for research reactors, in most cases this awareness is not followed by concrete action.

As reported in previous years, there is increasing openness among operators of fuel cycle facilities to share safety information, and more use is being made of the Fuel Incident Notification and Analysis System. Fuel cycle facilities face unique safety challenges and although the principles of fuel cycle safety are similar to those of nuclear power plants, the approach to safety must be adequately graded.

In general, occupational radiation protection in nuclear installations around the world is well managed. Most significant occupational radiation exposures involve workers handling radioisotopes. Frequently, overexposures occur in isolated locations where supervision is limited and radiation protection programmes are not well developed. More than half of all radiation exposed workers are now in the medical field. New challenges in the occupational radiation protection of medical workers are appearing due to the increasingly innovative uses of radiation in the medical area.

The 12th International Congress of the International Radiation Protection Association, held in Buenos Aires, Argentina, brought together a broad range of professions to discuss the promotion and enhancement of radiation protection. The congress offered an important opportunity for feedback from all areas where ionizing radiation is applied, including inter alia, protection of medical workers and patients, transport of radioactive materials, safety and security of radioactive sources, decommissioning and management of radioactive waste.

Over the past decade, medical radiation exposures have increased at a remarkable rate. The medical use of ionizing radiation is rapidly evolving, with increasingly advanced medical radiation technologies and a growing complexity of medical radiation techniques. Patient exposure data can be difficult to obtain or might not be available and many Member States continue to find it difficult to manage or control medical radiation exposures. It has been observed that where the quality assurance programme was extended to evaluation of image quality and patient dose, image quality increased while patient dose decreased.

Increased attention to protection of the environment continues, even though there is still a diversity of opinions on various aspects of this protection. The International Conference on Radioecology and Environmental Radioactivity, held in Norway in June 2008, confirmed the need to maintain and enhance competences in radioecology and supported an integrated approach to the protection of the environment, including taking into consideration both non-radiological and radiological factors.

High activity radioactive sources are in widespread use around the world. In a limited number of applications, radioactive sources are being replaced with other technologies such as particle accelerators, but in many cases radioactive sources will continue to be used in medical, industrial and academic applications. Although Member States recognize the importance of ensuring that radioactive sources are under regulatory control, maintaining a comprehensive national register of sources remains a challenge in many Member States. An increasing number of countries recognize that the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on the Import and Export of Radioactive Sources provide the foundation for radioactive source safety and security and many Member States are incorporating their provisions into national legislation.

Denials and delays of shipment of radioactive materials continue to occur in all parts of the world. The underlying trend in the reduction of available routes seems to be a precursor to denials, but the ability to objectively measure this remains difficult due to commercial sensitivities. This, in turn, creates difficulties in identifying acceptable solutions. However, it is clear that inter alia, effective outreach to, communication with, and training of transport industry personnel whose main activity is not handling radioactive material is essential to combat undue denials and delays. The International Steering Committee on Denials of Shipment of Radioactive Material continues to guide international activities to deal with the issue.

Confidence in the safety of spent fuel and radioactive waste management is an important factor in the public acceptance of nuclear energy. However, difficulties in siting and putting into operation waste disposal facilities in many Member States have led to arrangements for extended storage having to be made. Such storage can be undertaken safely in the short to medium term, but is not sustainable in the longer term. In 2008, the Agency issued an updated safety standard on classification of radioactive waste that covers all radioactive waste types in a coherent manner. The importance of the global nuclear safety regime providing a coherent and harmonized framework for the safety of geological disposal and in particular the importance of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management in providing an international peer review mechanism in this regard is more and more recognized.

As existing nuclear installations and other facilities using radioactive material continue to age, the time for their eventual decommissioning approaches. From a technological perspective, there are many options available for the safe decommissioning of nuclear installations. However, in many cases, decommissioning planning is far from complete, and in some cases, even the fundamental approach to decommissioning, including the allocation of responsibilities, funding system and waste route, has not been agreed. Although a number of Member States have taken steps to ensure that financial and human resources are available, for a large number of facilities worldwide, decommissioning activities are not adequately resourced.

The vast majority of contaminated sites are the result of former uranium mining and production activities in various parts of the world. In many cases, safety arrangements in the relevant countries are not in conformity with the Agency's safety standards and the financial or human resources to effectively deal with these contaminated sites are often insufficient. In an effort to assist the concerned States in the management of uranium mines and production, the Agency has reconstituted its Uranium Production Site Appraisal Team programme designed to provide Member States with a peer review service for uranium mining and production facilities.

Table of Contents

Analytical Overview

A. Introduction

1. In many Member States nuclear technologies are seen as increasingly important solutions for meeting rising energy demands, reducing greenhouse gas emissions, mitigating climate change, counterbalancing fluctuating oil prices, providing life-saving treatments, supporting human development and creating jobs. This trend is accompanied by a growing recognition that the benefits of the peaceful application of nuclear technologies cannot be realized without guarding against the associated risks. Enabling the peaceful use of nuclear technology to support global energy demands and other human needs must be accompanied by deliberate, internationally-coordinated actions to minimize the potential for nuclear accidents and terrorism.

2. As the uses and the introduction of nuclear technologies expand, the vigilance and concrete actions by the global nuclear community to enhance nuclear safety must continue. While in recent years, the safety performance of the nuclear industry has been at a high level, it is important to avoid any complacency. Therefore, it is necessary to keep up the momentum of continuous improvement of the existing global nuclear safety and security regime so that worldwide confidence is inspired and the levels of safety and security keep pace with emerging technologies, expanding nuclear programmes and new entrants to the global nuclear community.

3. The Agency continues to support and promote the global nuclear safety and security regime as a framework for worldwide achievement of high levels of safety and security in nuclear activities. In the focus of the regime are the activities undertaken by governments, regulatory bodies and licensees to ensure safety and security. International cooperation supported by legally binding conventions, non-binding codes of conduct, international standards and guidance, peer reviews, advisory services and a global knowledge network are key elements of the regime.

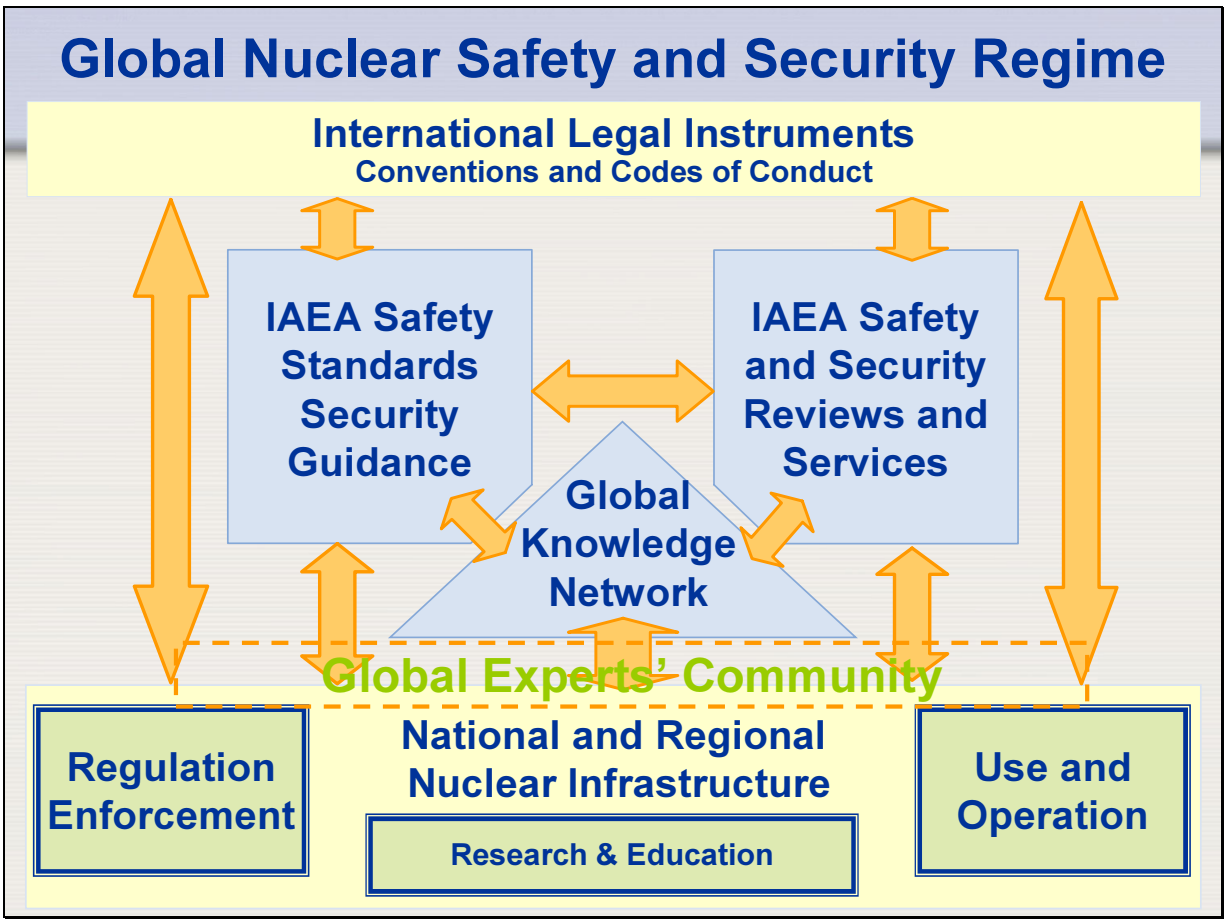

Figure 1: The Global Nuclear Safety and Security Regime

4. The *Nuclear Safety Review for the Year 2008* 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 2008. 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.

B. Global nuclear safety trends, issues and challenges

5. In 2008, three general themes can be observed from the global trends, issues and challenges in nuclear safety: the continuous improvements in strengthening safety worldwide through international cooperation; an expected increase of new entrant nuclear power programmes and the expansion of

[1] *Safety Related Events and Activities Worldwide during 2008* (document 2009/Note 4) and *The Agency's Safety Standards: Activities during 2008* (document 2009/Note 5).

existing programmes; and safety and security synergy. In addition, a number of specific technical issues were identified.

B.1. Continuous improvement of nuclear safety worldwide through international cooperation

B.1.1. Introduction

6. During 2008, international cooperation continued to advance efforts aimed at improving nuclear safety worldwide. The nuclear community supported the continuous improvements in the global nuclear safety and security regime that is already in place today by working and learning together. Such cooperation within the nuclear community has, among other achievements, resulted in the availability of high-quality safety standards, guidelines, peer reviews and advisory services that complement international instruments such as conventions and codes of conduct. In particular, notable improvements were seen in knowledge network activities, peer reviews and self assessment efforts, and synergy between nuclear safety and security.

B.1.2. Operating experience feedback and knowledge networking

7. In 2008, the International Nuclear Safety Group (INSAG) published *Improving the International System for Operating Experience Feedback* (INSAG-23). INSAG noted that in all fields of human activity, serious accidents are nearly always preceded by less serious precursor events. If lessons can be learned from the precursors and these lessons put into practice, the probability of a serious accident occurring can be significantly reduced. The high level of operational safety performance at nuclear power plants (NPPs) worldwide is due, in part, to an effective programme of operating experience feedback. Most utilities operating NPPs have strong operating experience programmes where low level and near miss events are analysed and improvements made to eliminate the root causes. In some cases, this also happens at a national level. At an international level, there is a good exchange of information for more serious events. However, there is limited exchange of information for low level and near miss events, which prevents the lessons learned from being put into practice worldwide. The same is true for research reactors, where 50 Member States participate in the Incident Reporting System for Research Reactors. In the case of other applications of ionizing radiation, such as medical applications, operating experience feedback is quite limited, even at the operator level. There is limited exchange at the national level and almost no exchange at the international level. The success of national operating experience programmes for NPPs needs to be considered for all other nuclear applications.

8. Nuclear safety networks, such as the Asian Nuclear Safety Network, the Ibero-American Radiation and Nuclear Safety Network, the European ALARA[2] Network, the Asian Network of Cardiologists in Radiation Protection, and the International Decommissioning Network, continued to provide effective platforms for sharing knowledge, experience and information. The Agency is also proceeding with the establishment of a global nuclear safety network that will further contribute towards effective international cooperation, and sharing of knowledge, experience and lessons learned. In addition, work started on an international regulators' network in 2008, which will allow nuclear safety regulators to exchange operating experience and best practices. Furthermore, there were discussions regarding the establishment of other regional and topical networks for nuclear safety. International conventions and non-binding codes of conduct also provide good opportunities for

[2] ALARA stands for "as low as reasonably achievable".

nuclear safety knowledge networking. The increasing participation of Member States, users of nuclear technologies and regulatory bodies in such networks would allow for broader sharing of lessons learned and their wider and more effective application.

B.1.3. Self-assessment and peer review

9. A key aspect of any management system is measurement, assessment and improvement. Some of the main processes used for assessing work performance and improvements in nuclear safety culture are self-assessment and peer review. NPP utilities have long recognized the importance of self-assessment and peer review. A number of mechanisms, including the Agency's Operational Safety Review Team (OSART) programme and World Association of Nuclear Operators (WANO) peer reviews, are available to identify whether the processes necessary for nuclear safety are in place and effective.

10. For other nuclear applications, including fuel cycle facilities, hospitals and laboratories using radioisotopes, peer reviews are not yet common practice. In many cases, external review is limited to inspections by the regulatory authority. Such inspections are usually limited in scope to compliance with regulatory requirements and cannot be considered as benchmarking activities. This makes it difficult for mutual learning of best practices to be adopted and integrated into all activities.

11. All of the Agency's safety review services are based in part on a peer review mechanism and many include self-assessment activities. For example, a specific feature of the Integrated Regulatory Review Service is the requirement that a Member State complete a self-assessment before receiving an IRRS mission. The results of this self-assessment are an important input to the review process. In addition, the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the Joint Convention) require, inter alia, the production of a self-assessment report outlining how each Contracting Party complies with the provisions of the Convention. These reports are subject to extensive peer review leading up to, and during, the triennial review meetings of Contracting Parties. The nature and format of this peer review process provides an opportunity for open and frank discussions on trends, challenges and best practices.

B.1.4. Revised proposal for a European Council Directive setting up a Community framework on nuclear safety

12. On 26 November 2008, the European Commission adopted a revised proposal for a Directive setting up a Community framework for nuclear safety. It defines basic obligations and general principles for the safety of nuclear installations in the European Union while enhancing the role of national regulatory bodies. The general objective of the proposal is to achieve, maintain and continuously improve nuclear safety and its regulation in the Community and to enhance the role of the regulatory bodies. Its scope of application is the design, siting, construction, maintenance, operation and decommissioning of nuclear installations, for which consideration of safety is required under the legislative and regulatory framework of the Member State concerned. The right of each Member State to use nuclear energy or not in its energy mix is recognised and fully respected. The proposal is based on the obligations of the Convention on Nuclear Safety and the Agency's Safety Fundamentals. The European Nuclear Safety Regulators Group (ENSREG) will become the focal point of cooperation between regulators and will contribute to the continuous improvement of nuclear safety requirements, especially with respect to new reactors.

B.2. New entrant nuclear power programmes and expansion of existing programmes

B.2.1. Introduction

13. There are now 438 nuclear power reactors operating worldwide and the number of new NPPs planned or under construction continues to grow. The Agency's updated projections show a significant increase in the use of nuclear energy by 2030, with nuclear power capacity possibly doubling. However, total electricity generation from all sources could well double also, in which case nuclear power's share of total generation would hold steady around the current level of about 14%. While most reactors on order or planned are in Asia, plans are firming up for new NPPs in all regions. Significant further capacity is being created by power uprates, in addition to plant life extension programmes that are maintaining capacity.

14. Nuclear technologies also provide for vital benefits towards the improvement of human well-being throughout the world. These nuclear applications help support and improve medical treatments, food and agriculture, and development and management of natural resources. In all Member States nuclear applications will continue to play an important role in supporting human needs and social development.

B.2.2. National nuclear safety infrastructures

15. As outlined in Safety Fundamentals No. SF-1, the prime responsibility for safety must rest with the person or organization responsible for facilities and activities that give rise to radiation risks. An effective legal and governmental framework for safety, including an independent regulatory body, must also be established and sustained. The development of a national nuclear safety infrastructure and relevant capacity building are complex undertakings that take significant time and resources. In all cases where there is an intention to utilize nuclear energy, this must be associated with a strong commitment to nuclear safety, a sound governmental and regulatory framework and a competent, independent regulatory body.

16. In 2008, INSAG published *Nuclear Safety Infrastructure for a National Nuclear Power Programme Supported by the IAEA Fundamental Safety Principles* (INSAG-22). The report identifies main phases in the lifetime of an NPP, spanning from before a decision to launch a nuclear power programme is made, through construction, operations, and eventual decommissioning. Although focused on nuclear power programmes, the discussions in this report are also relevant, in part, to uranium mining and production facilities and other nuclear installations, such as research reactors and fuel cycle facilities, as well as other uses of nuclear energy.

