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Upgrading Nuclear Security

IAEA Efforts Aim to Bridge Key Gaps

Upgrading nuclear security must be one of the world's urgent priorities, in the view of IAEA Director General Mohamed ElBaradei. "We have the solutions," he says, "now Governments have to come up with the resources."

Mr. ElBaradei presented a report in November 2001 to the IAEA Board of Governors, outlining plans to expand and strengthen programmes for nuclear security. He later briefed the press (*photo*).

"We need to urgently identify the most vulnerable locations and see they get the necessary security upgrades," Mr. ElBaradei said. "In the long term, we need to ensure all countries have a stringent nuclear security framework in place — with high standards to abide by, state-of-the art equipment, and people trained in security". Past efforts have focused largely on diversion of nuclear material by States for non-peaceful purposes, without the same degree of focus on malicious activities by sub national groups — thus creating a gap between the risk of nuclear terrorism and existing response capabilities.

The report addresses the IAEA's response to the following threats from acts of nuclear terrorism by a subnational group: acquisition of a nuclear weapon; acquisition of nuclear material to construct a nuclear weapon or to cause a radiological hazard; acquisition of other radioactive materials to cause a radiological hazard; and violent acts against nuclear facilities to cause a radiological hazard.

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All the stories featured in *Newsbriefs www.iaea.org* first appeared on the Web pages of the IAEA's *WorldAtom* site, accessible on the Internet at www.iaea.org. Visit the pages for regular reports about the IAEA's work and global nuclear developments.

Each edition of *Newsbriefs www.iaea.org* will feature stories on the wide range of issues and topics related to the IAEA's three main pillars of work — nuclear verification, technology, and safety. This edition particularly focuses on the issue of nuclear security, and steps that the international community is considering to strengthen the protection of nuclear material and facilities. Other stories report on IAEA-supported projects that are helping countries reach their development goals.

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International Atomic Energy Agency

How Real?

Experts at the IAEA point to the need for reducing three categories of risks from nuclear terrorism. As outlined in an IAEA press release, they pertain to:

Nuclear Facilities: The primary risks associated with nuclear facilities would involve the theft or diversion of nuclear material from the facility, or a physical attack or act of sabotage designed to cause an uncontrolled release of radioactivity to the surrounding environment.

From its inception, the nuclear industry has been keenly aware of the dangers of nuclear material falling into terrorist's hands. At all levels — operator, State and international — there is a complex infrastructure at work to ensure nuclear material is accounted for; safeguarded from diversion; and protected from theft and sabotage.

Nuclear facilities are protected by well-trained security forces and are extremely robust, designed to withstand, for example, earthquakes, tornado-force winds and accidental crashes of small aircraft. Although it is not automatic that any attack would result in a release of radioactivity, they are, however, industrial facilities and as such are not hardened to withstand acts of war.

Countries with nuclear facilities have heightened security since the 11 September attacks, and are conducting urgent analyses of their safety and security systems. The IAEA plans to strengthen and tailor its existing safety and security services to address the terrorism threat, by assisting countries in upgrading the security and safety of their nuclear facilities.

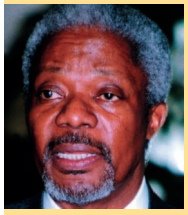
Nuclear Material: According to IAEA experts, terrorists obtaining nuclear weapons would be the most devastating scenario. While that possibility cannot be excluded, it is highly unlikely terrorists could use the nuclear material to manufacture and successfully detonate a nuclear bomb, in the view of IAEA Director General Mohamed ElBaradei.

Beyond the difficulty for terrorists to obtain weapon usable material — scientists estimate that 25 kg of highly enriched uranium or 8 kg of plutonium would be needed to make a bomb — actually producing a nuclear weapon is far from a trivial exercise. Scientific expertise and access to sophisticated equipment would be required.

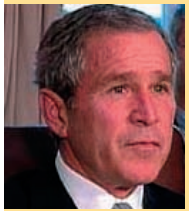
Nuclear material has traditionally been subjected to extensive national

Notes & Quotes:

"An unconventional threat requires an unconventional response, and the whole world needs to join together and take responsibility for the security of nuclear material. Because radiation knows no frontiers, States need to recognize that safety and security of nuclear material is a legitimate concern of all States. Countries must demonstrate to their own populations, neighbours and the world that strong security systems are in place. The willingness of terrorists to sacrifice their lives to achieve their evil aims creates a new dimension in the fight against terrorism."
Mohamed ElBaradei, lAEA Director General, background press release, 31 October 2001



