

GLOBAL PERSPECTIVES AND KEY ISSUES

The United Nations “Millennium Summit” in September 2000 highlighted a number of objectives in its “Millennium Declaration” to which it assigned special significance. These covered, among others, the areas of: peace, security and disarmament; development and the eradication of poverty; and protection of the environment. In the efforts to realize these objectives, the Agency plays a modest but important role.

In carrying out its mandate, the Agency groups its activities under the three “pillars” of *technology*, *safety* and *verification*. Specifically, the Agency seeks to: act as a catalyst for the development and transfer of peaceful nuclear technologies; build and maintain a global nuclear safety regime; and assist in global efforts to prevent the proliferation of nuclear weapons. This chapter reviews some of the key issues and events in 2000 as they relate to the Agency’s programme of work.

TECHNOLOGY

Nuclear power around the world

Over the past 50 years, nuclear power has become an important part of the energy mix in many countries. At the end of 2000, there were 438 operating nuclear power reactors. This was equal to 351 GW(e) of installed capacity. Together they provided about 16% of global electricity generation. Six new power reactors, with a total capacity of 3056 MW(e), were connected to their respective national electricity grids in 2000. Three of these were in India, while Brazil, the Czech Republic and Pakistan each had one. One reactor was shut down — Chernobyl-3 in Ukraine.

Over 30 countries are using nuclear power to produce electricity. In 2000, its share of total electricity generation ranged from 76% in France to 1.4% in Brazil. The construction of 31 new power reactors continued in Argentina, China, the Czech Republic, the Islamic Republic of Iran, Japan, the Republic of Korea, the Russian Federation, Romania, Slovakia and Ukraine. National energy plans envisage additional reactors in China, the Democratic People’s Republic of Korea, India, the Islamic Republic of Iran, Japan, the Republic of Korea and the Russian Federation. In November, the Finnish utility TVO applied for a government decision “in principle” to build a fifth nuclear power plant. This is the first such initiative in western Europe in many years. On the other hand, the German Government and utilities concluded an agreement to phase out Germany’s 19 nuclear power plants. The agreement allows nuclear power plants to operate for an average lifetime of 32 years.

The coming on line of six new power reactors in 2000 still represents only about 3% of estimated total world electricity capacity *additions* in 2000. This is considerably less than nuclear power’s 16% share of global electricity *generation*. Projections show that this pattern is expected to continue in the near term, in which case nuclear power’s share of electricity production in the coming decade would decline.

While a survey of global nuclear power plant construction plans indicates that, in contrast to Asia, no new plants are being built or have been ordered in North America and western Europe, the economics of *existing* nuclear power plants showed improvement in 2000, particularly in North America. The USA enjoyed record capacity factors, outputs, low costs and short refuelling outages. Moreover, capacity factor improvements in the USA since 1998 have been equivalent to nine new 1000 MW(e) reactors. The US Nuclear Regulatory Commission also granted its first

two 20-year licence renewals. The licensed reactor lifetime in each case is now 60 years.

Nuclear fuel cycle and waste technology

Important initiatives were taken during the year in the areas of the nuclear fuel cycle and radioactive waste management. With regard to the fuel cycle, the Agency convened a symposium on uranium mining activities and their impact on the environment. The aim of the conference was to review changes in mining practices and compile the latest information in this field (Box 1).

An issue critical to the future of all nuclear technologies is the management and disposal of high level radioactive waste. The management of waste was the subject of the Scientific Forum at the Agency's 44th General Conference in September 2000. There was agreement at the Forum that while technological solutions for the safe management of radioactive waste existed, public acceptance of — and confidence in — these solutions were critical. As for permanent waste disposal facilities, Finland, Sweden and the USA were considered to be the farthest ahead. In the USA, the opening of the Waste Isolation Pilot Plant

(WIPP) in New Mexico in 1999 was an important step towards demonstrating the geological disposal of long lived waste. In addition, the US Department of Energy intends to begin accepting commercial radioactive waste at the Yucca Mountain site in Nevada in 2010. Sweden evaluated proposals from six communities to host a spent fuel repository. In November 2000, the field was narrowed to three sites, for which detailed geological investigations should begin in 2002. And in December, the Finnish Cabinet approved a proposal by Posiva, the nuclear waste authority, to build a final repository for spent nuclear fuel in a cavern near the nuclear plants at Olkiluoto. While still requiring the approval of the Finnish Parliament, the plan, if approved, envisages the start of construction in 2010 and operation some ten years later.

Investigations also continued in 2000 on new energy production technologies that reduce actinide generation and focus on long lived waste transmutation. The Agency's role in this area included facilitating international cooperation in research and development and work on demonstration projects in underground research laboratories.