17. Nuclear safety infrastructure is particularly important for nuclear power programmes. From site selection, through design, construction, operation and eventual decommissioning, the lifetime of an NPP can exceed 100 years. An effective and sustainable nuclear safety infrastructure is essential for the assurance of long term nuclear safety. Over time, national boundaries may change, companies that supply nuclear technologies may cease to exist, components will become obsolete and nuclear safety knowledge will evolve considerably. The nuclear industry will continue to innovate, both to address obsolescence issues and to improve performance. Therefore, a strong national nuclear safety infrastructure will ensure that nuclear safety continues to receive the requisite attention through the lifetime of an NPP. A severe accident at any NPP would impact on the public perception of the safety of all NPPs.

18. A growing number of Member States are considering a nuclear power programme for the first time. These new entrants may have an adequate nuclear safety infrastructure for their current nuclear applications, but do not yet have an adequate infrastructure for nuclear power. The Agency is not the only organization providing assistance to new entrant countries. The European Union has also developed support activities and other international initiatives, such as the Global Nuclear Energy Partnership (GNEP) initiated by the US Department of Energy, are also planning assistance in this regard. The challenge is to ensure that these activities are coordinated at the international level so that resources are effectively and efficiently used. In this respect, the Agency is well placed to serve as a clearing house of coordination of international efforts devoted to safe and secure introduction of nuclear power programmes. There is growing international understanding that suppliers of nuclear technology should assist new entrants in the development of their national nuclear safety infrastructure. Evidence of this are the bilateral or multilateral agreements and memoranda of understanding between countries that are designed to support the development of effective and sustainable nuclear safety infrastructures.

19. Most countries with currently operating NPPs have, over time, established the necessary nuclear safety infrastructure for their current programmes. However, some of these countries have not launched new NPP projects for many years or even decades and would need to augment their nuclear safety infrastructure to deal with an expansion of their nuclear power programme. Other Member States which are in the process of reconsidering the nuclear power option will also need to re-establish their national nuclear safety infrastructure.

B.2.3. Human resources and capacity building

20. Many Member States continue to report that maintaining adequate staffing and competence levels for nuclear safety are significant challenges that extend to both users of nuclear technology and regulatory bodies and their technical support organizations. Recent announcements regarding expansion of the nuclear industry and in other applications of nuclear technology have resulted in increased competition for competent staff. In many cases, the expertise is simply not available or there is insufficient expertise for both operators and regulatory bodies. Even so, some regulatory bodies have increased staffing levels and plan to further increase staffing levels to deal with increased workloads resulting from expanding nuclear programmes, new NPP construction, and new applications of nuclear technologies. During the 4th Review Meeting of Contracting Parties to the Convention on Nuclear Safety, a number of Contracting Parties outlined initiatives to support nuclear research and education, and proactive measures, such as hiring well in advance of new NPP construction or senior retirements, mentoring and training programmes, competitive remuneration packages and international collaboration.

21. In addition to mature national education and training institutions in many Member States, the Republic of Korea opened in 2008 the International Nuclear Safety School, a centre designed to advance the international education of nuclear safety experts on a global and regional basis. The school also serves as a regional training centre of the Agency. Equipped with state-of-the-art IT-based learning facilities, the school will host in-person lectures, training sessions and distance learning courses based on an organized curriculum.

B.2.4. Regulatory independence

22. The understanding of what is meant by regulatory independence has evolved considerably in the past few years. Previously, regulatory independence was focused on establishing a regulatory body that is legally separate from other bodies or organizations that promote or use nuclear technology.

Many Member States have introduced or amended legislation to support this separation in legal terms, although in a number of Member States, the legal and administrative separation is still lacking. The currently prevailing view regarding regulatory independence is that having a legally separate regulatory body is only the first step towards regulatory independence. To be fully independent, the regulatory body must have, in addition to the full legal authority to exercise its mandate, adequate and predictable financial resources, sufficient competent human resources, and freedom from undue interference of any nature be it political or commercial. It should be noted that a number of Member States still require considerable Agency assistance in developing even the basic core competencies of their regulatory bodies. The 4th Review Meeting of Contracting Parties to the Convention on Nuclear Safety noted the importance of regulatory independence and considered that the issue requires further attention.

B.2.5. Nuclear incident and emergency preparedness and response

23. Among Member States, there is growing recognition that the national nuclear safety infrastructure must include adequate resources and arrangements for preparing for and responding to nuclear incidents and emergencies. In general, Member States with nuclear installations tend to have adequate emergency preparedness and response capabilities to deal with local incidents and emergencies. However, only a few Member States have adequate capabilities to respond to a major nuclear emergency.

24. The emergence of new nuclear entrants underlines the need for effective emergency preparedness and response capabilities. The Agency is well placed to facilitate the development and perfection of these systems by responding to Member States' request for Emergency Preparedness and Response (EPREV) missions carried out for the assessment and evaluation of the emergency preparedness and response programme and capabilities. The Agency's Integrated Regulatory Review Service (IRRS) also includes a module on emergency preparedness and response aspects of national regulatory systems.

B.2.6. Spent fuel and radioactive waste management

25. Every country should have some form of policy and strategy for managing its spent fuel and radioactive waste. Such policies and strategies are important; they set out the nationally agreed position and plans for managing spent fuel and radioactive waste and are visible evidence of the concern and intent of the government and the relevant national organizations to ensure that spent fuel and radioactive waste are properly taken care of. There is a large diversity in the types and amounts of spent fuel and radioactive waste in Member States and, as a result, the strategies for implementing the policies are sometimes different, although the main elements of policy show considerable similarities from country to country. The Agency continues to promote efforts to harmonize strategies.

B.2.7. Multinational aspects of nuclear activities

26. The nuclear industry is becoming increasingly multinational in nature. In the nuclear power sector, there are a large number of NPP component suppliers and service providers. One supplier may provide components for many different countries. To provide assurances that these suppliers, particularly those that supply major components, are meeting the high standards of quality required for nuclear safety, oversight audits are conducted. Through careful coordination of effort, there is an opportunity for suppliers, utilities and regulatory bodies to efficiently provide the necessary oversight to face this continuous challenge. Multinational design reviews, such as those provided by the Multinational Design Evaluation Programme (MDEP) or the Agency's design review service, are

pooling expertise to provide a level of assurance that the design has adequate nuclear safety provisions.

27. In the area of radioactive sources, again a limited number of suppliers, operating in only a few countries, are responsible for providing the vast majority of sources used in medical, industrial and academic applications. A growing problem appears to be that shipment of radioactive sources is denied or delayed for a number of reasons, including inter alia entry refusals at ports and pilots refusing to have radioactive sources on aircraft. The challenge is to ensure that these sources arrive at the intended user in a timely, safe and secure manner.

B.3. Nuclear safety and security synergy

28. Nuclear safety and security share a common goal, which is the protection of public health and safety and the environment. In recent years, awareness of nuclear security has increased, and every Member State must continue to strive for high levels of nuclear safety and security. There is recognition that safety requirements are well established, while security requirements continue to evolve. Care must be taken to ensure that this process of continuous improvement results in harmony between nuclear safety and those aspects of security that relate to control of facilities and sources. There is an increasing awareness among global nuclear safety and security professionals that processes must be in place to ensure that nuclear safety activities do not compromise security and vice versa. This point was emphasized by the chair of the Commission on Safety Standards in his Third Term Report[3]. The ultimate goal must be to maximize the benefit to protection of health, safety and the environment; harmonization of relevant aspects of nuclear safety and security is a means to achieve the goal, but it is not the goal itself.

29. There are many commonalities between nuclear safety and security. Both rely on detailed analyses to assess threats and vulnerabilities and both use the philosophy of layers of defence with multiple barriers, both physical and procedural, to minimize these vulnerabilities. In many cases, measures taken to enhance nuclear safety also serve to enhance security and vice-versa. There are also a number of differences between nuclear safety and security. Safety experts and security experts have very different backgrounds and experiences. Openness and transparency for nuclear safety and security activities have fundamentally opposed, yet equally effective, approaches. Through the open sharing of nuclear safety information, safety experts have improved the safety of all nuclear applications; in the security area, long experience has shown that limiting information on a 'need to know' basis is key to a high level of security. Other differences can include the legislative and regulatory bases in States where nuclear safety legislation is typically an administrative or civil law issue, whereas security is normally a criminal law issue. International efforts to achieve synergy between nuclear safety and security need to consider these commonalities and differences.

B.4. Specific technical issues

B.4.1. Introduction

30. To be proactive in responding to developments and events that result from changing technologies and circumstances, the Agency has identified a number of specific technical issues that have global implications.

---

[3] http://www-ns.iaea.org/committees/files/css/204/CSS4yreportfinal.pdf

B.4.2. Changing technology

31. In many areas, advances in technology, while offering solutions to long-standing issues, can also create new challenges for nuclear safety. One example is the introduction of digital instrumentation and control systems; these systems have the potential to be very useful in nuclear installations, but it is challenging to demonstrate their reliability as part of the safety demonstration. All changes must be thoroughly examined to ensure that unintended consequences are avoided. A balance must be found between innovation and stability. Much of the new technology is being developed by a limited number of vendors in a small number of countries. Vendors and the nuclear safety infrastructure in vendor countries are an important source of nuclear safety information as they provide the primary detailed assessments needed for nuclear safety and licensing. Vendors have a responsibility to ensure that users have access to all information and resources necessary for safe operation. It is also important that countries contemplating using specific nuclear technology and vendor countries collaborate so that nuclear safety knowledge is transferred effectively.

B.4.3. Uranium industry resurgence

32. After many years of reduced activity, the world's uranium industry is experiencing resurgence. Abandoned mines are being examined for potential reopening or treatment of their residues, previously known uranium deposits are being considered for exploitation, and uranium exploration is expanding worldwide. This new activity provides an opportunity to ensure that uranium resources are explored, developed and produced with due regard to health, safety and the environment. It is essential that regulatory control be established before these activities commence. In past years improper management of residues and wastes from uranium mining operations have resulted in negative human health and environmental impacts. A number of Member States continue to struggle with these legacy sites and adequate regulatory framework and proper planning will be required to avoid that the problems associated with such legacy sites will reoccur.

B.4.4. Severe earthquakes and extreme natural events

33. In recent years, a number of severe natural events, such as earthquakes and tsunamis, have affected various parts of the world. Safety systems at nuclear installations affected by these severe events responded as necessary to protect workers, the public and the environment from undue effects. However, in a few cases, the magnitude of the event was much more severe than previously thought possible or anticipated during the design and construction of affected installations. The re-evaluation of the integrity of existing nuclear installations, taking into account the increased magnitude observed during these events, has begun. In addition, the design of new installations should also consider whether additional measures need to be taken.

C. Incident and emergency preparedness and response

C.1. Trends, issues and challenges

34. During 2008, the Agency was informed or became aware of 183 events involving or suspected to involve ionizing radiation. In 140 cases, it was determined that no Agency action was required. In the

other 43 cases, the Agency took action, such as authenticating and verifying information with external counterparts, sharing and providing official information or offering the Agency's services.

35. There continues to be a need to establish clear communication procedures in response to any type of radiation emergency, which could be used by public information officers and media representatives at both preparedness and response stages to ensure that the public is well informed. In this light, an emergency preparedness and response manual on communicating with the public during a nuclear or radiological emergency is currently under development.

36. The *Manual for First Responders to a Radiological Emergency* continues to be one of the most downloaded publications on the Agency's website and continues to be translated into a variety of languages (the latest being Arabic and French) and provided in formats making it more accessible to Member States. A recent improvement to the personal digital assistant (PDA) version of the manual is the introduction of a Web browser-based tool enabling more user-friendly access while in the field. The manual provides practical guidance for those who will respond during the first few hours to a radiological incident or emergency and for national officials who would support this early response. The manual is co-sponsored by the International Technical Committee for the Prevention and Extinguishing of Fires (CTIF), Pan American Health Organization (PAHO) and World Health Organization (WHO). A website based on the manual has been created and a First Responders Suite containing the manual and other training materials is currently being developed. In addition, e-learning training materials are currently under development to increase the access to, and number of end-users of, Agency training tools.

37. Drills and exercises in emergency response need to be increased in number at the local, national, and international levels, as well as expanded in their scope to include both nuclear safety and security aspects and initiators. In 2008, the Agency offered 20 training courses at regional and national levels in various aspects of emergency preparedness and response.

38. Although every Member State must have plans and core resources available to deal with incidents and emergencies, it is not practical for every Member State to have a full range of specialized capabilities. Rather, enhanced regional and international cooperation is necessary. The Agency's Response Assistance Network (RANET) programme provides a convenient method of both registering national capabilities and matching capabilities with needs. Many Member States have reported increased bilateral and multinational cooperation, including data exchange for effective off-site incident and emergency preparedness.

39. The International Nuclear and Radiological Event Scale (INES) has been used for 18 years. During this period, it has been extended and adapted to meet the growing need for communication of the significance of all events associated with the use, transport and storage of radioactive material and radiation sources. In July 2008, the INES Advisory Committee members and the INES national officers representing the Member States participating in INES endorsed the INES User's Manual, which consolidates additional updated guidance for rating radioactive source and transport events and other needed clarifications, for use.

C.2. International activities

40. By the end of 2008, 14 Member States had registered a number of expert capabilities with the Agency's RANET. Although this is a good start, it is not sufficient if RANET is to be a global network with information about national assistance capabilities that can be called upon on request under the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

41. In July 2008, the Inter-Agency Committee on Response to Nuclear Accidents (IACRNA) coordinated an emergency exercise — known as ConvEx3 (2008) — that tested the international response to a simulated accident at an NPP. The exercise was conducted over two days in cooperation with 75 countries and nine international organizations. The simulated accident occurred at Mexico's Laguna Verde NPP. The Agency used its Incident and Emergency Centre to act as the global focal point for international communication and response during the exercise. Key systems that would be required in an actual emergency were tested and, in addition to several strengths, a number of areas for improvement were identified.

42. 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 currently developing a unified system that will replace the Agency's current Early Notification and Assistance Conventions Website (ENAC) and the Nuclear Events Web-based System (NEWS).

43. The International Action Plan for Strengthening the International Preparedness and Response System for Nuclear and Radiological Emergencies has entered its third and final phase focusing on sustainable, effective and efficient infrastructure for the enhancement of the international preparedness response system.

D. Civil liability for nuclear damage

D.1. Trends, issues and challenges

44. 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 a subject of increased attention among Member States, especially in light of the renewed interest in nuclear power around the world.

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

46. The deposit by the USA of its instrument of ratification of the Convention on Supplementary Compensation for Nuclear Damage (CSC) in May 2008 marked an important milestone in the Agency's efforts at strengthening the global international nuclear liability regime as it brought the amount of installed nuclear capacity to nearly 80% of the amount needed for the CSC to enter into force.

D.2. International activities

47. The 8th meeting of INLEX was held from 21 to 23 May 2008 at Agency Headquarters in Vienna to review the various activities and developments since the previous meeting held in 2007. Major topics discussed during the meeting included, inter alia, INLEX outreach activities, the ongoing European Commission (EC) impact assessment on nuclear liability and a proposal by Germany to allow Contracting Parties to the revised Vienna Convention on Civil Liability for Nuclear Damage

(1997 VC) and to the CSC to exclude certain small research reactors and nuclear installations being decommissioned from the scope of application of these Conventions.

48. Regarding INLEX outreach activities, the meeting reviewed the results of the 3rd Regional Workshop on Liability for Nuclear Damage held in Sun City, South Africa from 11 to 13 February 2008 and noted the growing interest expressed by workshop participants on the mechanisms associated with developing national implementing legislation in accordance with the international nuclear liability instruments. INLEX also discussed matters relating to the 4th Regional Workshop on Liability for Nuclear Damage, which is scheduled to be held in early 2009 for countries that have expressed an interest in launching a nuclear power programme.

49. INLEX agreed to continue to follow closely the ongoing EC impact assessment on nuclear liability aimed at identifying the possible impacts of the different policy options that are open to the EC with respect to trying to achieve a uniform regime on nuclear third party liability within the European Union (EU). INLEX expressed concern over the current alternatives proposed by the EC, especially the proposal inviting all EU Member States to join the Paris regime — adopted under the auspices of the Nuclear Energy Agency of the Organisation of Economic Co-operation and Development (OECD/NEA) — to the detriment of the Vienna regime (adopted under the IAEA's auspices) and the suggestion that Euratom adopt a separate directive on nuclear liability fragmenting even further the current international nuclear liability regime. INLEX encouraged the EC to continue to look at all the possible avenues available, including those that would contribute to strengthening the global nuclear liability regime such as the CSC or the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention.

50. Regarding the proposal by Germany to allow Contracting Parties to exclude certain small research reactors and nuclear installations being decommissioned from the scope of application of the 1997 VC and the CSC, INLEX took note that similar proposals had also been introduced by Germany in the framework of the Paris regime. The meeting agreed that a uniform approach between the Paris regime and the Vienna regime should be pursued and called for continued cooperation between the OECD/NEA and the IAEA in this regard. As a first step, the meeting agreed to forward the proposals for technical evaluation by the Agency's Waste Safety Standards Committee (WASSC) and Radiation Safety Standards Committee (RASSC). Accordingly, the matter was discussed at the joint meeting of RASSC and WASSC held in Vienna from 10 to 14 November 2008 and it was decided that further technical information on the German proposals was needed before a technical evaluation could be made. To that effect, the joint meeting decided that an ad-hoc RASSC–WASSC subgroup should be set up and tasked with assessing the technical elements of both proposals.