"In addition to measures taken by individual Member States, we must now strengthen the global norm against the use or proliferation of weapons of mass destruction. This means, among other actions ... redoubling efforts to ensure the universality, verification and full implementation of key treaties relating to weapons of mass destruction, including those outlawing chemical and biological weapons, and the nuclear non-proliferation treaty."
Kofi Annan, UN Secretary-General, address to the UN General Assembly, 8 October 2001



"The IAEA is central to the world's efforts to prevent the proliferation of nuclear weapons. For more than 40 years, the IAEA and its member states have established safeguards for special nuclear materials and the facilities that produce them. Much more remains to be done, and we will look to the IAEA to continue serving as a critical instrument to help combat the real and growing threat of nuclear proliferation."
George W. Bush, US President, message to the IAEA General Conference, 17 September 2001

protection measures. To prevent theft of nuclear material, nuclear facilities employ a range of protection measures, including site security forces, site access control, employee screening and co-ordination with local and national security authorities. In some States, national security forces provide back-up to facility security. The IAEA offers countries around the world assessments and advice on physical security. It also maintains a database on incidents of trafficking in nuclear material, although the IAEA considers the information States provide on incidents and on follow-up to be inadequate.

In non-nuclear weapon States, the IAEA carries out international safeguards to verify that nuclear material has not been diverted to non-peaceful uses. These safeguards, the verification tool entrusted to the IAEA in the 1970 Treaty on the Non-Proliferation of Nuclear Weapons (NPT), also play an important role in reducing the risk that terrorists could acquire nuclear material without detection. But when the NPT was drafted, nuclear terrorism was not perceived as a significant threat.

IAEA safeguards require that a State account for all its nuclear material and serve as a "burglar alarm" against a terrorist. A well-designed system will also help to pinpoint the origin of missing material, identify individuals who had access to it, and facilitate recovery of the material.

Not under the purview of IAEA safeguards are the nuclear weapon programmes in the five nuclear weapon States — China, France, the Russian Federation, the United Kingdom and the United States, as well any that may exist in India, Pakistan and Israel, the three non-NPT countries known to have nuclear programmes.

Among other measures for reinforcing nuclear security, the IAEA plans to significantly expand its advisory services and help States strengthen systems and procedures for protecting nuclear material.

Radioactive Sources: Experts are concerned that terrorists could develop a crude radiological dispersal device using radioactive sources commonly used in every day life. The number of radioactive sources around the world is vast: those used in radiotherapy alone are in the order of ten thousand. There also is a large number of unwanted radioactive sources, many of them abandoned, others are simply "orphaned" and remain outside of any regulatory control.

Such a weapon, sometimes referred to as a "dirty bomb", could be made by shrouding conventional explosives around a source containing radioactive material, although handling the nuclear material could well be deadly. While experts think the effects of a dirty bomb would not be devastating in terms of human life, its contamination in even small quantities could have major psychological and economic effects.

In many countries, regulatory control over radioactive sources is weak, and the IAEA is accelerating efforts to upgrade their national capabilities through a multi-faceted action plan.

"New Dimension in Fight Against Terrorism"

"The IAEA is the only international institution of global scope devoted to controlling access to weapons-usable material. There is little hope that we can build an effective global system to secure nuclear material from terrorists without an effective and well-financed safeguards system."
Charles Curtis, President, Nuclear Threat Initiative, statement to the IAEA International Symposium, 20 October 2001.

"The IAEA ...like the United Nations...has been responding to new challenges virtually throughout its existence. The Agency now has the opportunity to re-examine the adequacy of safeguards and physical security controls. It must also re-examine closely its own past assumptions about the likely motivations of terrorists and their willingness and capabilities to 'do the unthinkable' .... I have every confidence that the IAEA has the leadership and professional expertise to rise to this challenge."
Jayantha Dhanapala, Under-Secretary-General, UN Department for Disarmament Affairs, statement to the IAEA International Symposium, 29 October 2001

"Just as Chernobyl spurred positive action, we in the nuclear industry and those in this Agency can do no better today than to use the opportunity to reapply ourselves, with new resolve, to a duty already on our agenda: that of identifying and correcting those aspects of the nuclear fuel cycle that may be vulnerable to extreme and malicious acts. This Agency and the world industry should seize the moment to institute added precautions that will stand nuclear power in good stead for decades to come."
John Ritch III, Director General, World Nuclear Association, address to the IAEA International Symposium, 1 November 2001

Special Session

Nuclear experts meeting at the IAEA in November 2001 urged stronger measures on the global front to prevent nuclear or radioactive material from falling into the wrong hands, or nuclear facilities from becoming targets.