BOX 1. URANIUM MINING AND PROTECTION OF THE ENVIRONMENT

Environmental management at uranium mines today is different from past approaches. Improved production techniques and better planning have resulted in smaller environmental impacts. To chart some of these changes and disseminate information on good practices, the Agency held a symposium in Vienna in October 2000 entitled 'The Uranium Production Cycle and the Environment'. Addressing for the first time the environmental issues related to uranium mining and production, the meeting's principal conclusions included the following:

- Technological advances have improved exploration methods, mining practices, disposal of tailings and operational safety. They have also reduced waste, lowered the impact on the environment, enhanced safety and improved production economics.
- Waste management techniques have improved greatly. For example, increased interest is being shown in 'natural attenuation' for groundwater restoration at mine sites. This method relies on the chemical reactivity of rocks at the site to neutralize residual leach solutions remaining in the ground following in situ leach operations.
- Decommissioning and closure plans are being prepared before the start of an operation. At many sites these planning activities have become an ongoing process conducted throughout the lifetime of the project. ■

The global climate change debate

In December 1997, industrialized countries agreed to limitations on their greenhouse gas (GHG) emissions under a protocol adopted in Kyoto. They also agreed on three “flexibility mechanisms” that would establish a ‘market’ for GHG reductions, while leaving for later discussion the rules for implementation of the protocol. One of these three mechanisms — the “Clean Development Mechanism” (CDM) — created a means for transferring credits obtained for reducing emissions from projects in developing countries to industrialized countries that are sponsors of those projects to meet their own reduction obligations.

At the Sixth Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) (or “CoP-6”), held in The Hague in November 2000, no agreement was reached on finalizing the rules governing the three flexibility mechanisms and negotiations were suspended until the next meeting, scheduled for July 2001 in Bonn. At CoP-6, several parties pressed for nuclear power’s exclusion from consideration for the flexibility mechanisms, citing concerns over radioactive waste management, proliferation, safety and economics. However, other parties argued that “it [was] not a good approach to overrule the judgement of developing countries on sustainable development by limiting the types of eligible CDM Projects”.

Agency activities in 2000 in this area included co-ordination of national case studies prepared by teams in China, India, Pakistan, the Republic of Korea and Viet Nam to explore potential nuclear power CDM projects. Among electricity generation options, nuclear power generally proved to be the lowest cost GHG mitigation alternative. The mitigation costs were found to be considerably lower than the estimated marginal mitigation costs for compliance with the Kyoto Protocol. In presentations at the 2000 General Conference and at CoP-6, the Agency used these and other data to emphasize the contribution that nuclear can make — and is already making — to reducing global warming risks.

The ninth session of the UN Commission on Sustainable Development (CSD-9) was held in April 2001. The CSD was created to follow up on “Agenda 21”, negotiated at the same 1992 UN Conference on Environment and Development (the Rio “Earth Summit”) that produced the UNFCCC. The Agency contributed a range of preparatory materials through the UN Ad Hoc Inter-Agency Task Force on Energy, which is responsible for co-ordinating all UN system inputs. In this regard, an important

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activity for the Agency in 2000 was the development and field testing of ‘Indicators for Sustainable Energy Development’ in collaboration with other international organizations. These indicators provide a comprehensive set of benchmarks for assessing progress, or needs, related to sustainable energy development, or to the role of nuclear power.

The future prospects for any energy technology depend increasingly not only on its economics and environmental impact, but also on its potential contribution to sustainable development. Two important studies were published in 2000, the *World Energy Assessment* by UNDP, WEC and the UN Department for Economic and Social Affairs, and the *Special Report on Emissions Scenarios* by the Intergovernmental Panel on Climate Change, both of which received substantive inputs from Agency staff. These studies suggest that nuclear energy will enjoy a significant share of total energy production through 2100 in most scenarios.

Advanced technologies and innovative designs

To ensure that nuclear power is given a fair and full hearing in the ongoing climate change and energy supply debates, it is necessary to promote greater innovation, leading to

new reactor types and fuel cycle designs that offer enhanced safety features, are proliferation resistant, and are economically competitive.

Some 25 projects, both innovative and evolutionary, are under development in France, India, Japan, the Republic of Korea, the Russian Federation, South Africa and the USA, among others. Complementing these at the international level is the Generation IV International Forum, an initiative of the USA that

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seeks to co-ordinate advanced R&D in nine countries — the OECD Nuclear Energy Agency (OECD/NEA) and Agency are participating as observers in this endeavour. The aim is to identify the most promising technology concepts for new designs by 2002 and then draw up an R&D plan to support deployment by 2030. Another international undertaking is a new Agency effort, the extrabudgetary International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO). The goal of INPRO is to reinforce other efforts in this area by involving all interested countries, including developing countries whose energy demands are growing fastest, and to incorporate the Agency’s safeguards and safety expertise early in the design process.

Maintenance of knowledge and competence

An area of concern is a possible shortage in the future of qualified, well trained personnel in all areas of nuclear power (including the operation of power plants, radiation protection, waste management and decommissioning). Most countries with advanced nuclear programmes report a decrease in the number of new graduates in the nuclear field. The reasons for this trend include public perceptions of a ‘stagnant’ industry and the conse-

quent impression among younger people that the nuclear area offers poor career prospects. The result has been an emerging shortfall of specialized expertise and a gradual shrinking of nuclear science and engineering departments at universities and institutes.

The maintenance of knowledge and expertise in nuclear science, technology and engineering has recently received much attention at the governmental and non-governmental levels in a number of Member States. In response, a new subprogramme on this issue is being proposed by the Agency for 2002–2003. Also, the Agency has strengthened its efforts to coordinate international co-operation in setting up training activities.