E. Nuclear power plant safety

E.1. Trends, issues and challenges

51. NPP operators continued to show strong nuclear safety performance in 2008 with no serious accidents or significant radiation exposure to workers or the public to report. Most utilities operating NPPs have a strong operating experience programme where even low level events and near misses are analysed and shared. At the national level, some Member States with NPPs have good operating experience feedback programmes. In general, however, these national programmes do not include all

low level and near miss events. Operating experience at the international level is also limited since most Member States only report a fraction of the unusual events.

52. During the Agency's International Conference on Topical Issues in Nuclear Installation Safety, hosted by the Government of India in Mumbai, participants concluded that, inter alia, an integrated nuclear safety approach based on the defence in depth principle and deterministic criteria, when properly applied and complemented with probabilistic analyses and operational experience feedback, continues to be successful. However, guarding against the risk of accidents requires constant vigilance, high technical competence and a never-ending fight against complacency. Strong leadership with a commitment to continuous improvement and a vision of sustained excellence is a key element of nuclear safety.

53. Starting construction of a new nuclear installation is very demanding because much of the earlier experience and resources have been lost from the nuclear industry. It is evident that the performance will improve when lessons have been learned from prototype projects. In addition, the standardization of the nuclear power industry would ensure that improvements in plant design features and lessons learned during construction are incorporated in subsequent designs and construction practices. Planning and scheduling should take into account the availability of qualified designers, constructors and manufacturers to implement the project. During construction, close monitoring and oversight by both licensee and regulatory body is necessary to achieve the quality, technical standards and criteria specified by the vendor and approved during the licensing and design processes.

54. To enable the expansion of existing nuclear programmes and the introduction of new programmes, careful management of the supply chain becomes essential as nuclear industries and businesses become increasingly multinational. The assurance of quality in the nuclear technology supply chain is an emerging issue. Harmonization of nuclear safety requirements and quality standards within the supply chain is acknowledged to require further collaboration among Member States, international organizations and supplier companies. The Multinational Design Evaluation Programme (MDEP) is an important first step towards this goal.

55. Site selection and site evaluation activities are continuing in many Member States, both for licensing of new sites and for new units at existing sites.

E.2. International activities

56. In April 2008, Contracting Parties to the Convention on Nuclear Safety (CNS) met in Vienna for their 4th Review Meeting, with 55 of the 61 Contracting Parties participating. The participants conducted a thorough peer review of the Contracting Parties' national reports. For each Contracting Party, the participants identified good practices and specific areas for improvement. The participants also concluded that all Contracting Parties in attendance were in compliance with the requirements of the CNS and that nuclear safety performance at NPPs remained strong. The Contracting Parties noted that the nuclear industry and regulators had to avoid any complacency resulting from this success. Contracting Parties also noted that a number of challenges remained, including effective regulatory separation and independence and new reactor licensing. A number of Contracting Parties also noted positive experiences with the Agency's safety standards and review missions. Contracting Parties encouraged those countries considering nuclear power programmes to join the CNS well in advance.

57. In 2008, the Agency inaugurated the International Seismic Safety Centre (ISSC), which will serve as a focal point on seismic safety for nuclear installations worldwide. ISSC will assist Member States on the assessment of seismic hazards of nuclear facilities to mitigate the consequences of strong earthquakes. To further seismic safety at nuclear installations worldwide, the ISSC will promote

knowledge sharing in the international community, support countries through advisory services and training courses, and enhance seismic safety by utilizing experience gained from previous seismic events. The ISSC is supported by a scientific committee of high-level experts from seven specialized areas, including geology and tectonics, seismology, seismic hazard, geotechnical engineering, structural engineering, equipment and seismic risk.

58. At the request of Member States, the Agency has conducted generic reactor nuclear safety reviews to assess new NPP designs for compliance with the Agency's safety standards. These reviews aim at providing an early harmonized appraisal of safety cases made by vendors. Such nuclear safety evaluations, conducted against selected sets of the Agency's safety standards, contribute to more effective management of subsequent activities within a global framework consistent with a harmonized approach to nuclear safety worldwide and also provide a focus and foundation for the subsequent more detailed individual evaluation or licensing process, which remains a sovereign activity of the Member State. This work complements the work of MDEP and provides an important input to the licensing of new reactors.

59. The Agency has established a Web-based platform[4] to support Member States with advanced reactor safety assessment training methods including training simulators. This platform provides long term support primarily to regulatory authorities and technical support organizations in building or maintaining independent and competent nuclear safety infrastructure and decision making.

60. Significant progress has been made by the Agency in the major joint Agency-EC-Ukraine extrabudgetary project to assess the compliance of all 15 Ukrainian NPPs with the Agency's safety standards. The project covers the following four main areas: design safety, operational safety, waste management and decommissioning and regulatory issues. In 2008, the technical guidelines for the implementation of the project were prepared and approved by the steering committee of the joint project. As part of the project, an IRRS mission was conducted in June 2008 and the results have been provided to the Ukrainian regulatory authority. A programme for the implementation of the mission's recommendations has been approved by the Ukrainian Government and is being implemented. The first pilot design review mission was successfully conducted at Khmelnitski NPP in October 2008 and an OSART mission took place at Rovno NPP units 3 and 4 in November–December 2008. The project is scheduled to be completed in February 2010.

F. Research reactor safety

F.1. Trends, issues and challenges

61. For more than 50 years, research reactors have continued to provide a cornerstone for national nuclear science and technology programmes worldwide and are an important part of the nuclear infrastructure of Member States. Research reactors around the world continued to be operated safely in 2008 and there were no serious incidents. More Member States are using the Code of Conduct on the Safety of Research Reactors to guide their research reactor activities. Even so, there is considerable room for improvement as many research reactors continue to lack resources dedicated to operation and

[4] http://www-ns.iaea.org/tech-areas/safety-assessment/casat-home.htm

safety. In many Member States, research reactors are not subject to formal periodic safety review. Considering that ageing of research reactor facilities is a continuing issue and the proven effectiveness of a periodic safety review process for NPPs, implementing such a process should receive serious consideration. The loss of experienced staff due to retirement continues to be compounded by the difficulty of recruiting new personnel and is still a critical issue in some research reactor facilities. Plans for new research reactors and upgrading of existing ones are being developed in several Member States. In this regard, there is also a need to establish technical and nuclear safety infrastructures in Member States planning to build their first research reactor.

62. The need for a network where operators and regulators could share nuclear safety information regarding research reactors has been identified and the Agency is exploring options for establishing a research reactor information network. There is a need to continue efforts to enhance the effectiveness of research reactor safety committees and to ensure a wider use, by their members, of the Agency's safety standards.

63. Member States generally recognize the need for preliminary decommissioning plans, but this awareness is not followed up by concrete action. In some Member States, there continues to be resistance to preparing decommissioning plans because of the perception that the preparation of a plan is an indication that the facilities will be shutdown.

F.2. International activities

64. An international meeting on the application of the Code of Conduct on the Safety of Research Reactors was conducted in October 2008 in Vienna. The large number of Member States represented at this meeting showed evidence of interest in the Code of Conduct and its application in regulation and operation. This is especially important in light of the renewed interest in nuclear technologies today. In many fields, research reactors are an essential part of building the required nuclear safety and technical infrastructures of the country and realizing the benefits of nuclear technology. Many of the presentations focused on the legal and regulatory infrastructure, in particular to improve the laws and regulations in line with the recommendations of the Code of Conduct. Some Member States reported deficiencies in arrangements for reactors in extended shutdown and for decommissioning. Member States reported that they have requirements for periodic safety review in place, generally done as part of a relicensing or licence extension process. However, improvement in the requirements and implementation process is still needed. Many Member States felt that their safety culture was satisfactory, but recognized that continuous attention is needed. Separation of the operating functions from the utilization functions was advocated as a measure to improve nuclear safety by several speakers. Several Member States emphasized the necessity for improved nuclear safety management, as well as transparency, stakeholder engagement and public involvement in regulation and operations to enhance the perception as well as the reality of nuclear safety. Ageing of facilities and staff, and availability of well-trained and competent staff for both the operating organizations and regulatory bodies continues to be a challenge. Establishment of adequate ageing management programmes and appropriate financing of both the operating organization and regulatory body is also a challenge in many countries.

65. The Agency's work programme for addressing the need to establish technical and nuclear safety infrastructures in Member States planning to build their first research reactor includes:

- the development of an IAEA TEC DOC on milestones for building a new research reactor, similar to the one published for NPPs;

- a new type of Agency review service to review, upon request, the situation regarding a Member State's technical and safety infrastructures for research reactors, to identify the gaps and to define the improvement actions; and,
- a six week training course, open to fellows from Member States planning to build their first research reactor, organized in cooperation with Vienna Atominstitut.

66. During 2008, safety standards for research reactors continued to be produced. These provide key technical requirements and recommendations that are needed to implement the Code of Conduct and achieve enhanced nuclear safety. They also provide the basis for the Agency's Integrated Safety Assessment for Research Reactors (INSARR) service.

G. Fuel cycle facility safety

G.1. Trends, issues and challenges

67. As reported last year, there is increasing openness among operators of fuel cycle facilities to share nuclear safety information and more use is being made of the Fuel Incident Notification and Analysis System (FINAS), developed by the Agency in cooperation with the OECD/NEA.

68. Fuel cycle facilities face unique nuclear safety challenges such as criticality control, chemical hazards and susceptibility to fires and explosions. Many of these facilities rely heavily on operator intervention and administrative controls to assure nuclear safety. Although the principles of fuel cycle facility safety are similar to those of NPPs, the approach to nuclear safety must be adequately graded. Most of the smaller facilities must cope with a lack of human and financial resources. In some Member States, these resource limitations are also seen in the regulatory bodies. Many facilities are also operating at only a fraction of full capacity, a situation that exacerbates the financial limitations and results in additional challenges, such as maintaining human performance skills and exercising system operations in a predictable manner. Thus, it is difficult for many of these facilities to maintain competence in all areas of nuclear safety.

69. There is a continuing need for the sharing of operating experience. In particular, peer review activities, such as the Agency's Safety Evaluation During Operation of Fuel Cycle Facilities (SEDO) service, are not being used systematically to evaluate and enhance nuclear safety measures. Efforts will be continued to have a complete set of safety standards to cover all types of fuel cycle facilities.

G.2. International activities

70. The Web-based version of FINAS, on a common platform with the Incident Reporting System[5] (IRS) and the Incident Reporting System for Research Reactors (IRSRR), became operational in 2008.

[5] For NPPs

H. Occupational radiation exposure

H.1. Trends, issues and challenges

71. In general, occupational radiation protection in nuclear installations around the world is well managed and few workers in these installations receive significant radiation doses. Figure 2 shows the trend for total annual collective dose received by NPP workers. It should be noted that the recent levelling off of the collective dose over the past three years is mainly the result of the completion of earlier successful and significant efforts at optimization of radiation protection over the past ten years. There should be renewed efforts made to standardize radiation dose limits and constraints, including associated record-keeping, for radiation workers, given the globalization of the nuclear work force in providing trans-border support services during plant operations and maintenance outages. Most significant radiation exposures involve workers handling radioisotopes. Frequently, these overexposures occur in isolated locations where supervision is limited and radiation protection programmes are not well developed. In addition, most nuclear installations have some form of operating experience feedback, while isolated radioisotope users do not. This provides fewer opportunities for these radioisotope users to learn from others.

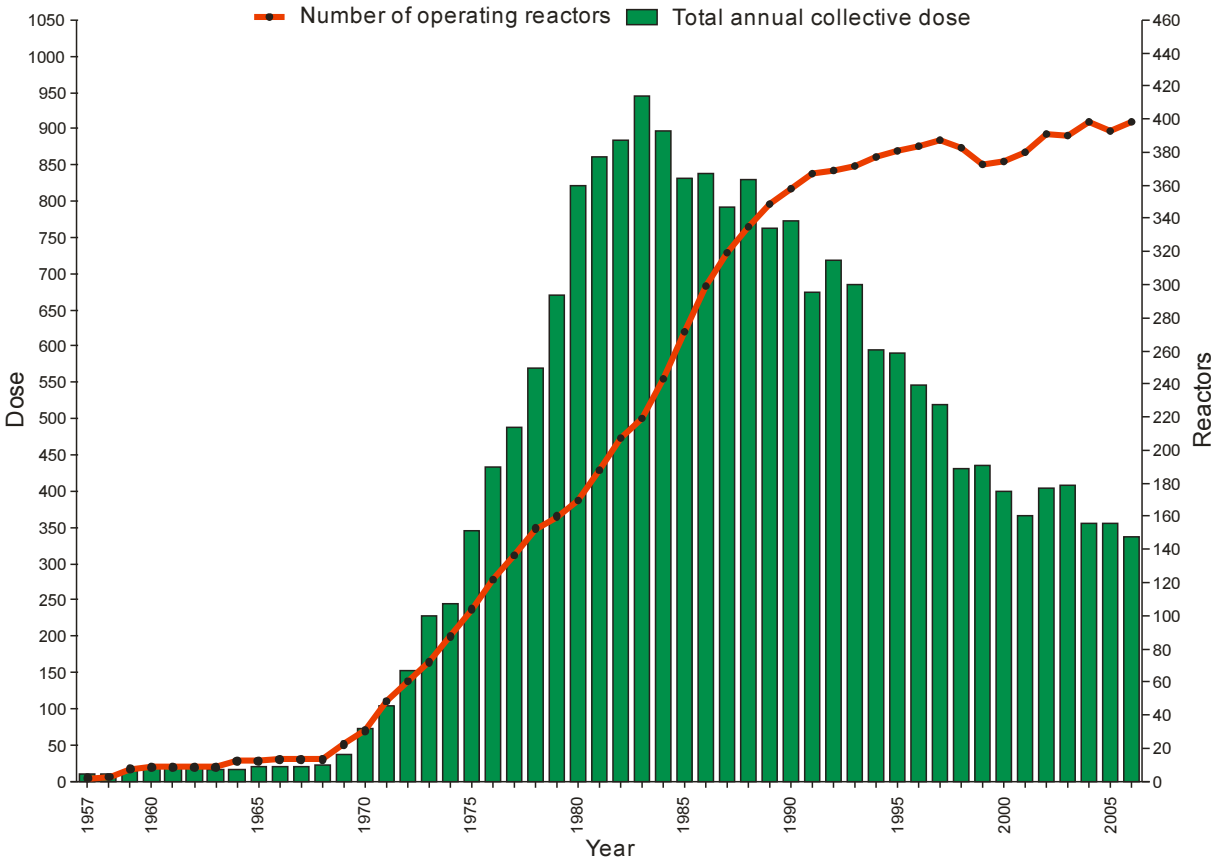

Figure 2: Evolution of the total annual collective dose (man Sv) and number of operating reactors

72. According to the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the collective dose due to occupational radiation exposure continues to rise, primarily due to expanding uses of radiation.

73. More than half of all radiation exposed workers are now in the medical field. New challenges in occupational radiation protection of medical workers are appearing due to the increasingly innovative uses of radiation in the medical area. These innovative uses offer exciting possibilities for patient care; however they also create situations where radiation protection professionals may encounter difficulties in providing adequate protection for medical staff. The issue of radiation protection for medical personnel is particularly acute for some medical procedures performed under X ray fluoroscopic guidance. Proper use of tools and techniques for radiation protection will continue to ensure safety at work for medical staff.

74. As more Member States consider building NPPs or research reactors, the capabilities and basic infrastructure for occupational radiation protection must also increase, including for example neutron dosimetry. Monitoring of workers will still require more attention in order to, for example in uranium mines, improve the monitoring strategies and related techniques.

75. Another area that will require further consideration is the ethical and justification issues surrounding the deliberate exposure of individuals for security or legal purposes.

H.2. International activities

76. The 12th International Congress of the International Radiation Protection Association (IRPA) was held in Buenos Aires, Argentina, from 20 to 25 October 2008. The objectives were to strengthen radiation protection worldwide by ensuring a broad gathering of professionals directed at the promotion and enhancement of radiation protection and to produce a definite outcome of concrete findings and follow-up recommendations that can be implemented in practice. The congress offered an important opportunity for feedback from all areas where ionizing radiation is applied, including inter alia, protection of medical workers and patients, transport of radioactive materials, safety and security of radioactive sources, decommissioning and management of radioactive waste. This feedback is a valuable element for the development of the Agency's safety standards, particularly for the revision of the Basic Safety Standards.

77. Existing collaboration 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 Information System on Occupational Exposure has to be maintained in order to improve the harmonized implementation of the Agency's safety standards. Lack of dose data in some of the medical, industrial and research areas will justify the development of appropriate approaches for collecting, validating and analysing this missing data.

78. The Agency hosted a technical meeting on radiation protection guidance for medical workers in Vienna from 17 to 19 November 2008. The meeting provided an opportunity for experts from the health sector and regulatory bodies to discuss issues concerning radiation protection for medical workers including monitoring, information and education, modality specific issues, pregnancy, regulatory process and incident situations.