The Special Session on Nuclear Terrorism in Vienna capped a week of meetings at the Agency's International Symposium on Safeguards, which was attended by more than 500 experts and officials from the IAEA's Member States.

"Many of our programmes go to the heart of combating nuclear terrorism. Now we have to actively reinforce them."
IAEA Director General Mohamed ElBaradei

At the symposium, IAEA Director General Mohamed ElBaradei said the Agency is critically examing its programmes across the board — to upgrade physical protection of nuclear material and radioactive sources; to enhance accident prevention at nuclear facilities; and to reinforce emergency response mechanisms, among other areas. A key aim will be to improve the IAEA's capabilities to help States that lack the resources to upgrade the security of their nuclear facilities and material, he said.

"Many of our programmes go to the heart of combating nuclear terrorism," the Director General said. "Now we have to actively reinforce them."

The Special Session covered a range of security and safety issues related to nuclear facilities, nuclear material, and radioactive sources. Speakers included senior IAEA officers, and nuclear security and non-proliferation experts, nuclear regulators, and terrorism specialists from national and international institutes and organizations. Chairing the Session were Mr. N.E. D'Amato, head of the Nuclear Regulatory Authority of Argentina; Mr. Pierre Goldschmidt, IAEA Deputy Director General for Safeguards; Mr. Charles Curtis, President, Nuclear Threat Initiative, a global foundation in the USA; and Mr. Piet de Klerk, IAEA Director of the Office of External Relations and Policy Coordination.

"There are good reasons to be concerned," said Mr. Curtis in summing up the Special Session. The terrorist attacks of September 11, and dangers posed by biological agents, he said, starkly show that "thresholds have been crossed... we can now imagine our worst scenarios." He said the Session had highlighted the need for better coordinated and integrated nuclear security and safeguards measures. The international community has a "good foundation to build on," he said, and he urged governments to support the IAEA in its important work.

Press Briefing. At a heavily attended press briefing on 2 November, IAEA Director General Mohamed ElBaradei underscored his view that the IAEA and its Member States will meet the challenges posed by nuclear terrorist threats. The Agency has responded effectively to earlier nuclear challenges, he said, noting the cases of Chernobyl and Iraq which triggered stronger international nuclear safety and verification

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Funding the Fight

An estimated $30 to $50 million per year is needed to fund the set of proposed measures for nuclear security and safety submitted to the IAEA Board in late November. *(See story, page 6.)* Among other options, the IAEA is exploring the feasibility of establishing an international fund for protection against nuclear terrorism.

To help fund the fight against nuclear terrorism, the United States is providing the IAEA with $1.2 million of additional funds, US Secretary of Energy Spencer Abraham announced on 30 November 2001 in Vienna. *(Also see story, page 6.)*

"The Agency's broader mission for combating terrorism means that greater resources will be required," he said at a press briefing at the IAEA on 30 November. He underlined that the United States is undertaking "a fundamental and exhaustive review" of its approach to IAEA funding and the Agency's needs, and expressed the hope that other IAEA Member States will do likewise to meet financial needs.

The US funds match a recent grant to the IAEA by the Nuclear Threat Initiative, a global foundation set up by Ted Turner, CNN founder, and Sam Nunn, former US Senator. In late October, NTI granted the IAEA $1.2 million over three years. The grant supports steps to expand the Agency's ability to review security for nuclear facilities worldwide, identify needed security upgrades, and organize contributions from IAEA Member States to carry out the upgrades, said Charles Curtis, NTI President, in announcing the pledge.

Combating Terrorism

The report puts a price tag on its proposed programme at $30-to-$50 million per year, representing an initial 10–15% increase in the IAEA's overall resources. Additionally, Mr. ElBaradei said the IAEA's budget is currently underfunded by about $40 million due to a budgetary policy of "zero real growth", and called on Member States to provide the resources required to cope with the newly emerging threat.

Besides resources for urgent international assistance, Mr. ElBaradei said that the necessary global upgrades to meet the full range of possible threats would be in the range of hundreds of millions of dollars and would have to be carried out by individual States and through bilateral and multilateral assistance. The IAEA would play a coordinating role in delivering this assistance.

"These measures should be regarded as an insurance policy designed to help protect the whole world against an act of nuclear terrorism," he said. "The premiums might seem steep, but they are worth the investment to protect ourselves."