Applications of nuclear technologies

A major part of the Agency’s work in the technology area takes place in the field of nuclear science and applications. The high level Standing Advisory Group on Nuclear Applications (SAGNA), established in April 2000 to advise the Director General on the Agency’s activities in the application of nuclear techniques, emphasized the important role of the Agency in supplementing the scientific and technological capacities of Member States and as a catalyst for social and economic development.

The Agency implements a wide range of nuclear technology applications in its regular programme of activities. For instance, Coordinated Research Projects — supported by research and service laboratories in Seibersdorf and Monaco — focus on the use of radiation and isotope techniques to increase food production, fight disease, manage water resources and protect the environment. In the area of food and agriculture, for example, insect sterilization techniques have produced significant gains in livestock production and fruit production, radiation induced mutations have been used to produce crops with greater yield and higher quality, and the irradiation of food has helped to preserve freshness and eliminate disease causing organisms.

The Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear

Weapons (NPT Review Conference) in 2000 noted the role of the Agency as the principal international organization for nuclear technology transfer. The Conference participants also confirmed the importance of the Agency's technical co-operation activities in fulfilling the obligations set forth in Article IV of the NPT.

The Agency's technical co-operation programme — running to approximately \$86 million a year — is the main vehicle for the transfer of nuclear science and technology to developing countries. The emphasis here is on supporting projects that respond to the real needs of the country, produce an economic or social impact and reflect the distinct advantages of nuclear technology over other approaches.

Technology transfer has greater impact when a strong partnership exists with the end user — frequently a water authority, health ministry, or livestock or plant protection service. Moreover, Agency technology must be combined, in the recipient country, with committed resources and sustained effort (Box 2). It is also clear that government interest is decisive for projects to succeed in delivering long lasting results. The existence of a

national programme financed from either domestic or external sources has been found to be the best indicator of this commitment.

Turning to the issue of human health, some of today's most important health problems are the result of the reduction in mortality from infectious diseases, especially in industrialized countries. The very successes of the past few decades have generated a 'demographic transition' from traditional societies, where almost everyone is young, to societies with rapidly increasing numbers of middle aged and elderly people. With this transition, a new set of diseases has risen to prominence, such as cancers, heart disease, stroke and mental illness. Nuclear techniques have much to offer in the diagnosis and control of these non-communicable diseases.

In recent years there have also been very effective applications for combating infectious diseases such as tuberculosis, malaria and HIV/AIDS, all of which remain major health associated constraints to economic growth. In 2000, the Agency focused on the validation of new nuclear tools for diagnosing drug resistant strains of malaria and tuberculosis. Other applications of nuclear techniques were in the

BOX 2. AFRICAN HEADS OF STATE RECOGNIZE THE SUCCESS OF TSETSE FLY ERADICATION EFFORTS

Following the successful eradication of the tsetse fly from Zanzibar Island in the United Republic of Tanzania as a direct result of a large scale Agency technical co-operation project, the sterile insect technique (SIT) has attracted greater interest and recognition of its potential by Member States. The major reason for this attention is the increasing problem of African trypanosomosis, a livestock disease caused by the tsetse fly. At the 36th Summit of African Heads of State and Government in Lomé, Togo, in July 2000, it was decided to initiate a campaign for the eradication of tsetse flies from the African continent. The Summit recognized the tsetse problem as one of Africa's most important constraints to continued socioeconomic development, affecting human and livestock health and limiting land use. Acknowledging the transboundary nature of the problem, States were urged to act collectively to eliminate this insect and mobilize the necessary human, financial and material resources required to make Africa tsetse-free within the shortest time possible.

The Summit commended those African countries that have initiated the application of SIT for their pioneering work, and welcomed the establishment of the Pan-African SIT Forum of African scientists as a mechanism through which sustainable, area wide tsetse eradication can be achieved. Following the Summit's decision, a task force of African tsetse/trypanosomosis specialists, organized by the OAU and supported by the Agency, developed an action plan for a Pan-African Tsetse and Trypanosomosis Eradication Campaign. ■

areas of paediatrics (Box 3) and cardiology, and the use of stable isotopes in malnutrition studies to track the intake of vitamins and other nutrients.

Another area of increasing worldwide concern is the management of increasingly scarce water resources. It is estimated that over one billion people in the world have no access to clean water. Dwindling supplies and unequal distribution of freshwater resources exacerbate this problem. In many countries the situation is becoming more acute as water demand rises and more people move to urban areas. In short, the need for safe, clean drinking water is growing as fast as the world's population. Experts agree that if nothing is done, two thirds of the world's population will suffer from moderate to severe lack of water by 2025. This sobering outlook is bringing more countries and international organizations together in new ways. As they forge partnerships for sustainable water development, they are pooling expertise and limited resources on several fronts, including the use of nuclear science and related technologies. In this connection, a noteworthy co-operative

effort in 2000 was the launching of the Joint International Isotopes in Hydrology programme between the Agency and UNESCO, designed to co-ordinate the integration of isotope hydrology techniques into the water sector activities of States belonging to the two organizations. The two agencies have also established other areas of co-operation and dialogue, for example joint publication of teaching material on environmental isotopes in the hydrological cycle, and the holding of consultations with a view to identifying areas of common interest in their respective programmes.