I. Medical radiation exposure

I.1. Trends, issues and challenges

79. Contrary to other exposures to ionizing radiation, which have remained constant or decreased over the past decade, medical exposures have increased at a remarkable rate. After natural background radiation, medical uses constitute the next largest source of ionizing radiation to the world's population (see Figure 3). Almost 4 billion medical and dental radiation procedures are carried out annually around the world, with over 90% of these being diagnostic X ray examinations. UNSCEAR estimates that, in 2008, the collective effective dose to the world population due to diagnostic medical and dental X ray examinations was about 4 000 000 man Sv, a rise of just over 70% in less than a decade. In some developed countries, medical exposure now equals or exceeds that from natural background.

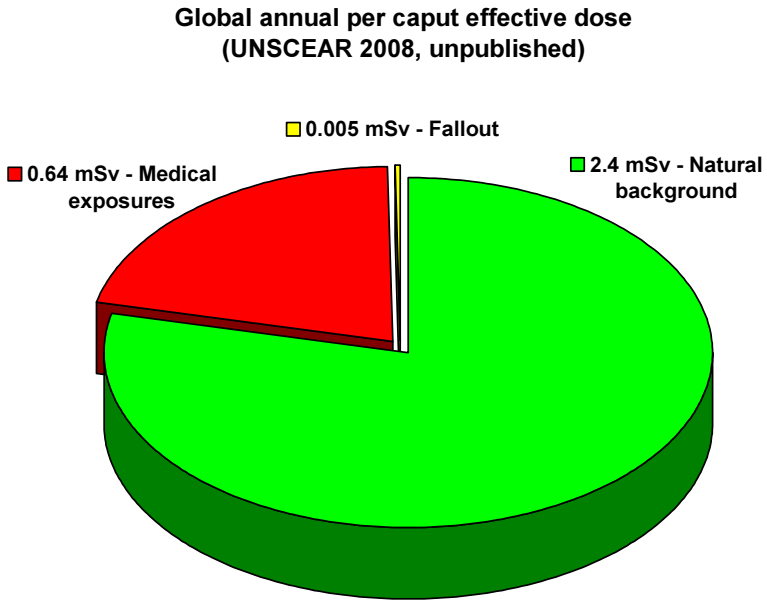

Figure 3: Global annual per caput effective dose

80. The medical use of ionizing radiation is rapidly evolving, with increasingly advanced medical radiation technologies and a growing complexity of medical radiation techniques. Patient exposure data can be difficult to obtain or might not be available. The sharing of experience among practitioners is still in the early stages. In many cases, regulatory oversight of patient exposure is lacking, even in highly developed countries. It is important to note that medical exposures need to be subject to justification and optimization.

81. Many countries find it difficult to manage or control medical radiation exposures because of poor equipment and insufficiencies in dosimetry and radiation protection guidelines and training. Developing countries frequently rely on donated equipment that is normally used or refurbished and might have reduced capacity to control or manage patient dose when compared to new equipment. In many developing countries, vital information about both the quality of X ray images and patient doses is grossly lacking at many hospitals. In one survey, more than 50% of all X ray images evaluated were of poor quality affecting diagnostic information. Patients are given repeat examinations, entailing additional exposure and cost.

82. In the past, quality assurance (QA) programmes were limited to primarily testing the radiographic equipment. It has been observed that where the QA programme was extended to evaluation of image quality and patient dose, image quality increased while patient dose decreased.

83. Accidental and unintended medical exposures have been reported. The introduction of new equipment or new procedures for medical radiation exposures is a safety critical step. Again, the sharing of experiences between health professionals on this subject is in the early stages.

I.2. International activities

84. The third meeting of the Steering Panel for the International Action Plan for the Radiological Protection of Patients was held in Vienna from 25 to 27 February 2008. Representatives from a number of international bodies, such as International Commission on Radiological Protection (ICRP), International Commission on Radiation Units and Measurements (ICRU), International Electrotechnical Commission (IEC), International Organization for Medical Physics (IOMP), International Society of Radiographers and Radiological Technologists (ISRRT), International Society of Radiology (ISR), International Organization for Standardization (ISO), UNSCEAR, World Federation of Nuclear Medicine and Biology (WFNMB), and WHO, met with other experts in order to review progress of the actions under the Action Plan. The Panel also made additional prioritized concrete recommendations for continued actions, including the further enhancement of the Radiological Protection of Patients website and the development of a safety reporting system for radiotherapy.

85. In conjunction with the 12th International Congress of IRPA, the National Atomic Energy Commission of Argentina, in partnership with the Agency, hosted a technical meeting on radiation safety in newer imaging and radiation therapy technologies in medicine. This meeting focused on the deliberation of technological advances in medical imaging and therapy equipment, with emphasis on radiation safety, and on the identification of possible actions for the Agency in the field of radiation safety in medicine.

86. A briefing and round-table discussion on medical exposures to ionizing radiation was hosted by the French presidency of the European Union in partnership with the Agency and the European Commission in Vienna on 29 September 2008. Over 80 persons were in attendance and the conclusions helped improve ongoing and future Agency initiatives in the area of medical exposures.

J. Protecting the public and the environment

J.1. Trends, issues and challenges

87. There is still a diversity of opinions and some degree of controversy in various aspects of environmental protection and risk assessments, and in particular the integration of existing principles and methodologies in radiation protection with new approaches to the protection of the environment, such as the application of principles of justification, optimization and limitation for the protection of non-human biota or the application of stochastic effects for the protection of non-human biota.

88. Notwithstanding this diversity and controversy, a number of Member States did report to the Agency advances in protecting the public and the environment in 2008, including:

- The Canadian Nuclear Safety Commission has been implementing a quantitative integrated approach to risk assessment since 2000. This approach has worked well and the quality of information provided has improved. On the basis of this experience, Canada suggested that one should not solely focus on numerical criteria and that the application of expert judgement related to particular systems was key.
- France continues to develop applications in modelling for regulatory control for the protection of the environment and comparative methods for risk assessment in multi-stressor situations, such as chemical and radiological risk.
- The UK Environment Agency has applied a screening method to identify areas in the UK needing consideration regarding the conservation of habitats. Only a few sites were identified as needing more site specific modelling. One such site is a protected habitat close to the Sellafield nuclear site, which is being scrutinized from the environmental protection perspective regarding current discharges, the historical legacy and environmental conservation.

89. Sustainability of radioecological expertise is becoming a concern and there is a need to train young professionals and to transfer knowledge between generations.

J.2. International activities

90. The International Conference on Radioecology and Environmental Radioactivity, held in Bergen, Norway in June 2008, confirmed the need to maintain and enhance competences in radioecology. The Conference also supported an integrated approach to the protection of the environment, including taking into consideration both non-radiological and radiological factors. The Conference demonstrated that assessment of the impact of an industry on the environment, when well conducted, enables proper protection measures to be developed and proper regulatory control to be exerted. The Conference highlighted the need to further elaborate and harmonize approaches and methodologies for the radiation protection of humans and the environment under the Agency's coordination.

91. The 3rd annual meeting of the international coordination group on the radiation protection of the environment established under the Plan of Activities on the Radiation Protection of the Environment was held in June 2008 with participants from the Agency, other international organizations (EC, ICRP, International Union of Radioecology (IUR), OECD/NEA) and several Member States (Brazil, Canada, France, Japan, Norway, UK and USA).

92. The OECD/NEA has initiated a review of situations in which the ICRP paradigm (that controls in place to protect humans will also ensure environmental protection) does not necessarily apply. ICRP Committee 5 is continuing to work on developing the reference animals and plants (RAPs) approach, to be consistent with the system of protection for humans. UNSCEAR is preparing a report on radiation effects on biota.

93. The 30th consultative meeting of the Contracting Parties to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter — including inter alia radioactive materials — was held in London, UK in October 2008. At this meeting, the Agency updated participants on progress in updating the database on the inventory of radioactive materials disposed at sea and the database on accidents and losses at sea involving radioactive materials. The Agency also provided information on two notifications received from France and the USA of corrections to their specific information involving historical radioactive waste disposal sites in the Pacific Ocean. The preliminary assessments indicate that these disposals do not represent a significant additional radiological impact to the Pacific Ocean region. The final assessment is expected to be concluded in 2010.

K. Radioactive source safety and security

K.1. Trends, issues and challenges

94. High activity radioactive sources are in widespread use 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 magnitude of the 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 of sources remains an issue in some Member States.

95. An increasing number of countries recognize that the Code of Conduct on the Safety and Security of Radioactive Sources provides the foundation for radioactive source safety and security and many Member States are incorporating the provisions of the Code of Conduct into their national legislation. 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 is using the Code of Conduct's supplementary Guidance on the Import and Export of Radioactive Sources.

96. 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 possibility of safety concerns and a 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.

K.2. International activities

97. In Vienna in May 2008, the Agency held an 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. The meeting brought to light several significant issues including difficulties in the provision of information to exporting States on the regulatory and technical capacity of importing States, the need for assistance in the development of regional networks and/or the utilization of existing networks to discuss the implementation of the Guidance, and a potential gap that might exist in relation to the notification of the transit or transhipment of sources across the territory of States. Participants also made a call for a general review of the Guidance at the next information exchange meeting, which is presently planned for 2010.

98. The Agency's orphan source search and secure project continued to assist countries in establishing their capabilities to search for and secure orphan radioactive sources and establish verified source inventories. The necessary capabilities include the establishment of a national strategy to search for and secure orphan sources based on verified national source inventories, qualified and trained staff capable of implementing search campaigns, and adequate technical means such as hardware and software for inventory and search equipment. Assistance, including expert advice on procurement of search equipment and services, was provided in 2008 to establish these capabilities in Burkina Faso, Cameroon, Democratic Republic of the Congo, Kenya, Mali, Nigeria and Zambia.

99. 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 considerations Member States' feedback and suggestions. The next stage of improvement, the 'RAIS Web Portal', was released in 2008 and provides a Web interface for RAIS 3.0, which could be used, for example, by inspectors in the field, regional offices of regulatory bodies and by authorized representatives of facilities to access facility data.

100. To increase the control of disused sealed radioactive sources (DSRSs) and to provide a viable option for Member States without an adequate disposal system, a concept for DSRS borehole disposal has been developed under Agency auspices. The concept also includes DSRS conditioning. The Agency has designed an integrated package of documents which will include a Safety Guide, technical guidance, and a generic design and safety assessment of the facility which needs to be adapted to local conditions in interested Member States. The implementation of DSRS borehole disposal has been supported through technical cooperation projects in Member States from Africa, Asia and Latin America having expressed interest in it.

L. Safety of transport of radioactive material

L.1. Trends, issues and challenges

101. Denials and delays of shipment of radioactive materials continue to occur in all parts of the world. The underlying trend in the reduction of available routes seems to be a precursor to denials, but the ability to monitor and measure this remains difficult due to commercial sensitivities. It is likely that increased monitoring and recording will result in an apparent increase in denials, although the actual trend may be harder to determine initially. It is clear that effective communication with

transport personnel whose main activity is not handling radioactive material is an essential tool to combat undue denials and delays. Therefore, the promotion of communication and training is the focus of the action plan of the International Steering Committee on Denials of Shipment of Radioactive Material.

102. Another continuing challenge is to improve cooperation and interfaces with other United Nations bodies associated with the transport of dangerous goods. There is also a need for integration of appraisal and information gathering with that obtained from the International Civil Aviation Organization (ICAO) and International Maritime Organization (IMO) during their dangerous goods audits, as well as a more general need for improving the quality of assessment tools provided to Member States.

L.2. International activities

103. The International Steering Committee on Denials of Shipment of Radioactive Material continues to guide international activities and in 2008 this included four regional workshops with a view to establishing regional networks to deal with the issue. These regional networks will 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. 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 and had received more than 100 denial reports by the end of 2008.

104. In 2008, the Board of Governors approved revisions to the 2005 Edition of the Transport Regulations and the updating of the suite of transport safety standards is almost complete. Future work will include the development of new fissile-excepted material requirements, as requested by the General Conference, for the transport of radioactive materials.

105. In September 2008, a group of coastal and shipping States held, with Agency participation, a fourth 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 safe maritime transport of radioactive material.

106. On 1 October 2008, during the 52nd regular session of the General Conference, the Secretariat and the Government of Canada jointly hosted a round-table meeting to provide information on the issue of delays and denials of shipment and to further sensitize people to the issue. In addition to a number of presentations, there was also a case study of the effects of the closure of the Channel Tunnel following a major fire on a shipment of radioisotopes for medical purposes.

M. Safety of radioactive waste management and disposal

M.1. Trends, issues and challenges

107. The safety of radioactive waste management has both short and longer term dimensions. The former concerned with the possibility of transboundary movement of materials and potential accidents with transboundary impact, the latter with radionuclide migration over longer timeframes when national borders have limited significance. Additionally, confidence in the safety of radioactive waste

management and disposal arrangements is an important factor in the public acceptance of nuclear energy. As such, and with a well developed series of Agency Safety Standards for radioactive waste management, there are increasing moves to the voluntary adoption of these standards and to harmonized approaches to demonstrate the safety of radioactive waste management activities and facilities.

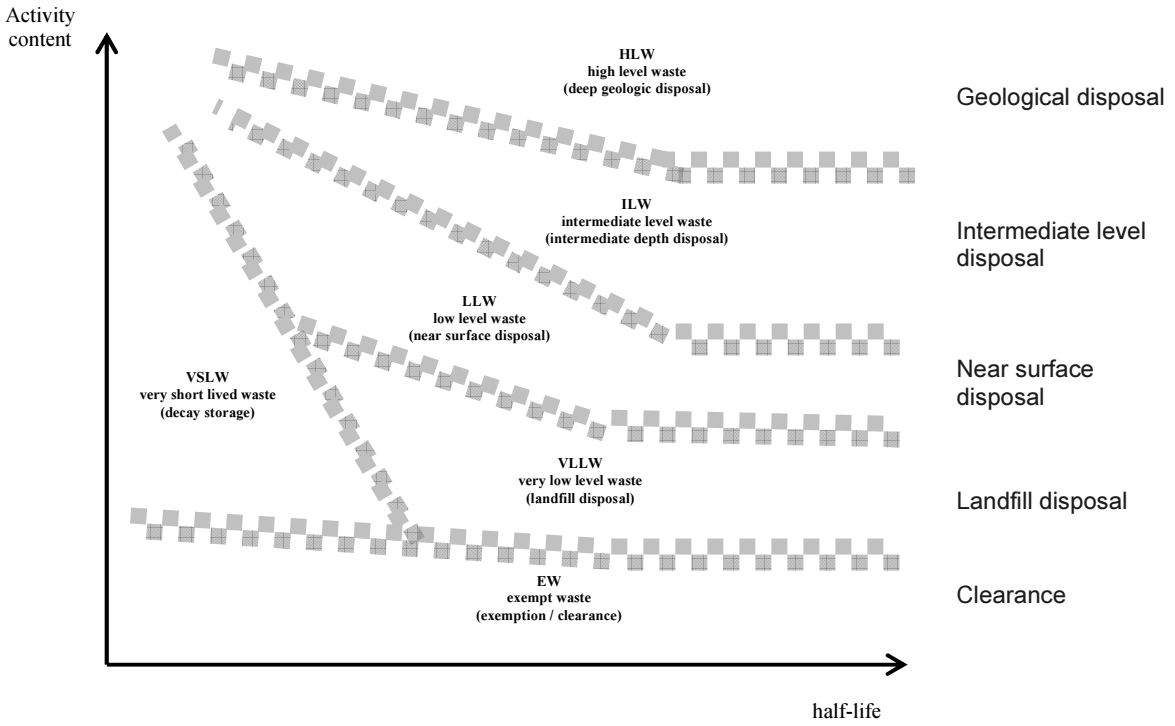

Figure 4: Classification of radioactive waste

108. The potential increased use of nuclear energy underlines the need for moving ahead with high level waste disposal programmes. These should provide a safe closeout of the fuel cycle and provide assurance to the public that this is a realistic and feasible outcome. Confidence in the safety of radioactive waste management including disposal arrangements is an important factor in the public acceptance of nuclear energy. Difficulties in developing waste disposal facilities in many Member States due to socio-political influences have led to arrangements for extended storage having to be made. Such storage can be undertaken safely in the short to medium term, but the collective opinion of most technical experts is that this is not a sustainable option in the longer term. International consensus has been developed on safety standards for near surface radioactive waste disposal and for geological disposal but no such consensus has been yet achieved for the disposal of intermediate level waste. A number of countries have made real progress with geological disposal programmes, and attention is now turning to actual licensing processes for geological disposal facilities in, inter alia, Finland, Sweden and the USA. The importance of the global nuclear safety regime providing a coherent and harmonized framework for the safety of geological disposal and in particular the importance of the Joint Convention in providing an international oversight mechanism is more and more recognized.

M.2. International activities

109. In 2008, the Agency issued an updated safety standard on classification of radioactive waste (see Figure 4). The updated standard covers all radioactive waste types in a coherent manner and

recognizes the clearance concept for identifying the boundary between waste that needs to be managed as radioactive waste and waste which can be removed from regulatory control for management as conventional waste.

110. The Agency organized a workshop in 2008 on disposal options for intermediate level waste, the first international discussion on the issue. Several Member States presented their disposal concepts, most of which call for disposal at depths below the surface to protect against human intrusion. The workshop called for further harmonization in the demonstration of safety and decided that the current Agency Safety Requirements were sufficient to address this form of disposal. Suggestions for development of further guidance were made.

111. The Euradwaste '08 conference reported on the EC's Sixth Framework Programme. Emphasis was placed on recent developments on disposal of spent fuel and high level and long lived waste, both at the policy and technical levels. Interesting discussions were held on multinational solutions for geological disposal. It was concluded that collaboration between implementers was well established but more was needed between regulators. The UK reported on a new initiative to site a geological disposal facility and Germany reported positive developments with the licensing of the Konrad mine for non-heat generating waste.

112. The US Environmental Protection Agency has established radiation standards for the proposed spent nuclear fuel and high level radioactive waste disposal facility at Yucca Mountain, Nevada. The Yucca Mountain standards are in line with approaches used in the international radioactive waste management community and in the Agency's Safety Requirements. These standards will be used in reviewing the licence application submitted in June 2008 by the US Department of Energy to site a geological disposal facility at Yucca Mountain.

113. The 2008 International High-Level Radioactive Waste Management Conference took place in Las Vegas, USA in September. The fact that the meeting was well attended by participants from around the world indicated the growing importance of this topic. The need to work cooperatively on establishing safety criteria was given considerable attention as was the regulatory review process, which is starting in the case of Yucca Mountain and will start soon in Finland and Sweden.

N. Decommissioning

N.1. Trends, issues and challenges

114. As existing nuclear installations and other facilities using radioactive material continue to age, the time for their eventual decommissioning approaches. In addition to the 439 reactors operating worldwide, various reports indicate that 30 more units are planned and 39 await decommissioning. The Agency's Integrated Nuclear Fuel Cycle Information System (iNFCIS) database reports 297 fuel cycle facilities in operation, with 69 currently undergoing decommissioning and 43 others awaiting decommissioning. From a technological perspective, there are many options available for the safe and secure decommissioning of nuclear installations. However, in many cases, decommissioning planning is far from complete, and in some cases, even the fundamental approach to decommissioning, including the allocation of responsibilities, funding system and waste route, has not been agreed. Although a number of Member States have taken steps to ensure that financial and human resources

are available, for a large number of facilities worldwide, decommissioning activities are not adequately resourced.

N.2. International activities

115. The International Decommissioning Network (IDN) is now coordinating and building on current efforts to assist Member States in the sharing of practical decommissioning knowledge. A number of activities were conducted in 2008, including workshops on waste management and clearance hosted by the National Company for Radioactive Waste (ENRESA) in Spain and on size reduction for decommissioning of nuclear facilities hosted by Belgium. The IDN Steering Committee met in June 2008 in Spain and discussed new basic courses in decommissioning and scientific visits to a number of facilities.

116. The Agency project to assist the Government of Iraq in the evaluation and decommissioning of the former facilities that used radioactive materials has progressed well and continued support is being given by experts from Germany, Italy, UK, Ukraine and the USA. The first facility identified by the prioritization system agreed to in 2007, the lightly contaminated LAMA building at Al-Tuwaitha, has begun decommissioning with the clearance of unexploded ordnance and scrap material from around the facility itself. This has been made possible due to the practical training given to the Iraqi expert team conducted at a contaminated site in Pripyat in the Ukraine.

117. In 2008, the Agency conducted an international peer review of the Magnox decommissioning programme in the UK, focusing on Bradwell NPP. The results of the peer review were examined at an international meeting in November 2008. The UK valued the benchmarking process and encouraged other decommissioning operators to take advantage of it. The Agency will improve the review service using the lessons learned during this pilot case.

118. The biennial French Nuclear Energy Society conference on decommissioning challenges was held from 28 September to 2 October 2008. During the conference, it became clear that lessons learned in decommissioning are not being communicated well enough across the industry and it was obvious that the Agency had a vital and continuing role in disseminating these lessons learned, as well as best practices, to Member States.

O. Remediation of contaminated sites

O.1. Trends, issues and challenges

119. The vast majority of contaminated sites are the result of former uranium mining and production activities in various parts of the world. In many cases, the Agency's relevant safety standards are not complied with and no sufficient financial or human resources to effectively deal with these contaminated sites are available.

120. An important challenge is to prevent repeating mistakes of the past with uranium mines and production sites through the development and application of sustainable best practices and stewardship principles throughout the global uranium production industry.

O.2. International activities

121. Regarding former uranium mining and productions activities, recent initiatives by the Agency in Central Asia include cooperation and communication with other international agencies including the Organization for Security and Co-operation in Europe (OSCE), United Nations Development Programme (UNDP) and the World Bank. The Agency is providing comprehensive assistance on both national and regional levels with the aim of upgrading institutional capabilities in Member States. The main focus of these programmes is on upgrading regulatory control, and expanding environmental monitoring and laboratory analysis capabilities in full compliance with Agency safety standards.

122. The Agency and the World Nuclear Association (WNA) organized a joint Technical Meeting on uranium mining environment, health and safety aspects in October 2008, in Vienna, Austria. The need for leading uranium mining producing countries and uranium mining companies to provide stewardship and support for emerging uranium producing countries was recognized. The consensus that arises from this is a shared commitment from these leading countries and companies to team-up to provide sustained leadership and support for constructive Agency initiatives such as regional meetings and benchmarking new sites in emerging uranium mining regions and countries.

123. The Agency has reconstituted its Uranium Production Site Appraisal Team (UPSAT) programme, which provides Member States with a safety related peer review service for uranium mining and production facilities. A key element of the programme is the sharing of best practices.

124. With respect to naturally occurring radioactive material (NORM), the work of the phosphate industries working group has been continued through a series of meetings at the Agency. In the longer term a key deliverable will be a global best practice model providing for an optimized approach to regulation, residue and waste management and safety in the phosphate industry.

Appendix 1
Safety related events and activities worldwide during 2008

A. Introduction

125. This report identifies those safety related events or issues during 2008 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 2008.

B. International instruments

B.1. Conventions

B.1.1. Convention on Nuclear Safety (CNS)

126. In 2008, Iceland ratified and Malta and Senegal[6] acceded to the CNS, which had 62 Contracting Parties at the end of 2008, including all Member States operating nuclear power plants (NPPs).

127. The Secretariat gave support for the 4th Review Meeting of Contracting Parties to the CNS in April 2008. At the request of the 3rd Review Meeting of the CNS, the Agency also provided Contracting Parties with a report entitled *Major Issues and Trends in Nuclear Safety*, which summarizes the significant issues, developments and trends in enhancing nuclear safety derived from the Agency's safety review services over the past three years, such as the need for a nuclear safety infrastructure, leadership and management for safety and safety culture, operational safety performance, and long term operation. This report was intended to help the Contracting Parties to prepare their national reports. The Agency also produced and distributed a report to Contracting Parties entitled *Synopsis of the relevant IAEA Safety Requirement Statements* reflecting the issues addressed by Articles 6 to 19 of the CNS.

128. In 2004, the Agency introduced a secure website for the CNS and, based on feedback from Contracting Parties, a number of upgrades were made in 2007 and 2008. The website is now a well established tool for communication in the peer review process, with over 4000 questions and answers provided electronically.

129. The 4th Review Meeting emphasized nine issues in the Summary Report: legislative and regulatory framework; independence of the regulatory body; safety management and safety culture; staffing and competence; probabilistic safety assessment; periodic safety review; ageing management

[6] For Senegal, the Convention on Nuclear Safety will enter into force on 24 March 2009

and life extension; emergency management; and new NPPs. For all of these issues, Agency safety standards have either already been published or are in an advanced state of preparation or planned. It was recognized that the Agency's Safety Requirements and their supporting guides are not only increasingly referred to by the Contracting Parties, but are also more and more implemented in national regulations. However, from the Agency's perspective, application of the safety standards needs to be further facilitated with respect to implementing them in the peer review process.

130. Many Contracting Parties reported on their positive experiences with Agency missions, especially the Operational Safety Review Team (OSART) and the Integrated Regulatory Review Service (IRRS), and recognized their importance. Contracting Parties were encouraged to invite such missions if they had not yet done so.

131. For the next review meeting in April 2011, Contracting Parties again requested that the Agency produce a report on major trends and issues in nuclear safety and distribute this report before Contracting Parties start to prepare their national reports. The Agency was also requested to prepare a brochure introducing the CNS and its associated rules of procedure and guidelines. This brochure is intended to pass on basic information to those who are new to the CNS and the peer review process.

132. The Contracting Parties discussed and agreed to a number of improvements to the review process for the CNS, including provisions for continuity between review meetings, increased transparency of the review process and expanded outreach activities.

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)

133. In 2008, Denmark ratified the Assistance Convention and Gabon acceded to and Senegal[7] ratified both the Early Notification and Assistance Conventions. The Early Notification Convention had 102 parties and the Assistance Convention had 101 parties at the end of 2008.

134. In 2008, no notification messages were submitted under the provisions of the Early Notification Convention. However, in relation to eight events with potential nuclear or radiological consequences, or elevated media interest, advisory messages were submitted by the official designated counterparts under the Conventions using the *Emergency Notification and Assistance Conventions* (ENAC) secured web system and as per the *Emergency Notification and Assistance Technical Operations Manual* (ENATOM) arrangements.

135. In two cases, the Agency was requested to provide assistance pursuant to the Assistance Convention. In both cases, the Agency deployed assistance missions to the requesting countries in cooperation with the State Party which delivered specialized assistance.

136. Every year, a number of activities, including Convention Exercises (ConvEx), are organized to evaluate and confirm various aspects of the practical arrangements for implementing the provisions of the Early Notification and Assistance Conventions. In 2008, four ConvEx were conducted, including one large-scale international exercise based on a simulated accident at Mexico's Laguna Verde NPP, as well as four exercises with the World Meteorological Organization (WMO) and 12 communication tests.

---

[7] For Senegal, the Early Notification and Assistance Conventions entered into force on 23 January 2009

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

137. The Joint Convention applies to spent fuel and radioactive waste resulting from civilian nuclear activities and to planned and controlled releases into the environment of liquid or gaseous radioactive materials from regulated nuclear facilities. In 2008, Senegal[8] and Tajikistan acceded to the Joint Convention, which had 46 parties at the end of 2008. Considering that the vast majority of Member States have some requirements for radioactive waste management, it would be beneficial that more States become Contracting Parties to the Joint Convention.

138. The Organizational Meeting for the Third Review Meeting of the Contracting Parties to the Joint Convention was held in Vienna in October 2008 with 40 Contracting Parties participating. The meeting elected Mr. Kunihisa Soda of Japan as the President of the Third Review Meeting. Mr. Frank Marcinowski of USA and Mr. Laszlo Koblinger of Hungary were elected Vice-Presidents. Six Country Groups were established and Contracting Parties were allocated to the Country Groups. Contracting Parties also met separately in Country Groups to elect Country Group Officers.

139. The Third Review Meeting will be held from 11 to 20 May 2009.

B.2. Codes of Conduct

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

140. The provisions and guidance in the Code of Conduct have been integrated into appropriate Agency safety review services, technical cooperation projects and extrabudgetary programmes. Application of the Code of Conduct is being accomplished through implementation of national safety regulations. Member States are being encouraged 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.

141. An international meeting on the application of the Code of Conduct on the Safety of Research Reactors was conducted in October 2008 in Vienna. The large number of Member States represented at this meeting showed evidence of interest in the Code of Conduct and its application in regulation and operation. In many Member States, research reactors are an essential part of the nuclear safety and technical infrastructures. Many of the presentations focused on the legal and regulatory infrastructure, in particular improvements to laws and regulations to comply with the recommendations of the Code of Conduct. Some Member States reported deficiencies in arrangements for reactors in extended shutdown and for decommissioning. In many cases, periodic safety reviews are required for research reactors, generally as part of a relicensing or licence extension process. Even so, participants noted that improvements could be made to the review process. Participants identified a number of challenges that both operating organizations and regulatory bodies will need to address, including the availability of well-trained and competent staff, ageing facilities, appropriate financing and stakeholder engagement.

[8] For Senegal, the Joint Convention will enter into force on 24 March 2009

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

142. By the end of 2008, 93 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 51 States had expressed support for the Supplementary Guidance on the Import and Export of Radioactive Sources.

143. In Vienna in May 2008, the Agency held an 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. The meeting brought to light several significant issues including difficulties in the provision of information to exporting States on the regulatory and technical capacity of importing States, the need for assistance in the development of regional networks and/or the utilization of existing networks to discuss the implementation of the Guidance, and a potential gap that might exist in relation to the notification of the transit or transhipment of sources across the territory of States. Participants also made a call for a general review of the Guidance at the next information exchange meeting, which is tentatively planned for 2010.

C. Cooperation between national regulatory bodies

144. 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)

145. INRA comprises the most senior officials of a number of well-established national nuclear regulatory organizations in Europe, America and Asia who wish to exchange perspectives on important issues with the purpose of influencing and enhancing nuclear safety and radiological protection from a regulatory perspective. INRA met twice in 2008 in USA and discussed, inter alia, recent events in each country, operating experience across a range of issues, countries considering developing nuclear energy, and radioactive source controls. In 2008, INRA issued a letter to the Director General strongly encouraging countries that are expanding their programs for peaceful uses of nuclear energy and those developing new nuclear programs to adopt programs of continuous improvement in nuclear safety.

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

146. Under the presidency of Japan, the G8-NSSG met three times in 2008. The Agency, the European Commission (EC), the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA) and the European Bank for Reconstruction and Development (ERBD) also attended these meetings. The G8-NSSG discussions focused on: the safety upgrading programme of the Armenian NPP; the Chernobyl Shelter Fund and Nuclear Safety Account managed by the EBRD; the implementation of activities under the EC-Agency-Ukraine Joint Project;

the Global Nuclear Safety Network (GNSN); strengthening of international nuclear safety and security activities; the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on Import and Export; the global initiative to combat nuclear terrorism; the international initiative on 3S-based (safety, security, safeguards) nuclear energy infrastructure; and human resources development in the field of nuclear safety and security.

147. At the last meeting in December 2008, the main themes to be addressed during the 2009 Italian G8 presidency were introduced. These include: Chernobyl NPP projects; earthquake and nuclear safety; improving the safety of NPPs in operation; safety and security of radioactive sources; global initiative to combat nuclear terrorism; multilateral approaches to the nuclear fuel cycle; GNSN; international initiative on 3S-based nuclear energy infrastructure; and nuclear education and training.

Western European Nuclear Regulators Association (WENRA)

148. WENRA was established in 1999 and currently includes the heads of nuclear regulatory authorities of 17 European countries having at least one nuclear power plant. One of its main objectives is to develop a harmonized approach to selected nuclear safety and radiation protection issues and their regulation, particularly within the European Union. To this end, two working groups had been previously established: the Reactor Harmonization Working Group (RHWG) and the Working Group on Waste and Decommissioning (WGWD).

149. In January 2008, the RHWG published its safety reference levels for nuclear reactors, which are based mainly on the Agency's safety standards and best regulatory practice/experience from European countries. As a follow-up, it will regularly revise the reference levels according to the latest development in the field of international standards. In addition, the RHWG was charged by WENRA to perform a pilot study on reactors not covered by the existing reference levels.

150. The WGWD is continuing to develop safety reference levels for radioactive waste and spent fuel storage and decommissioning. In 2008 it also reopened a discussion on terms of reference for study of repositories which aims at the formulation of safety reference levels for geological disposal facilities.

151. In 2008 WENRA invited European countries without nuclear power programmes to participate as observers at all WENRA meetings. At its October meeting, WENRA discussed the draft European Council Directive setting up a community framework for nuclear safety.

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

152. The Forum met in May 2008 in Uruguay, with the chief regulators from Argentina, Brazil, Cuba, Mexico, Spain and Uruguay attending. At the meeting, Chile was accepted as a new member. In addition, the Forum reviewed ongoing projects, including the implementation of the Ibero-American Radiation Safety Network. The presidency has been transferred from Uruguay to Argentina.

153. In 2008, the Forum completed a project on risk analysis and risk reduction in medical exposures. Lessons learned from accidental exposures in radiotherapy were combined with more proactive methods of finding out what else can go wrong and how to prevent accidental exposures. These methods included probabilistic safety assessment and risk matrix approaches. The findings are being used to improve the inspections of regulatory bodies and the safety in the radiotherapy departments.

154. A Forum project on continuous improvement of the regulatory control of medical exposure in Ibero America was also completed in 2008. The project was successful in exploring areas of collaboration between regulatory and health authorities, building up on the methods for self

assessment, identification of gaps and difficulties in implementing safety standards in medical exposure and providing approaches to address them.