SAFETY

Developments in nuclear safety in 2000

National and international efforts over the past decade have resulted in an increased level of nuclear safety in a number of countries of central and eastern Europe and the former Soviet Union. Some of these positive developments were highlighted in a report issued in 2000 by the Western European

BOX 3. NUCLEAR TECHNIQUES TO SCREEN NEWBORNS FOR THYROID DEFICIENCY

Thyroid deficiency in newborns is common in many parts of the developing world. It is most prevalent in areas of endemic iodine deficiency and its most significant effect is on the developing brain. The condition may lead to irreversible neurological impairment, deafness or loss of speech. Mental and intellectual impairment is possible even when the iodine deficiency is less severe. However, neonatal hypothyroidism is treatable if detected early, i.e. within the first few days after birth. The best method of detection is measurement of the thyroid related hormones in the baby's blood by radioimmunoassay methods. The cost of such a screening programme is insignificant compared with the cost of caring for even a limited number of people suffering from severe mental retardation. Thus, through the use of nuclear techniques, a completely treatable problem can be detected early enough to permit timely medical intervention with every hope of success.

In an Agency regional technical co-operation project for West Asia, Member States were able to establish and validate the methodology for the measurement of thyroid related hormones. The early clinical studies were followed by the extension of the method to as many peripheral laboratories as possible in order to permit them to establish screening protocols at a number of hospitals and laboratories and, at the same time, allow a longer lead time for local health authorities to improve the logistics of national screening programmes.

All participating laboratories have accepted the treatment method. In addition, the reagents used in the method are being produced locally, resulting in significantly lower costs and less reliance on imported materials. ■

Nuclear Regulators' Association (WENRA). The report identified positive developments related to regulatory regimes and bodies and to the safety status of nuclear power plants in the region.

During 2000, the Agency continued to provide nuclear safety review services and assistance to countries in central and eastern Europe and the former Soviet Union. Like WENRA, the Agency obtained a positive overall picture in the area of nuclear safety in a number of these countries while providing suggestions for

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further improvement. For example, the Agency's review mission to units 1 and 2 of the Bohunice nuclear power plant in Slovakia concluded that a comprehensive safety upgrading programme had been developed and implemented. Other missions gave a positive evaluation of the modernization programmes for the Kozloduy nuclear power plant in Bulgaria.

The Temelin-1 nuclear power plant in the Czech Republic, which is a WWER-1000/320 reactor with substantial design modifications, achieved criticality on 11 October 2000. In December 2000, the Austrian and Czech Governments signed an agreement for a joint team of experts to review the safety of the plant. According to the agreement, the process of putting the plant into operation would continue, but commercial power operation would not start until the experts had reported their findings.

On 15 December 2000, the last operating unit of the Chernobyl nuclear power plant was shut down. At a donor's conference in 2000 in Berlin, more than \$300 million, required for the commencement of the Chernobyl Shelter Implementation Plan, was pledged. At the

request of the Government of Ukraine, the Agency has refocused its assistance projects in order to help the government in preparing a comprehensive plan for the safe decommissioning of the entire plant.

In South East Asia, the Pacific and the Far East, the Agency continued, through a special programme, to provide assistance to China, Indonesia, Malaysia, Philippines, Thailand and Viet Nam in enhancing the capabilities of regulatory bodies and technical support organizations and the safety of nuclear power plants and research reactors.

Germany, Lithuania and Ukraine were the latest among a number of European countries that have taken decisions to close some of their nuclear power plants earlier than originally intended. There are important safety issues that stem from these decisions that must be addressed. For example, operational safety must be maintained from the time of the closure decision until shutdown and decommissioning. This requires specific programmes that compensate for the organizational and technical changes that will occur during this period. Furthermore, a decision for early closure can reduce incentives for making upgrades to improve the safety of these facilities for their remaining period of operation.

One area of increasing concern is the safety of research reactors. In April 2000, the International Nuclear Safety Advisory Group (INSAG) — which advises the Agency's Director General — highlighted three major safety issues concerning research reactors: the increasing age of operating research reactors, more than half of which are over 30 years old; the large number of such reactors — well over 200 worldwide — that are shut down but not decommissioned; and the number of research reactors not under adequate regulatory control. INSAG called for immediate efforts to address these issues, and suggested that there might be benefit in the development of a legal instrument to cover the safety of these reactors.

In response to these concerns, the Agency has strengthened its activities related to the

safety of research reactors. For example, the review services now place higher priority on assessing and helping to improve regulatory effectiveness and on operational safety aspects such as the management of safety and safety culture. During 2000, the Agency organized three interregional training courses with particular relevance to research reactor

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safety issues and dispatched eight safety review missions to assist the operators of these reactors.

While ensuring a high level of safety is a national responsibility, international co-operation on safety related matters has proved to be indispensable. In this regard, the Agency advocates a global nuclear safety culture comprising three elements: conventions, internationally agreed safety standards and measures to apply those conventions and standards.