155. The results of both of these projects will be provided to the Agency for use by all Member States in the region.

C.5. Cooperation Forum of State Nuclear Safety Authorities of Countries which operate WWER[9] Reactors

156. The Forum conducts annual meetings where senior staff of regulatory bodies in countries that operate WWER reactors discuss regulatory and safety issues related to operation of WWERs. The 15th Annual Meeting of the Forum was conducted in July 2008 in Kiev, Ukraine. The Forum members exchanged information related to the status of regulatory activities and WWER NPP safety performance. Other topics discussed included the Agency's IRRS and risk-informed decision making programmes. The Forum working groups reported on activities completed since the previous annual meeting in the areas of operating experience feedback, regulatory use of PSA methodology, regulatory aspects of organizational, and management and safety culture related issues of NPPs. Forum members also discussed a number of improvements to enhance the work of the Forum. The 16th Annual Meeting will be hosted by Bulgaria in 2009.

C.6. Network of Regulators of Countries with Small Nuclear Programmes (NERS)[10]

157. NERS is an independent organization of nuclear regulators dedicated to the free exchange of nuclear regulatory information among regulators of countries with small nuclear programmes. Members include Argentina, Belgium, Czech Republic, Finland, Hungary, Netherlands, Pakistan, Slovakia, Slovenia, South Africa and Switzerland. The 11th Annual Meeting of NERS was conducted in Prague, Czech Republic from 27 to 28 April, 2008. Topics discussed included general information regarding regulatory issues of interest to the members, licensing process for increasing power in operating reactor units, use of Probabilistic Risk Assessment results for inspection activities, and operational experience feedback.

158. The next meeting of NERS will be held in Brussels, Belgium from 4 to 5 June 2009.

C.7. The senior regulators from countries which operate CANDU-type nuclear power plants

159. The annual meeting of senior regulators of countries operating CANDU-type reactors (Argentina, Canada, China, India, Republic of Korea, Pakistan and Romania) was hosted by the Agency at its headquarters in Vienna in October 2008. The issues discussed covered a large variety of topics, including: requirements on operations related to availability of off-site power during long outages; experience and plans for long-term storage and waste disposal; regulatory assessment of new NPP design; regulatory approach and lessons learned from refurbishment; approaches/regulatory tools for independent verification of licensee's submissions; probabilistic safety assessment; technical cooperation; steam generator issues; risk-informed decision making and specific application for

---

[9] water cooled, water moderated power reactor

[10] www.ners.info

CANDU; design basis accident for CANDU reactors; radiation protection issues; periodic safety review and licensing; and, experience with respect to IRRS missions.

C.8. The International Nuclear Event Scale (INES)

160. More than 60 Member States are currently members of INES and use the INES to communicate the safety significance of events at the national level. Member States also used the INES to communicate on events that are rated at Level 2 or higher or that are of international media interest — through the Nuclear Event Web-based System (NEWS) — to the media, the public and to the international scientific community.

161. The International Nuclear and Radiological Event Scale (INES) has been used for 18 years. During this period, it has been extended and adapted further to meet the growing need for communication of the significance of all events associated with the transport, storage and use of radioactive material and radiation sources. In July 2008, the INES User's Manual, which consolidates the additional guidance for rating radiation source and transport events and other needed clarifications and provides examples and comments on the continued use of INES and replaces earlier publications, was endorsed for use by the INES Advisory Committee and INES national officers.

D. Activities of international bodies

162. 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)

163. The United Nations General Assembly established UNSCEAR in 1955 to assess and report levels and effects of exposure to ionizing radiation. UNSCEAR's Programme of Work is approved by the General Assembly, and has extended typically over a 4–5 year period. The secretariat, which is provided through the United Nations Environment Programme (UNEP), engages specialists to analyse information, study relevant scientific literature and produce scientific reviews for scrutiny at UNSCEAR's annual sessions. At the end of the cycle, the United Nations publishes the substantive reports, which are recognized as authoritative scientific reviews and provide the scientific foundation for the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS). UNSCEAR also reports annually to the General Assembly. In 2008, UNSCEAR issued a scientific report covering sources of radiation exposure, the Chernobyl accident and effects on non-human biota.

164. UNSCEAR held its fifty-sixth session in Vienna from 10 to 18 July 2008. The Committee scrutinized and approved for publication five scientific annexes. It was also noted that the General Assembly, in its resolution 62/100 of 17 December 2007, had appealed to the Secretary-General of the United Nations to take appropriate administrative measures so that the secretariat could adequately service UNSCEAR in a predictable and sustainable manner.

165. UNSCEAR has developed a strategic plan to provide vision and direction for all its activities during the period 2009–2013, to facilitate result-based programming by the secretariat, to help foster management of sufficient, assured and predictable resources and to improve planning and coordination among the various parties involved. The strategic objective for the period is to increase awareness and deepen understanding among authorities, the scientific community and civil society with regard to levels of ionizing radiation and the related health and environmental effects as a sound basis for informed decision-making on radiation-related issues. UNSCEAR also established that the thematic priorities for the period would be medical exposures of patients, radiation levels and effects of energy production, exposure to natural sources of radiation and improved understanding of the effects from low-dose-rate radiation exposure.

166. UNSCEAR's fifty-seventh session will be held in Vienna from 25 to 29 May 2009.

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

167. ICRP is an independent group of experts that issues Recommendations on the principles of radiation protection. ICRP Recommendations have provided the basis for national and international standards, including the BSS. Appointments to the ICRP and its Committees are made for five year periods, and the current cycle ends on 30 June 2009.

168. ICRP has revised its 1990 Recommendations and published its 2007 Recommendations in February 2008 as Publication 103. ICRP released two additional publications in 2008.

169. *Scope of Radiological Protection Control Measures* (Publication 104) offers advice to competent national authorities and relevant intergovernmental organizations for facilitating their definition of the scope of control measures for purposes of protecting people against possible adverse consequences of radiation exposure. The main concepts associated with the scope of radiological protection regulations are termed 'exclusion' and 'exemption'. Exclusion refers to the deliberate omission of exposure situations from the scope of regulatory requirements, and exemption refers to waiving regulatory requirements if their application is not warranted. A special case of exemption, termed 'clearance', refers to the relinquishing of regulatory control if such control becomes unwarranted.

170. *Radiological Protection in Medicine* (Publication 105) was prepared to underpin the ICRP 2007 Recommendations with regard to the medical exposure of patients, including their comforters and carers, and volunteers in biomedical research. It addresses the proper application of the fundamental principles (justification, optimization of protection, and application of dose limits) of the Recommendations to these individuals. It is not appropriate to apply dose limits to medical exposure of patients, because such limits would often do more harm than good. The emphasis is then on justification of the medical procedures and on the optimization of radiological protection. In diagnostic and interventional procedures, justification of procedures (for a defined purpose and for an individual patient), and management of the patient dose commensurate with the medical task, are the appropriate mechanisms to avoid unnecessary or unproductive radiation exposure. Equipment features that facilitate patient dose management, and diagnostic reference levels derived at the appropriate national, regional, or local level, are likely to be the most effective approaches. In radiation therapy, the avoidance of accidents is a predominant issue. With regard to comforters and carers, and volunteers in biomedical research, dose constraints are appropriate.

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

171. The ICRU, a sister organization of the ICRP, provides internationally acceptable recommendations concerning concepts, quantities, units, and measurement procedures for users of ionizing radiation in medicine, basic science, industry, and radiation protection. The ICRU held its annual meeting from 22 to 27 September 2008 in Nyon, Switzerland. At the meeting, two ICRU draft reports were reviewed for final approval for publication: *Assessment of Image Quality in Mammography* and *Fundamental Quantities and Units for Ionizing Radiation*. In addition, a joint ICRP-ICRU draft report was reviewed for final approval for publication in the Annals of the ICRP: *Reference Computational Phantoms of the Adult Male and Female*.

172. The current ICRU programme is focused on four areas:

- Diagnostic radiology and nuclear medicine;
- Radiation therapy;
- Radiation protection;
- Radiation in science.

D.4. International Nuclear Safety Group (INSAG)

173. The International Nuclear Safety Group (INSAG) is a group of experts with high professional competence in the field of nuclear safety working in regulatory organizations, research and academic institutions, and the nuclear industry. It was initially constituted following the Chernobyl accident in 1986 and is constituted under the auspices of the International Atomic Energy Agency with the objective of providing authoritative advice and guidance on nuclear safety approaches, policies and principles.

174. In 2008, INSAG published *Nuclear Safety Infrastructure for a National Nuclear Power Programme Supported by the IAEA Fundamental Safety Principles* (INSAG-22) and *Improving the International System for Operating Experience Feedback* (INSAG-23). A report on the interface between safety and security is in preparation.

175. As in previous years, the INSAG forum was held during the 52nd Regular Session of the General Conference. This year the INSAG Forum focused on the challenges faced by countries embarking in a nuclear power programme to establish a nuclear safety infrastructure and achieve a sustainable high level of nuclear safety. Four Member States that have expressed an interest in developing a nuclear power programme for the first time shared their views on how to achieve nuclear safety as a foundation for that programme in a round table discussion.

176. INSAG Chairman Richard Meserve also issued his fifth 'State of Nuclear Safety' letter[11] to the Director General of the IAEA.

[11] http://www-ns.iaea.org/downloads/committees/insag/2008AssessmentLetter.pdf

E. Activities of other international organizations

E.1. Institutions of the European Union

177. In 2008, the European High-Level Group on Nuclear Safety and Waste Management, which was renamed the European Nuclear Safety Regulators Group (ENSREG), met five times in 2008. At these meetings, the chairperson was confirmed, rules of procedure were established, the work programme was discussed, three working groups on safety, waste management and transparency were created and vice-chairpersons designated. The delegates committed to transparency, self-assessment, IAEA peer-review and strengthened cooperation to further improve radioactive waste and spent fuel management practices. ENSREG also endorsed three reports on waste management. On 7 November 2008, ENSREG held an extraordinary meeting to exchange views and make individual recommendations regarding a draft of a revised proposal for a Directive setting up a Community framework for nuclear safety.

178. The European Nuclear Energy Forum (ENEF) is a platform to promote a broad discussion among all relevant stakeholders on the opportunities and risks of nuclear energy. The European Commission's (EC) proposal to create the European Nuclear Energy Forum was endorsed by the European Council in March 2007. Hosted successively in Bratislava and Prague, ENEF meets twice per year. The third plenary meeting of ENEF took place in Bratislava in November 2008. More than 200 high-ranking participants joined the discussions on transparency, risks and opportunities of nuclear energy, representing all relevant stakeholders. First results relate to safety, nuclear waste, and to concrete ways to translate the competitive advantage of nuclear energy into consumer benefit. The discussions also addressed governance and new concepts of electricity grids.

179. On 26 November 2008, the EC adopted a revised proposal for a Directive setting up a Community framework for nuclear safety. It defines basic obligations and general principles for the safety of nuclear installations in the EU while enhancing the role of national regulatory bodies. The general objective of the proposal is to achieve, maintain and continuously improve nuclear safety and its regulation in the Community and to enhance the role of the regulatory bodies. Its scope of application is the design, siting, construction, maintenance, operation and decommissioning of nuclear installations, for which the consideration of safety is required under the legislative and regulatory framework of the Member State concerned. The right of each Member State to use nuclear energy or not in its energy mix is recognized and fully respected. The proposal is based on the obligations of the Convention on Nuclear Safety and the Agency Safety Fundamentals. ENSREG will become the focal point of cooperation between regulators and will contribute to the continuous improvement of nuclear safety requirements, especially with respect to new reactors.

180. The Report from the EC to the European Parliament and the Council of Ministers of the European Union: Sixth Situation Report on Radioactive Waste and Spent Fuel Management in the European Union was issued on 8 September 2008 and gives an overview of the current status of the management of radioactive waste and spent fuel in the EU. It also proposes actions at the Community and national levels with the purpose of ensuring progress towards implementation of radioactive waste and spent fuel disposal facilities. The key messages highlighted by the EC in the Report are the following:

- 'wait-and-see' policies are not acceptable.

- Many scientific and technical areas important to geological disposal have reached maturity level, and moving towards implementation should be encouraged and facilitated.
- All initiatives leading to encouraging and facilitating progress towards identification and operation of safe waste repositories are highly welcome.
- Regional and international cooperation could accelerate decision-making on definitive disposal solutions.
- Proposals from non-EU states for disposal of radioactive waste and spent fuel should not be encouraged.

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

181. The Nuclear Energy Agency 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.

182. To commemorate its 50th Anniversary, the OECD/NEA organized a special event in conjunction with the October 2008 Steering Committee meeting. It also prepared a special publication titled *Nuclear Energy Outlook*, which includes projections of nuclear energy's potential share of the world energy demand up to 2050. It also covers all the issues related to nuclear power, such as safety, waste, environmental issues, economics, fuel resources, non-proliferation and technology development.

183. The topic of NPP life management was selected for the policy debate at the Steering Committee meeting in April 2008 largely due to the fact that an increasing number of NPPs around the world are approaching the end of their original design lifetimes. Because of the characteristics of nuclear power — capital-intensive but low fuel and operating costs — life extensions are very attractive economically. Life extension raises a variety of issues requiring analysis: safety and regulatory issues, legislative issues, socio-political issues, economic issues and many technical issues. The debate concluded that there were different regulatory approaches in member countries regarding the definition of an NPP's lifetime and its extension; that safety is a prerequisite for any life extension; that extending the life of an NPP generally has considerable economic advantages; that in some countries, social and political considerations could play a significant role; and that NPP life management is a very important topic for member countries on which the OECD/NEA should continue its work.

184. The Multinational Design Evaluation Programme (MDEP) Policy Group met in March 2008 and approved the continuation of the programme, merging the current three stages into a single programme. It also approved a working group structure composed of two Design Specific Groups — Evolutionary Power Reactor (EPR) and AP1000 — and three Issues Specific Groups — Codes and Standards, Vendor Inspection Cooperation and Digital Instrumentation and Control Standards. The Codes and Standards Working Group will address the pressure boundary component design codes developed in Canada, France, Japan, Republic of Korea, Russian Federation and USA, and will evaluate differences to improve the effectiveness and efficiency in regulatory decision making. The Vendor Inspection Cooperation Working Group is related to the regulatory inspection of the design, manufacturing and supply of nuclear reactor systems, structures and components that have a safety function. Finally, the Digital Instrumentation and Control Working Group aims to identify and prioritize the MDEP member countries' challenges, practices, and needs regarding standards and guidance for digital instrumentation and control.

185. Drawing on developments in the last decade, the Radioactive Waste Management Committee (RWMC) has finalized a new collective statement on 'Moving Forward with Geological Disposal'. This collective statement expresses the collective views on why geological disposal remains an appropriate waste management choice for the most hazardous and long-lived radioactive wastes, on the current status, on challenges and opportunities associated with implementation and on expectations for further development of geological repositories.

186. The recently established Working Group on the Regulation of New Reactors (WGRNR) agreed on the importance of developing a construction experience database and decided to collect inspection findings during constructions of new NPPs, and the need to develop criteria for reporting. Regarding the regulation of nuclear sites, members agreed to review the various practices used in the regulation of nuclear power plant sites, including seismicity issues, security issues, multi-units aspects and regulator practices on sites where a mixture of activities are taking place (e.g., operating units, new construction, decommissioning, etc.).

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

187. Every organization in the world that operates a nuclear electricity generating 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.

188. WANO conducted peer reviews at 29 NPPs during 2008, altogether 387 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 Institute of Nuclear Power Operations (INPO) and Japan Nuclear Technology Institute (JANTI) reviews.

189. WANO continues to emphasize technical support missions, which focus on providing assistance in selected areas, with more than 200 technical support missions undertaken during 2008. Many of these technical support missions included experts from other WANO regions sharing their experiences to support improvements in operational safety.

190. 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.

191. WANO also conducted its second Plant Managers' Conference in Prague, Czech Republic from 10 to 12 November 2008. More than 120 plant managers attended this successful two-day conference, with discussions focused on the themes of 'Leadership to Improve Performance' and 'Use of Operating Experience.' In addition, each WANO region held workshops and seminars throughout the year on a variety of topics related to NPP operations.

F. Safety significant conferences in 2008[12]

F.1. International Conference on Radioecology and Environmental Radioactivity

192. The International Conference on Radioecology and Environmental Radioactivity was held in Bergen, Norway from 15 to 20 June 2008. It was organized by the Norwegian Radiation Protection Authority and the French Institute for Radiation Protection and Nuclear Safety in cooperation with the Agency, the International Commission on Radiological Protection, the International Union of Radioecology, the Journal of Environmental Radioactivity, the OECD/NEA and the WHO. The Conference provided a forum for experts from industry, government, international organizations and non-governmental organizations to identify environmental risk assessment needs and requirements and included sessions devoted to environmental protection, risk assessment, emergency preparedness and rehabilitation, naturally occurring radioactive material, radioactive waste, and radiation and society.

193. Participants expressed diverse opinions, particularly regarding the integration of radiation protection principles and methodologies with those of environmental protection. Participants supported an integrated approach to protection of the environment that takes into consideration both non-radiological and radiological factors. The Conference highlighted the importance of the Agency's effort to coordinate approaches and methodologies for radiation protection of both humans and the environment and identified the needs for effective knowledge management and a new generation of experts.