Three international conventions related to safety are currently in force: the Convention on Early Notification of a Nuclear Accident, the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency and the Convention on Nuclear Safety. A fourth convention, the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, will enter into force in June 2001.

International nuclear safety standards have to date been focused on nuclear power plants and research reactors. There are, however, some safety issues specific to other fuel cycle facilities that must be given consideration in their design and operation, such as criticality, chemical toxicity, fire and explosion hazards.

During the year, the Agency began work on developing specific safety standards for fuel cycle facilities.

The Agency continued to adjust the content of its safety review services, which are a means of providing for the application of the safety standards, in order to reflect developments in these standards as well as the needs of Member States. In particular, in light of developments in safety standards for operational nuclear safety, the relevant peer review services gave greater attention to safety culture and the management of safety, and promoted the increased use of self-assessments. The results of Agency reviews continue to indicate a general improvement in the safety of many nuclear power plants and implementation of corrective safety measures, as well as progress in enhancing the effectiveness and technical capabilities of regulatory bodies.

Developments in radiation and radioactive waste safety in 2000

International efforts continued to focus during 2000 on providing assistance for upgrading national radiation and waste safety infrastructures. The Agency, through a technical co-operation Model Project, has provided technical support and assistance in the implementation of action plans in more than 50 participating States. Seventeen peer review teams visited participating States during 2000 to evaluate: the adequacy of the legal and regulatory framework; the empowerment of the regulatory authority to enforce legislation and regulations; the system of notification, authorization and control of radiation sources; existing financial and human resources; and the number of adequately trained personnel.

A Code of Conduct on the Safety and Security of Radioactive Sources was developed in 2000 as guidance for States. A resolution of the 2000 General Conference invited Member States to consider means to ensure its wide application. The Code particularly addresses the establishment of an adequate system of regulatory control, from the production of radioactive sources to their final disposal, and a system for the restoration of such control if it has been lost.

Where the amount of radioactive material used in medicine, research and industry is substantial, such as with sources used in radiotherapy or industrial radiography, extreme care is necessary to prevent accidents that may result in severe consequences for the affected individuals. In 2000, five people died in Thailand and Egypt as a result of two accidents involving radiation sources. The Agency's 'Action Plan on the Safety of Radiation Sources and the Security of Radioactive Materials' has been designed to address the problems in this area. As part of its activities in 2000 to implement this Plan, the Agency developed a simple, generally applicable system for categorizing radiation sources. The sources are ranked according to the harm they could cause, so that the controls to be applied will be appropriate to the radiological risks which the sources (and the materials contained in them) present. A related activity in the implementation of the Action Plan was a conference organized by the Agency of national regulatory authorities and hosted by the Government of Argentina in Buenos Aires, in December 2000. Various actions that States should take with a view to ensuring the safety and security of radiation sources were identified at the conference.

Environmental assessments of areas with residues of radioactive material are becoming

an important activity for international organizations. The Agency, together with other relevant United Nations system organizations, has received requests for assessments of areas in the Balkans, the Gulf and the Middle East where it is known or believed that depleted uranium (DU) in ammunition has been used in the past. One example of the Agency's cooperative efforts in this area during 2000 was its participation in investigations by UNEP of the use of DU in Kosovo (Box 4).

The 2000 report by UNSCEAR on sources and effects of atomic radiation was presented to the 55th Session of the United Nations General Assembly. In addition to re-evaluations of some important parameters in radiation protection, the report also included an evaluation of the consequences of the Chernobyl accident. UNSCEAR's scientific assessments indicated that there have so far been about 1800 cases of thyroid cancer in children who were exposed at the time of the accident, primarily as a result of ingesting radioactive iodine. Although the Committee found no scientific evidence of increases to date in the incidence of any other health effects that could be related to radiation exposure, it concluded that the individuals most highly exposed as a result of the accident have an increased risk of suffering radiation associated effects in the future. UNSCEAR decided during its April

BOX 4. CO-OPERATION IN INTERNATIONAL ENVIRONMENTAL ASSESSMENTS — DEPLETED URANIUM IN KOSOVO

In November 2000, a field mission organized by UNEP visited several sites in Kosovo, Yugoslavia, where NATO had used ammunition containing DU in 1999. The mission was based on information provided by NATO in 2000 about locations at which such ammunition was used. The members of this mission, who included two experts from the Agency, made measurements of external dose rates and took samples of soil, water, vegetation and milk.

The mission report, released in March 2001, concluded that no widespread ground contamination had been found in the investigated areas and, therefore, that the corresponding radiological and chemical risks were insignificant. Although UNEP's findings show no cause for alarm, the report describes specific situations (e.g. high radiation doses as a result of prolonged contact with DU ammunition, or ingestion of small amounts of contaminated soil) where risks cannot be excluded, and the possible DU intake might be somewhat higher than the applicable standards. In addition, according to the report, some uncertainties still exist relating to the long term behaviour of DU in the environment. For these reasons, the report calls for certain precautionary actions. ■

2001 session to continue its consultations with scientists and experts from interested States to study the radiological consequences of the Chernobyl accident and prepare a further report thereon to the United Nations General Assembly.