F.2. International Workshop on Lessons Learned from Strong Earthquakes

194. This international workshop — hosted by the Nuclear and Industrial Safety Agency (NISA), Nuclear Safety Commission (NSC) and Japan Nuclear Energy Safety Organization (JNES) in Kashiwazaki, Japan —was organized by the Agency from 19 to 21 June 2008 to share recent technical knowledge and approaches on designing and maintaining the robustness of NPPs to safely withstand such severe external hazards. The workshop attracted more than 300 participants from 28 countries and two international organizations. The design of a new generation of NPPs was a primary topic of discussion, along with the concept of 'back-checking' — a process of examining the structural integrity, functionality and seismic safety of existing facilities to a seismic hazard higher than the original design basis. Key conclusions of the workshop included:

- Seismic hazard evaluation continues to be a key element of assuring seismic safety of NPPs;
- Site-specific information and a full understanding of the geological, tectonic and seismological features of an NPP site are critical to seismic safety;
- Design and safety regulations play a critical role in maintaining NPP robustness; and
- Information from the Kashiwazaki-Kariwa NPP experience is providing valuable input to the Agency safety standards.

---

[12] 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.

195. A related Agency-led workshop on the effects of tsunamis on NPPs was held on 23–27 June 2008 in Daejon, Republic of Korea, where participants exchanged information on training and software available for modeling and calculation of tsunami hazards at NPP sites. Participants will apply the discussed methodology and software at specific sites and the results will be followed up at the next workshop tentatively planned for 2009.

F.3. Workshop on the roles and responsibilities in relation to safety of vendor countries and countries embarking on nuclear power programmes

196. From 1 to 3 July 2008, the Agency conducted a workshop in Vienna on the roles and responsibilities in relation to safety of vendor countries and countries embarking on nuclear power programmes, with participants from 43 countries. The workshop provided a forum for vendors, utilities, regulatory bodies, and industry organizations to share their experiences regarding challenges encountered during the development of nuclear power programmes from financial, project management, construction management, regulatory, and operational perspectives. Countries interested in embarking on nuclear power were encouraged to utilize these experiences in their planning.

F.4. Seventh European Commission Conference on the Management and Disposal of Radioactive Waste (EURADWASTE ´08)

197. EURADWASTE ´08[13] was held in Luxembourg from 20 to 22 October 2008. The conference brought together researchers, radioactive waste management organizations, policy-makers, regulators, engineers and educators to discuss the underground disposal of spent nuclear fuel and long-lived high level radioactive waste, as well as the impact of advanced fuel cycles (partitioning and transmutation) on deep geological repositories.

198. The first day of the conference dealt with the strategic, economic and socio-political aspects of geological disposal. As the strategy and needs of each country vary so widely, finding common ground to some of the issues on a European level proved to be a challenging task.

199. The second part of the conference was dedicated to discussing the scientific and technical aspects of partitioning and transmutation, which aim to reduce the amount and toxicity of radioactive waste, the near- and far-field issues that impact the development of geological repositories, engineering studies, and aspects such as overall performance and safety assessment of these repositories. Approximately 270 scientists, engineers, politicians and regulators, and specialists in converging areas had a rare opportunity to hear about the state of play in the various disciplines related to radioactive waste management. Results from FP6 (Sixth Framework Programme) projects were presented and future directions for projects funded under Euratom in FP7 were discussed.

F.5. 12th International Congress of the International Radiation Protection Association (IRPA 12)

200. IRPA 12, which was co-sponsored by the Agency, was held in Buenos Aires, Argentina from 20 to 24 October 2008. The event attracted more than 1 300 participants from 90 countries and was the largest international meeting on radiation protection to date.

---

[13] http://cordis.europa.eu/fp7/euratom-fission/euradwaste2008_en.html

201. IRPA 12 featured an extensive technical programme divided into three sections; Epistemology - status of levels and effects of radiation exposure; the radiation protection paradigm; and radiation safety in practice. The three sections included in total 20 refresher training courses, three seminars, three poster sessions, eight plenary sessions and 40 technical sessions.

202. A number of special plenary sessions were included in the programme with presentations on: the status of levels and effects of radiation; harmonization of recommendations; radiation safety in practice: towards an international safety regime; low dose and low-dose-rate effects and models; the epistemology of radiation protection; radiation protection paradigm; and stakeholder involvement in decision making.

203. All papers and training material from the congress will be available on the IRPA 12 website[14]. The meeting records will contain a summary of the various technical sessions.

204. A highlight of IRPA 12 was the presentation of the Sievert Lecture by Professor Christian Streffer from Germany, recipient of the Sievert Award. His lecture was entitled 'Radiological Protection: Challenges and Fascinations of Biological Research'. In this lecture, Professor Streffer outlined the limitations faced by epidemiological studies in providing low dose radiation effects information. He also provided a review of recent biological studies at the molecular level.

F.6. International Conference on Topical Issues in Nuclear Installation Safety: Ensuring Safety for Sustainable Nuclear Development

205. This conference was organized by the Agency and hosted by the Government of India from 17 to 21 November 2008 in Mumbai. Over 200 participants from 33 countries and three international organizations participated.

206. Conference participants noted that the nuclear safety approach is based on the philosophy developed in the 1960s: defence in depth principle and deterministic criteria. When properly applied and complemented by probabilistic analyses and operational experience feedback, it should continue to be successful. However, guarding against the risk of accidents requires constant vigilance and high technical competence and a never ending fight against complacency. Strong leadership with a commitment to continuous improvement and a vision of sustained excellence is a key element of nuclear safety.

207. To collaborate on safety matters is in the interest of Member States. Conference participants concluded that all Member States should be parties to the relevant international legal instruments applicable to the peaceful use of nuclear energy, including on civil liability for nuclear damage. The Convention on Nuclear Safety, the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, international cooperation through the Agency and other organizations, and bilateral and multilateral arrangements are an important element for establishing networks for sharing and transferring knowledge.

208. The Conference also confirmed that countries embarking on nuclear power assume a very important safety responsibility that cannot and must not be delegated. Therefore, the establishment of a sustainable national safety infrastructure is an essential foundation for ensuring the safe design, construction, operation and decommissioning of nuclear power plants. The process involves the development of a governmental, legal and regulatory framework as well as the necessary education

[14] http://www.irpa12.org.ar/index.htm

and training, technical capacity building and integrated approach to safety, and safety management for all nuclear stakeholders.

209. Participants noted that vendor countries that are supplying nuclear technology, materials and equipment to the new entrants have a moral responsibility and common interest in the creation of strong safety infrastructure in the recipient countries. Specific Agency safety guides for countries embarking on nuclear power will be enhanced or developed, and tailored safety reviews should be required at various stages of programme development.

210. In a panel discussion on the synergy between safety and security, it was generally agreed that it is vital in the current environment that synergies should be maximized, and that a culture needs to be developed that harmonizes safety and security requirements. It was recognized that both safety and security have the same purpose: protecting people, society and the environment.

211. Conference participants also discussed operating experience feedback, quality of the supply chain; emergency preparedness and response and the need to build and sustain technical capacity through education and training programmes.

G. Safety significant events in 2008

212. Through the various reporting mechanisms, the Agency was informed of 140 safety-related events involving or suspected of involving ionizing radiation. In all 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. Most of the events were found to have no safety significance and/or no radiological impact to people or the environment.

213. 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.[15]

214. 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. Since 2006, Web-based IRS has facilitated data input and report availability. As a consequence, the number of reports has increased and the dissemination delays have reduced. Activities within the IRS extend beyond the exchange of IRS reports. The Agency and the OECD/NEA have meetings and working groups of experts who meet regularly and discuss the safety relevance of events.

215. Events of interest that were reported to the Agency in 2008 include:

- *Ascó NPP, Spain (Pressurized Water Reactor)*: (2007-11-29) During an extended periodic radiological surveillance outside the controlled area on

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

2 April 2008, several solid radioactive particles were detected both within and beyond the site area of Ascó 1 NPP. It was determined that these particles were released through the chimney of the fuel building ventilation system, which was contaminated during cleaning operations of the fuel transfer channel at the end of the refuelling outage on 26 November 2007. The Consejo de Seguridad Nuclear (CSN) sent an inspection team to search for evidence and possible causes, and to make independent radiological verifications. The CSN also ordered a deeper investigation including root cause analysis and a radiological review of exposed people. The CSN was not notified of the 26 November 2007 event, even though this was required. Additionally, the ventilation system was set to normal on 29 November 2007, bypassing HEPA filters, without checking contamination levels inside ventilation conduits.
An extensive program of radioactive measurement has been carried out on workers and others who have been on the site since 28 November 2007, as well as students from local schools and people living in the vicinity of the plant on a voluntary basis. Of the more than 2,500 cases where people have been measured, no contamination has been found.
An INES rating of Level 2 has been assigned to this event. (Level 1 for the uncontrolled radiological release, plus one due to additional factors on safety culture deficiencies.)

- *Rades, Tunisia (radiography)*: (2008-03-23) A worker in industrial radiography carried by hand an unshielded Ir-192 radioactive source. The estimated whole body dose was 2 Gy to one worker and 0.5 mSv to another worker. The regulatory authority became aware of the event on 19 April 2008. Following a request for assistance from Tunisia, the Centre National de Radio-Protection (CNRP) and the Agency made arrangements for the most exposed worker to be treated at a specialist facility in France. The Agency also conducted a mission, with the full cooperation of Tunisian authorities, to Tunisia for the purposes of accident scenario reconstruction and dose reconstruction.
No INES rating was assigned to this event.

- *Seibersdorf, Austria*: (2008-08-03) Pressure build-up in a small sealed sample bottle in a storage safe resulted in plutonium contamination of a storage room at the Agency's Safeguards Analytical Laboratory. Nobody was working in the laboratory at the time. The laboratory's safety system detected plutonium contamination in the storage room where the safe was located and in two other rooms; this was subsequently confirmed by Agency radiation protection experts. The laboratory's safety systems, including an air-filtering system, prevented any release to the environment. A full investigation of the incident was conducted and the laboratory decontaminated.
An INES rating of Level 1 was assigned to this event.

- *Krsko NPP, Slovenia (Pressurized Water Reactor)*: (2008-06-04) The Krsko NPP was safely shut down following detection of a primary circuit leak earlier in the day. The operator classified the event as an unusual event and emergency level zero. It was later determined that the stem seal of the isolation valve on the hot leg loop 2 was found to be leaking. There was no demand on the safety systems. The loss of coolant was controlled by the charging flow. There was no need for off-site protective measures since there were no releases to the environment. The shut down was performed in a controlled way by following the general operating procedures. As this was the first time Krško NPP and Slovenian Nuclear Safety Regulator were mobilized for an actual event (not an

exercise), the event attracted large attention from European emergency centres, media, politicians and general public.
An INES rating of below scale/Level 0 was assigned to this event.

- *SOCATRI Nuclear Facility, Bollène (Vaucluse), France*: (2008-07-07) A tank of the uranium-bearing effluent treatment station (STEU) at the facility overflowed, resulting in spillage of a solution containing uranium to the environment. The solution both percolated in the soil within the SOCATRI facility boundary and flowed through rain collectors to local rivers. On 9 July 2008, SOCATRI removed the contaminated soil to prevent underground migration of uranium. The French Nuclear Safety Authority (ASN) conducted a thorough investigation of the incident and issued a number of directives, including forbidding the use of certain equipment and the implementation of an extended monitoring system. As a precaution, on the advice of ASN, restrictions were placed on nautical and fishing practices and the use of water for irrigation and drinking purposes. These restrictions were lifted on 22 July 2008. The incident resulted in large media coverage and two press conferences were organized to inform the public about the incident and its consequences.
  An INES rating of Level 1 was assigned to this event.

- *Institute for Radioelements (IRE)-Fleurus, Belgium*: (2008-08-22) Following the transfer of liquid radioactive waste from one tank to another, I-131 was released through a vent stack. The quantity of radioactivity released into the environment is estimated at 45 GBq I-131, which corresponds to a dose of 160 microsievert (effective dose) for a hypothetical person remaining permanently at the site's enclosure. A ban on fresh fruits and vegetable and rain water use in the areas was implemented as a countermeasure from 28 August to 7 September 2008. Radioactivity was not detected by the Belgian or European monitoring networks. The incident did not cause a contamination of the personnel, and no dose limits were exceeded.
  An INES rating of Level 3 was assigned to this event.

216. In addition, there have been a number of events involving contaminated goods or radioactive sources detected in scrap metal. In some of them, the Agency has facilitated the exchange of information among Member States or provided assistance in recovering the source. Examples of this type of event include:

- *Port of Colombo, Sri Lanka and Continuo, Benin*: (2008-01-08) On arrival in Sri Lanka, a shipping container was screened for radiation using a portal monitor system and gamma and neutron radiation was detected. The Atomic Energy Authority of Sri Lanka recommended that the container be returned to the point of origin. The ship arrived back at the port of Continuo, Benin on 16 April 2008. Upon request of the Benin authorities, the Agency provided assistance in off-loading the container and recovering the source. Agency staff took measurements of the container before it was off-loaded and provided guidance on the temporary storage of the container to maximize security and minimize exposure to workers. The source recovery was later performed by a field team from France. The source was isolated and locked up in a small storage building until it could be properly packaged and transferred.

- *Puerto Cortes, Honduras*: (2008-10-31) A shipping container loaded with scrap metal triggered alarms from portal monitors at the port and was isolated at the facility. A survey of the outside of the container was completed on 5 November 2008 and the source located. The Honduran Government

requested assistance from the USA and an expert was sent. The source was recovered and placed in a locked shipping container for temporary storage. At the request of Honduran authorities, the Agency is providing advice regarding an appropriate container to transport the source to a more permanent storage facility.

217. The 2008 joint OECD/NEA–Agency meeting of the IRS coordinators discussed corrective actions and lessons learned from 22 recent events that occurred in NPPs. One event was discussed in detail:

- *Pickering 6, Canada (Pressurized Heavy Water Reactor)*: (2007-01-06) On 6 January 2007, with Pickering Unit 6 operating at low power critical, maintenance was performed to eliminate a hot spot associated with a fuse terminal block on the assumption that this was one of the redundant power supplies for the shut-off rod clutch current. Following removal of the fuse, panel meters in the control room indicated two shutoff rods had fallen into the core and that the regulating system was attempting to drive them out. Alternative indications provided conflicting information and the decision was made to manually trip the reactor.
  The resulting investigation determined that the station documentation regarding the fuses was incorrect, even though this had been reviewed in 2005. The investigation concluded that: a questioning attitude was partially applied, but should have been more rigorous; there was a lack of adequate independent verification; complacency and overconfidence led to not documenting uncertainty; and roles and responsibilities were not clearly communicated or reinforced. There were no radiological consequences from this incident.

H. Safety Networks

H.1. Asian Nuclear Safety Network (ANSN)

218. During 2008, the ANSN continued to develop with hubs in China, Japan and Republic of Korea and national centres in Indonesia, Malaysia, Philippines, Thailand and Vietnam. Australia, France, Germany, Japan, the Republic of Korea and USA provide in-kind and/or financial support to ANSN through the Extrabudgetary Programme on the Safety of Nuclear Installations in South East Asia, Pacific and Far East Countries (EBP-Asia).

219. In April 2008, a strategy dialogue meeting was held in Vienna. Senior representatives of the ANSN participating countries discussed the development of the ANSN, its usefulness to date, and, most importantly, strategies for future enhancement of nuclear safety in the Asian region. In view of the rapid expansion of nuclear power programmes in Asia, additional cooperation and timely efforts to establish effective nuclear safety infrastructure will be required. In this regard the ANSN is an existing and powerful tool which could be utilized, at a more strategic level, to promote safety in the region in developing a regional capacity building system.

220. The ANSN Steering Committee, co-chaired by Malaysia and Japan, met in October 2008 in Malaysia. For the first time, in addition to its usual mandate to coordinate ANSN development in the direction given by the strategy dialogue meeting, the steering committee discussed results of 2008 activities and the work programme for 2009.

221. The topical groups are an important part of the ANSN and in 2008 attained higher status and increased resources. The topical groups participate in the integrated safety evaluation process, propose and implement regional workshops and training courses and identify knowledge to upload in the IT network. A new topical group on governmental and regulatory infrastructure was created in 2008 and future activities on siting and public awareness are under consideration.

222. The Agency's ANSN website improved in 2008 with the continuous upload of the material of past ANSN activities and the management of the ANSN. Work started in 2008 to reinforce the security of the network and to update the software.

223. To increase the ANSN outreach, the bi-weekly ANSN Newsletter continues to be widely distributed worldwide. In 2008, a promotional meeting was conducted in Malaysia to present the ANSN to some 300 specialists of the scientific community.

224. Increasing cooperation with the Forum of Nuclear Cooperation in Asia (FNCA) took place in 2008 with Agency participation in a FNCA Panel meeting and a representative of FNCA attending the ANSN steering committee meeting. Discussions are still in progress with the Association of Southeast Asian Nations (ASEAN) to look into the possibility of cooperation between ANSN and the ASEAN nuclear energy safety sub-sector network.

H.2. Ibero-American Nuclear and Radiation Safety Network

225. In 2008, the installation of the server in Brazil hosting the Network was fully implemented. The Network contains technical knowledge of regulatory interest in areas such as radiological protection of patients, safety of radioactive sources, national and Agency safety standards, national legislation and education and training. The Network is populated with resources provided by participating countries. Resources are classified and uploaded according to an agreed taxonomy that allows efficient interrogation and retrieval by registered users. The Network also provides a working environment for implementing specific projects (see section C.4). Project working group spaces provide participants with common access to drafts and results and meeting reports, as well as teleconferencing facilities.