The Agency continued to work during the year on maintaining international focus on the issue of the safe management of radioactive waste, accelerating progress towards demonstrated solutions and bridging the gap in perception between technical waste experts and the public at large. To raise international awareness of this issue, the Agency in March organized an international conference on the safety of radioactive waste management, in Córdoba, Spain. Continuing this effort, the Agency's General Conference featured a Scientific Forum on radioactive waste management.

A resolution passed at the 2000 General Conference requested the Secretariat to develop internationally agreed radiological criteria for long lived radionuclides in commodities, particularly foodstuffs and

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wood. Differences between national approaches and criteria have led to difficulties in international trade in such commodities.

The transport of radioactive materials, particularly nuclear fuel and radioactive waste, has continued to cause concern in a number of States. At the 2000 General Conference, a resolution called for several actions, including inviting States shipping radioactive materials to provide potentially affected States, upon their request, with assurances that their national regulations take the Agency's *Regulations for the Safe Transport of Radioactive Material* (the 'Transport Regulations') into account and with information on shipments. It also called for efforts to: examine and further

improve measures and international regulations on the international maritime transport of radioactive material and spent fuel; and encourage Member States to ensure that they have national regulatory documents governing the transport of radioactive materials that are in conformity with the Agency's Transport Regulations. For its part, the Agency reached agreement in 2000 with other international organizations in the transport field on timetables for implementing the latest version of the Transport Regulations into the specific regulations for the air, sea and land transport of hazardous goods.

VERIFICATION

The international non-proliferation and disarmament scene

The seminal event of the year in the area of non-proliferation and disarmament was the May 2000 Review Conference of the 187 States Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). For the first time in 15 years, the parties were able to successfully conclude their discussions on a broad range of nuclear non-proliferation and disarmament issues with the adoption, by consensus, of a final document. One of the key outcomes of the Review Conference was agreement by all parties on the need for an “unequivocal undertaking by the nuclear-weapon States to accomplish the total elimination of their nuclear arsenals”.

The final document reviewed the implementation and operation of the NPT from 1995 to 2000, and outlined a framework for moving ahead with nuclear disarmament and non-proliferation during the next five year period. In an effort to overcome the perceived stalemate in international arms control, the States established objectives for 2000–2005 to stimulate progress in the implementation of the obligations under the NPT. These included a number of practical steps for non-proliferation, nuclear disarmament, safeguards and export controls, peaceful nuclear co-operation, universal adherence to the treaty, and further strengthening of the review process. Moreover, the Conference agreed that there should

be more transparency on the part of the nuclear weapon States with regard to their capabilities, as well as a diminishing role for nuclear weapons in security policies.

Implementation of safeguards agreements and additional protocols

As of 31 December 2000, the Agency had 224 safeguards agreements in force with 140 States (and with Taiwan, China). Over 900 facilities and locations outside facilities were under Agency safeguards or contained safeguarded nuclear material in 2000.

Agency activities to verify the commitments of States to nuclear non-proliferation and in support of the development of peaceful uses of nuclear energy received positive attention both during the Review Conference and in the final document. In particular, States expressed their support for the Agency's continuing efforts to strengthen the safeguards system, and called upon all States that had not already done so to conclude safeguards agreements and protocols additional to those agreements. They reaffirmed that the additional protocols, in particular, greatly enhance the Agency's verification capability by providing for increased information and greater physical access. It was concluded that the combination of a safeguards agreement and an additional protocol in force for each non-nuclear-weapon State would assist the Agency in providing credible assurance not only about the non-diversion of declared nuclear material but also about the absence of undeclared nuclear material and activities in a State.

Regrettably, as of the end of 2000, 54 non-nuclear-weapon States party to the NPT had not fulfilled their legal obligation to bring into force the required safeguards agreements, and since 1997, when the Model Additional Protocol was adopted, additional protocols with only 57 States had been approved by the Agency's Board of Governors, of which only 19 had entered into force or were being provisionally applied.

Adherence to safeguards agreements and protocols additional to those agreements is a key element in international nuclear

non-proliferation efforts. To this end, a General Conference resolution called upon the Director General and Member States to consider ways and means, which could include a possible plan of action, to promote and facilitate the conclusion and entry into force of such safeguards agreements and additional protocols. The Secretariat has developed a new and updated action plan with a focus on greater co-operative

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efforts with Member States. A number of Member States, notably Japan, Kazakhstan, New Zealand and Peru, responded positively and concretely to the action plan by developing activities with the Agency.

In keeping with General Conference resolutions, the Agency has continued to hold consultations with the States of the Middle East region on the application of full scope safeguards to all nuclear activities in the Middle East, and the development of model agreements that would contribute to the establishment of a nuclear weapon free zone in that region. However, little progress has been achieved so far.

With regard to the current safeguards situation in the Democratic People's Republic of Korea (DPRK), the Agency is still unable to verify the correctness and completeness of the initial report of nuclear material made by the DPRK and is, therefore, unable to conclude that there has been no diversion of nuclear material in that State.