H.3. International Decommissioning Network (IDN)

226. As a 'network of networks', the IDN was formed to coordinate and build efforts aimed at assisting Member States in the sharing of practical decommissioning knowledge. Within the IDN, organizations with a demonstrated record of excellence in a wide range of areas offer to share their experience. In 2008, the IDN organized a workshop hosted by Spain on waste management and clearance, and a workshop hosted by Belgium on size reduction for decommissioning of nuclear facilities.

H.4. International low level waste disposal network

227. To build credibility in national low level waste disposal programmes, the Agency is creating a non-commercial network as a forum for the prompt, open and efficient transfer and exchange of knowledge gained. Member States with less advanced programmes will benefit from the experience of organizations with advanced designs and disposal facilities in operation.

H.5. Global Nuclear Safety Network (GNSN)

228. A major impetus for the GNSN was provided by the G8 NSSG in 2007 and it continues to be supported by them. In addition, the Commission of Eminent Persons recommended in their report on

the future of the Agency that the Agency lead an international effort to establish a global nuclear safety network.

229. The GNSN is the set of existing networks and information resources i.e. internationally accessible information and data sources, whether open or password protected. This includes active or latent interactions between them that can support work related to nuclear safety matters. The aim of the GNSN is to ensure that critical knowledge, experience, and lessons learned about nuclear safety are exchanged as broadly as they need to be.

230. In 2008, a prototype platform for the GNSN was established. The aim is to have all safety related networks and information resources made visible and available through links on this platform. Ultimate responsibility for the content and quality remains with the respective providers of the information.

H.6. International Regulatory Knowledge Network (RegNet)

231. The objective of RegNet is to achieve and promote radiation and nuclear safety and security by: enhancing effectiveness and efficiency of international cooperation in the regulation of nuclear, radiation, transport and waste safety, and nuclear security, as well as preparedness and response to nuclear and radiological emergencies; enabling adequate access for regulators to relevant safety and security information; promoting dissemination of information on safety and security issues as well as information of good practices for addressing and resolving such issues; enabling synergies among different web based networks to strengthen and enhance the global nuclear safety regime; and providing additional information to the public on international regulatory cooperation in safety and security matters.

232. In 2008, the Agency established a task group and held a series of meetings to prepare and design the concept and programme. It is expected that RegNet will be operational in 2010.

Appendix 2
The Agency's Safety Standards: Activities during 2008

A. Introduction

233. 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.

234. The year 2008 marked the 50th anniversary of the IAEA Safety Standards programme. The first IAEA Safety Series publication, entitled Safe Handling of Radioisotopes, was issued in December 1958. Since then more than 200 safety standards have been published. The experience accumulated over these 50 years, and the focus on continuous improvement, have resulted in the global recognition of the high quality and relevance of the safety standards. A wide interest in and use of the safety standards worldwide are observed today.

235. The main achievement during the year was the approval by the Commission on Safety Standards of a roadmap for the long term structure of safety standards, which provides for an improved structure and format for the Safety Requirements and a set of criteria for the collection of Safety Guides.

236. A number of strategies for improving the safety standards programme were discussed by the Safety Standards Committees and the Commission on Safety Standards in 2008. For the Safety Standards Series**,** the strategies pertained to completeness, logical and top-down relationships, consistency, user-friendliness, and manageability of the number of publications. For the safety standards content, the strategies pertained to consensus on high levels of safety and best international practices. For the safety standards review and approval process, the strategies pertained to rigour, transparency, high level approval and effectiveness of feedback mechanisms. The IAEA Safety Standards programme was an agenda item for the Senior Regulators' Meeting, held in conjunction with the 52nd regular session of the General Conference. The discussions during this agenda item confirmed that the programme was headed in the right direction.

237. The Safety Requirement relating to the Safety of Nuclear Fuel Cycle Facilities was published in 2008 and three draft Safety Requirements (on the Predisposal Management of Radioactive Waste, the Safe Transport of Radioactive Material and the Safety Assessment for Facilities and Activities) were adopted as Agency standards by the Board of Governors in 2008.

238. In 2008, the revision of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (the BSS) continued and a draft 1.0 was reviewed

by the Safety Standards Committees at their meeting in October and November 2008. Revised drafts of Safety Requirements No. GS-R-1: *Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety* and No. NS-R-2: *Safety of Nuclear Power Plants: Operation* were submitted to Member States for comment in 2008. The revision of the Safety Requirements No. NS-R-1: *Safety of Nuclear Power Plants: Design* is progressing with a view to its submission to Member States for comment in 2009.

239. 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. These improvements were facilitated by the use of information technologies and in particular, the newly established interactive website[16].

240. The IAEA Safety Glossary, which represents the international consensus on the terminology used in the safety standards, has been published in all official languages. This work will assist in ensuring consistency in the six languages throughout all safety standards. A process of review and revision of the IAEA Safety Glossary has been initiated in 2008 with the aim of the further harmonizing and clarifying terminology usage in the safety standards, through the use and the possible joint sponsorship of a more prescriptive, globally agreed upon set of definitions of terms in the safety standards.

241. Since the establishment of the Commission on Safety Standards and the Committees in 1995, 95 standards have been established; of these, 89 (one Safety Fundamentals, 14 Safety Requirements and 74 Safety Guides) have been published; and 57 further standards (eight Safety Requirements publications and 49 Safety Guides) are being drafted or revised. A list of published IAEA Safety Standards, indicating their status as of 31 December 2008, is attached as Annex I, and an up-to-date status report can be found on the Agency's website[17]. The full texts of published IAEA Safety Standards are also available on the website.

B. Commission on Safety Standards (CSS)

242. The CSS commenced a new four year term starting from 1 January 2008. Mr. Lacoste, Chair of the French Nuclear Safety Authority, was reappointed as Chairman. New countries represented by senior officials at the CSS are Belgium, Finland, Lithuania, Ukraine and Vietnam. An invitation to participate as observers[18] has been extended to the Chair of the International Nuclear Safety Group (INSAG) and to the Chair of the Advisory Group on Nuclear Security (AdSec).

243. The CSS met twice in 2008, in May and in September and endorsed the submission to the Board of Governors for approval of three draft Safety Requirements publications on: Safe Transport of

---

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

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

[18] In addition to INSAG and AdSec, observers include the European Commission (EC), International Commission on Radiological Protection (ICRP) and Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA).

Radioactive Material, revision of TS-R-1, Predisposal Management of Radioactive Waste Management, revision of WS-R-2, and Safety Assessment for Facilities and Activities. The CSS also endorsed in 2008 for publication the draft Safety Guides on: Compliance Assurance for the Safe Transport of Radioactive Material (DS327), Safety of Uranium Fuel Fabrication Facilities (DS317), Safety of MOX Fuel Fabrication Facilities (DS318), Safety of Conversion and Enrichment Facilities (DS344), Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors (DS340), Safety Assessment for Decommissioning of Facilities Using Radioactive Material (DS376), Borehole Facilities for the Disposal of Radioactive Waste (DS335), Management System for Nuclear Installations (DS349), Ageing Management for Nuclear Power Plants (DS382), Seismic Evaluation for Nuclear Power Plants (DS383), Classification of Radioactive Waste (DS390), and Severe Accident Management Programme for Nuclear Power Plants (DS385).

244. CSS also approved in 2008 document preparation profiles (DPPs) for three new Safety Guides on Establishing a National Nuclear Installations Safety Infrastructure (DS424), Radiation Safety in Well Logging (DS419) and on Radiation Safety for Nuclear Gauges (DS420). The CSS also approved DPPs for the revision of Safety Guides on Evaluation of Seismic Hazards for Nuclear Installations, revision of NS-G-3.3 (DS422) and on Periodic Safety Review of Nuclear Power Plants, revision of NS-G-2.10 (DS426).

C. Nuclear Safety Standards Committee (NUSSC)

245. NUSSC commenced a new three year term on 1 January 2008. Forty eight Member States have nominated experts as members of NUSSC, of whom three are corresponding members. In addition, six international organizations attend NUSSC meetings as observers[19].

246. NUSSC, chaired by Mr. Geoff Vaughan of the Nuclear Installations Inspectorate of the United Kingdom, met twice in May and October 2008.

247. In 2008, five Safety Guides were published: Conduct of Operations at Nuclear Power Plants, The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors, Operational Limits and Conditions and Operating Procedures for Research Reactors, The Management System for Technical Services in Radiation Safety, and Core Management and Fuel Handling for Research Reactors.

248. At its meetings in May and November 2008, NUSSC approved ten draft IAEA Safety Standards for submission to the CSS, namely Safety of Uranium Fuel Fabrication Facilities, Safety of MOX Fuel Fabrication Facilities, Safety of Conversion and Enrichment Facilities, Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors, Development and Application of Level 2 PSA for NPPs, Development and Application of Level 1 PSA for NPPs, Deterministic Safety Analysis and their Application for NPPs, Ageing Management for NPPs, Seismic Evaluation of Existing Nuclear Installations, and Severe Accident Management Programmes for NPPs.

---

[19] EC, FORATOM, International Electrotechnical Commission (IEC), International Organization for Standardization (ISO), OECD/NEA, and World Nuclear Association (WNA).

249. In addition NUSSC reviewed and commented on 13 draft safety standards dealing with nuclear safety issues, such as regulatory infrastructure, operation, ageing, decommissioning, safety assessment, management systems, seismic hazards, as well as radiation protection aspects.

250. In 2008, NUSSC approved DPPs for four new safety standards.

251. NUSSC also discussed twice the ongoing issue of the strategy for the future development and application of the IAEA Safety Standards, in particular the set of Safety Guides for 2015 according to the Roadmap on the Long Term Structure for Safety Standards approved by the CSS.

252. As for working methods, NUSSC has agreed to a new procedure with regard to NUSSC members commenting on documents after the Member State comment period. NUSSC also introduced a new permanent agenda item on 'Feedback on Regulatory Arrangements, Developments and Using IAEA Safety Standards'.

D. Radiation Safety Standards Committee (RASSC)

253. RASSC commenced a new three year term on 1 January 2008. Fifty-nine Member States have nominated experts as members of RASSC, of whom nine are corresponding members. In addition, 13 international and regional organizations attend RASSC meetings as observers[20].

254. RASSC, chaired by Mr. Sigurdur Magnusson of the Icelandic Radiation Protection Institute, met in March-April and November in 2008. Both meetings included a joint session with WASSC to discuss issues of common interest.

255. In 2008, RASSC approved the Safety Requirements "Regulations for the Safe Transport of Radioactive Material" 2009 Edition, the Safety Requirements "Safety Assessment for Facilities and Activities", the Safety Guide on the Application of Management System for Nuclear Installations, and the Safety Guide on the Classification of Radioactive Waste. RASSC approved DPPs for three new Safety Guides.

256. RASSC and WASSC reviewed draft 1.0 of the revised International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources at its meeting in November. More than 1200 written comments were provided, many of which were editorial or suggestions to improve the text, while there were also many substantive issues. More than three days of the November meeting were spent discussing these substantive issues, for RASSC and WASSC to provide guidance on the further development of the revised BSS.

[20] EC, Food and Agriculture Organization of the United Nations (FAO), ICRP, IEC, International Labour Organization (ILO), International Radiation Protection Association (IRPA), ISO, International Source Suppliers and Producers Association (ISSPA), OECD/NEA, Pan American Health Organization (PAHO), United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), World Health Organization (WHO), and WNA.

E. Transport Safety Standards Committee (TRANSSC)

257. TRANSSC commenced a new three year term on 1 January 2008. Fifty Member States have nominated experts as members of TRANSSC, of whom six are corresponding members. In addition, 11 international and regional organizations attend TRANSSC meetings as observers[21].

258. TRANSSC, chaired by Mr. E. William Brach of the US Nuclear Regulatory Commission, met in March and October in 2008.

259. In 2008, TRANSSC approved the Safety Requirements "Regulations for the Safe Transport of Radioactive Material" 2009 Edition, the Safety Requirements "Safety Assessment for Facilities and Activities", approved two draft Safety Requirements documents and two draft Safety Guides for submission to Member States for comments and approved DPPs for three new Safety Guides.

260. TRANSSC reviewed draft 1.0 of the revised International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources at its meeting in October, examining the transport related written comments to support the work of RASSC.

261. In October TRANSSC carried out a comprehensive review of the transport portfolio (all of the Agency activities and outputs related to transport safety) in order to provide guidance for the future programme of work in the transport area. This review confirmed the need for the current transport safety standards, provided advice on how they should be modified in future and suggested changes in the supporting products that are required to provide for the effective implementation of the standards.

262. The issue of denial of shipment of radioactive materials was discussed at both TRANSSC meetings in 2008, and TRANSSC provided a comprehensive examination of the issue in its October meeting accompanied by an extensive list of recommended actions to help address the issue.

F. Waste Safety Standards Committee (WASSC)

263. WASSC commenced a new three year term on 1 January 2008. Fifty five Member States nominated experts as members of WASSC, of whom nine are corresponding members. In addition, six international and regional organizations attend WASSC meetings as observers[22].

264. Mr. Thiagan Pather of the National Nuclear Regulator body of South Africa has been reappointed as Chairman of WASSC.

---

[21] EC, International Air Transport Association (IATA), International Civil Aviation Organization (ICAO), International Federation of Air Pilots Association (IFALPA), International Maritime Organization (IMO), ISO, ISSPA, United Nations Economic Commission for Europe (UNECE), WNA, the World Nuclear Transport Association (WNTI) and the Steering Committee of Denials of Shipment Management Group.

[22] EC, European Nuclear Installations Safety Standards Group of FORATOM (ENISS), ISO, ISSPA, OECD/NEA, and WNA.

265. WASSC met in April and November 2008. Both meetings included joint sessions with RASSC to discuss issues of common interest.

266. In 2008, WASSC approved for submission to the CSS two draft Safety Requirements publications: “Regulations for the Safe Transport of Radioactive Material”, 2009 Edition and “Safety Assessment for Facilities and Activities”. WASSC also approved for submission to the CSS draft Safety Guides on: Management System for Nuclear Installations and Classification of Radioactive Waste.

267. In addition, WASSC approved for submission to Member States for comments two Safety Requirements draft documents on: Safety of NPPs; and Operation and Governmental and Regulatory Framework for Nuclear, Radiation, Radioactive Waste and Transport Safety. WASSC also approved for submission to Member States for comments two draft Safety Guides on Licensing of Nuclear Facilities and Evaluation of Seismic Hazards for Nuclear Facilities.

268. WASSC also approved DPPs for Safety Guides on Evaluation of Seismic Hazards for Nuclear Facilities and Establishing a National Nuclear Safety Infrastructure.

269. At both meetings, WASSC received progress reports on the revision of the BSS and the waste safety standards under development. At the April meeting, WASSC members received reports on the working methods and functioning of WASSC including its website, and on the evolution of the structure of waste safety standards related to the long term structure of safety standards. In the November 2008 meeting, WASSC contributed to the discussion of issues arising from the first revision of the BSS and provided guidance on resolving those issues. At the November meeting, WASSC agreed to establish a Joint Subgroup of WASSC and TRANSSC to discuss and elaborate on issues of common interest.

Annex I
The published IAEA Safety Standards as of 31 December 2008

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)

Safety Guides in the Safety Series 50-SG

Q8	Quality Assurance in Research and Development (under revision)
Q9	Quality Assurance in Siting (under revision)
Q10	Quality Assurance in Design (under revision)
Q11	Quality Assurance in Construction (under revision)
Q12	Quality Assurance in Commissioning (under revision)
Q13	Quality Assurance in Operation (under revision)
Q14	Quality Assurance in Decommissioning (under revision)

One Safety Guide is being developed on management system for nuclear installations to replace the above Q8 to Q14 guides.

B.4. Assessment and Verification

GS-G-4.1	Format and Content of the Safety Analysis report for Nuclear Power Plants (2004)

One Safety Requirement on safety assessment for facilities and activities and 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)
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

WS-R-2	Predisposal Management of Radioactive Waste, including Decommissioning (2000) (under revision)
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)

B.10. Transport Safety

TS-R-1	Regulations for the Safe Transport of Radioactive Material 2005 Edition (2005) (2009 update adopted, awaiting publication)
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)

Two Safety Guides on compliance assurance and schedule of provisions are 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)
NS-G-1.2	Safety Assessment and Verification for Nuclear Power Plants (2002)
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)

Four Safety Guides on safety classification of structures, systems and components, on development and application of level 1 and level 2 PSA and on deterministic safety analyses 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-2.14	Conduct of Operations at Nuclear Power Plants (2008)

Four Safety Guides on ageing management, seismic evaluation of existing nuclear facilities, on severe accident management and on chemistry are 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)
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 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-1.6	Occupational Radiation Protection in the Mining and Processing of Raw Materials (2004)

Six Safety Guides on medical uses, 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)

Two other Safety Guides on borehole disposal of radioactive waste and on monitoring and surveillance of disposal facilities are being developed.