Since December 1998, the Agency has not been in a position to implement its mandate with regard to Iraq under the relevant United Nations Security Council resolutions. As a consequence, the Agency still cannot provide any assurance that Iraq is in compliance with its obligations under those resolutions. Following physical inventory verification inspections

performed under the safeguards agreement between Iraq and the Agency pursuant to NPT in January 2000 and January 2001, Agency inspectors were able to verify the presence of the nuclear material under safeguards at the Tuwaitha storage facility. However, these inspections cannot serve as a substitute for Agency activities under the relevant Security Council resolutions.

Integrated safeguards

The Agency has placed high priority on integrating traditional safeguards verification activities with a wide range of safeguards strengthening measures, especially those contained in protocols additional to safeguards agreements. As recognized by the NPT Review Conference, the aim of these efforts is to optimize the combination of all safeguards measures available to the Agency in order to meet its safeguards objectives with maximum effectiveness and efficiency.

The development of all aspects of integrated safeguards is continuing, drawing on internal resources, such as the Integrated Safeguards Working Group, as well as the Standing Advisory Group on Safeguards Implementation (SAGSI), a group of experts appointed by the Director General, and Member State Support Programmes. Considerable progress has been

made, including the identification of the conditions to be met before integrated safeguards can be implemented in a State and the development of generic approaches for several specific facility types. Work will proceed on the implementation of integrated safeguards in specific States when the relevant facility type approaches have been developed and the necessary conditions for the implementation of integrated safeguards have been met in the State concerned. The rate of implementation, however, is highly dependent on the actions of the States concerned in bringing into force their respective additional protocols.

New technologies

Unattended and remote monitoring of the characteristics and movement of radioactive material are key measures of a strengthened safeguards regime. The availability of such systems enables the Agency to implement its safeguards obligations with an improved level of efficiency and effectiveness (Box 5).

Other verification activities

In the final document of the NPT Review Conference, the States Parties welcomed the efforts by nuclear weapon States to co-operate in making nuclear disarmament measures irreversible. In that context, specific reference

BOX 5. USING NEW TECHNOLOGIES TO IMPROVE THE EFFECTIVENESS OF AGENCY SAFEGUARDS

An important measure to both strengthen and maximize the effectiveness of the current safeguards regime is the use of unattended and remote monitoring. In 2000, the Agency carried out numerous activities related to the remote monitoring and transmission of data on radiation and digital image surveillance systems. More sensitive radiation detectors with better discrimination were developed and installed in radiation monitoring systems, which allow the Agency to apply instrumented safeguards where previously an inspector presence or measures intrusive to the facility were required, and to obtain more definitive measurements such as the presence of specific isotopes where earlier only detection of radioactivity was possible. In addition, reliable and secure data transmission mechanisms were developed and tested, allowing the Agency to collect and evaluate data in near real time.

The Agency also conducted studies to ascertain the potential of using commercial satellite imagery as one tool of a strengthened safeguards regime. Satellite imagery analysis has proved to be useful in investigating open source information. In this connection, the Agency began development of an imagery database of nuclear sites under safeguards. ■

was made to the completion and implementation of the “Trilateral Initiative” between the USA, the Russian Federation and the Agency as one of the practical steps for the systematic and progressive efforts to implement Article VI of the NPT and paragraphs 3 and 4(c) of the Decision on “Principles and Objectives for Nuclear Non-Proliferation and Disarmament” agreed to by the NPT parties in 1995.

The Trilateral Initiative originated in 1996, at which time the USA, the Russian Federation and the Agency agreed to establish a prototype verification system for ensuring that weapon origin and other fissile materials specified by the States as “released from defence programmes” were not used for any military purposes. In 2000, progress was made in the development of technical approaches, particularly as they concerned the verification of such material with classified characteristics, and in the negotiation of a new related Model Verification Agreement. The aim, as indicated in the NPT final document, is to have a verification regime that can assure the international community that the material has been irreversibly removed from military applications. In August–September 2000, the USA and the Russian Federation signed a bilateral “Plutonium Management and Disposition Agreement” that commits each party to the withdrawal of 34 tonnes of weapons grade plutonium from weapons programmes. In September 2000, the two States agreed to hold early consultations aimed at concluding an agreement with the Agency to allow verification measures with respect to that material.

Physical protection of nuclear material

Terrorist and other groups and individuals may try to acquire nuclear material illegally. As such groups are less likely to have the means to manufacture this material, theft is a more likely route for its acquisition. The physical protection of nuclear material against theft is, therefore, an important non-proliferation issue.

The Convention on the Physical Protection of Nuclear Material, which entered into force in 1987, is designed to avert the potential dangers posed by the unlawful taking and use

of nuclear material, primarily while such material is in international transport. In addition, recommendations exist, published by the Agency, for the physical protection of nuclear material in use, storage and transport, whether domestic or international, against its unauthorized removal and/or sabotage, and for the protection of nuclear facilities against sabotage. The Expert Meeting convened by the Director General in 1999 to discuss whether there is a need to revise the Convention continued its work during 2000.

“Combating illicit trafficking is an issue that has gained prominence as such incidents continue to occur.”

Illicit trafficking is a downstream consequence of the theft of nuclear and other radioactive material. Combating illicit trafficking is an issue that has gained prominence as such incidents continue to occur. The Agency has a programme of activities that embraces information exchange, assistance to regulatory bodies and training. It has also established a database intended to provide an authoritative central source of information on incidents of illicit trafficking. The overall number of incidents reflected in the database that involve either nuclear material or other radioactive materials has dropped marginally in the last year. However, after a hiatus from 1996 to 1998, during which there were no reported seizures of weapons grade nuclear material, the last two years have witnessed four such incidents, the largest being one involving 920 grams of high enriched uranium.

OUTREACH

The Agency continued in 2000 to reach out to its many constituencies, in line with its public information and outreach policy that seeks to engage both traditional and non-traditional partners. A noteworthy example of this approach was a meeting with representatives from the nuclear industry, held in January

2000. This ‘Industry Forum’ provided an opportunity to exchange views with a broad range of professionals, including representatives of workers in the nuclear industry. There was broad consensus on the need for intensified efforts in the fields of safety, innovation and public confidence.

Another important activity during the year was to raise public awareness of the various

“The Secretariat in 2000 continued and accelerated its management reform initiatives ... to sharpen the process of programme formulation and maximize efficiency ...”

priority activities of the Agency. For example, non-proliferation became a subject of press attention during the NPT Review Conference in May 2000, with the Agency providing a range of background material for the press and public both in print and on its *WorldAtom* Web site. The site (<http://www.iaea.org/worldatom>), which was revamped in 2000, attracted an ever increasing number of visitors. The Sixth Conference of the Parties to the UNFCCC, held in The Hague, was another event for which the Agency prepared public information material. Also spotlighted was the issue of radioactive waste management. As one of the most controversial issues for the nuclear power industry, the Agency worked to offer balance and substance in its treatment of this issue.

These activities came in addition to concerted efforts by senior management, particularly the Director General, to reach out to a wider audience in civil society, including the arms control and disarmament community, academic institutions and think-tanks.

MANAGEMENT

The Secretariat in 2000 continued and accelerated its management reform initiatives

designed both to sharpen the process of programme formulation and maximize efficiency in programme delivery. In January 2000, the fourth Senior Management Conference convened by the Director General set the stage for the year. The Conference considered and formalized the practical details of introducing — within a deliberately condensed time schedule — a results based approach to programming and budgeting, and restrengthened and extended the Secretariat’s ongoing review of administrative practices.

A detailed explanation of results based methodology in the context of the Agency was presented to the Programme and Budget Committee of the Board of Governors in May, together with an initial planning document outlining the proposed programme and budget parameters for the 2002–2003 biennium. In this way, Member States were consulted in the development process from the outset — much earlier in the programme formulation cycle than in any previous year. Subsequently, a comprehensive document containing the *objectives, main outputs and outcomes* of the substantive major programmes was issued to Member States and became the subject of detailed consultations in September.

It was on the basis of the resultant programme that the initial budget estimates were then derived. Adjustments were subsequently made to the estimates to reflect anticipated financial constraints and to comply with guidelines issued by the Director General. The resulting draft programme and budget document for 2002–2003 was submitted to Member States in December 2000.

The “outcomes” referred to above are central to the results based approach and concentrate on the responses to stated problems that a given Agency programme is expected to bring about in Member States. *Performance indicators* are derived against which the effectiveness of the programme can subsequently be judged. The advantages of this approach include: increased transparency; greater participation of Member States in programming, leading to better identification of their needs; better priority setting; and improved evaluation of performance.

On a parallel track, developments continued in improving operational efficiencies. On 1 January 2000, a new financial information and control system was successfully put into operation — despite Y2K concerns — and enhancements to it were introduced throughout the year. The system provides programme managers with more timely and extensive data, permitting more precise implementation of activities. Additionally, special attention was given to restructuring the information technology services throughout the Agency to ensure efficient support to programme activities, with full advantage taken of the new technology.

Under the one house policy emphasized by the Director General, close attention is being paid to the working conditions of the staff. In this regard, a survey was carried out during the year to gain information on the views and concerns of members of the Secretariat. The results were analysed to identify any major issues and to suggest solutions. An important development was the expansion — under the management of the Agency and with a substantial grant from the City of Vienna — of the Child Care Centre to accommodate the children of staff members of the organizations based at the Vienna International Centre (VIC). In addition, planning began, together with the Government of Austria, on a project for the removal of asbestos from the buildings in the VIC. This will be a major undertaking lasting a total of six years and

involving detailed and careful project management.

CONCLUSION

The role that the Agency has played in helping to achieve the global objectives of “freedom from fear” and “freedom from want” continues to conform to the objective stated in Article II of its Statute, namely to “accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world”. In this context, several principles central to the Agency’s mission were reinforced during 2000, the most important of which were the following:

- Important benefits for achieving sustainable development and for improving the quality of life can derive from the peaceful application of nuclear energy and nuclear techniques. The Agency therefore has an important role in assisting developing countries to improve their scientific, technological and regulatory capabilities.
- Both national measures and international co-operation are essential for nuclear, radiation, waste and transport safety, and the Agency has a key role in the promotion of a global safety culture.
- Agency safeguards are a basic component of the non-proliferation regime and create an environment conducive to nuclear disarmament and nuclear co-operation.