He further noted that "an effective response must consider national vs. international roles; urgent (short term) priorities vs. medium and long term strategies; and both safety and security aspects. The most immediate task is to get the facts — to achieve a more complete picture of nuclear security worldwide, to enable a rapid response to the most urgent needs, and to develop a coherent plan for longer term action."

Expected outcomes. If States provide adequate funding, Mr. ElBaradei said that the enhanced and additional activities proposed in his report should lead over time to a powerful national and global security framework for nuclear facilities and material.

"If we can establish international standards, effective security systems and oversight in all States, and better monitoring of borders, then we can provide a guarantee that the world will be a much safer place," he said.

See story, page 6 for a summary of the Board report.

Headlines

In recent months, national and international journalists covering global security issues have interviewed IAEA Director General Mohamed ElBaradei and senior Agency officials. Among the interviews featured on *WorldAtom:*

- **"Concern, Not Panic",** CNN television interview with the Director General, aired on the weekend of 27 October 2001. The news clip and transcript are on line.
- **"Bridging the Gap",** CNN television interview with the Director General, aired on 8 November 2001. The transcript is on line.
- **"Need for Comprehensive Strategy"**, BBC radio interview with the Director General, aired on 31 October 2001. The transcript is on line.
- **"Global Priorities"**, news clips of remarks by IAEA Director General Mohamed ElBaradei.

To access these interviews, see the "Multimedia" section at http://www.iaea.org/worldatom/Press/Focus/Nuclear_Terrorism/

Also running on CNN International networks is a Public Service Announcement about the IAEA and its role as the world's nuclear authority. To view the video, see *WorldAtom's* front page; click on the "Latest IAEA Videos" button.

Photo: Experts in fields of nuclear safety, security, and non-proliferation were among participants at the IAEA Special Session on Nuclear Terrorism in November 2001. The Session capped the International Symposium on Safeguards, which focused on verification and security of nuclear material. (Credit: Calma/IAEA)

Nuclear Security Tops Board Agenda

The IAEA Board of Governors is considering a set of measures calling for urgent action to upgrade nuclear security around the world. The measures would substantially expand and strengthen IAEA programmes for the physical protection of nuclear material and facilities.

Following is a summary of the Report on "Protection Against Nuclear Terrorism", presented to the IAEA Board of Governors on 30 November 2001.

Nuclear Weapons. The report states that responsibility for preventing the theft of a nuclear weapon lies with the States that possess nuclear weapons. The IAEA urges these States to urgently revisit security and organizational arrangements to ensure that all necessary measures are in place to meet possible threats. The report offers IAEA services to provide advice on matters related to safety and physical protection.

Nuclear Material. The report indicates that nuclear material is subject to national protection measures, though these appear to be uneven in their substance and/or application. In recent years States have confirmed to the Agency some 175 cases of illicit trafficking involving nuclear materials. "While only a few of these cases involved significant amounts of nuclear material," the report says, "they demonstrate that security is still inadequate at certain locations and that there is an urgent need for improved protection and control."

The IAEA plans to increase the number and scope of its International Physical Protection Advisory Service (IPPAS) missions as well as workshops designed to help States to assess possible threats to nuclear activities. The Agency also plans to expand programme aimed at increasing the capabilities of Member States to detect and respond to theft, illicit trafficking, and other malicious use or threatened use of nuclear material and other radioactive materials.

According to the report, there are currently no comprehensive binding international standards for the physical protection of nuclear material. As an urgent measure, the IAEA is seeking to broaden the scope of the Convention on the Physical Protection of Nuclear Material to cover the security of additional activities and is convening a group of international experts in December to work on an amendment.

The report says the IAEA also plans to strengthen its assistance to States in improving their systems of nuclear material accountancy and control. "If a terrorist were to acquire nuclear material, a good system of nuclear material accounting and control, reinforced by IAEA safeguards, could help determine the origin of any missing material as well as to identify individuals who had access to it," the report says.

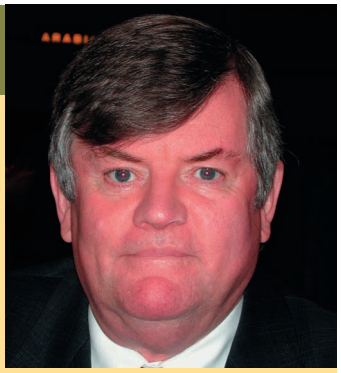
Radioactive Material. The report notes that there is lax security of radioactive sources in some States. As a consequence of this, an undetermined number of sources have become "orphaned" from regulatory control, and their location is unknown.

While the IAEA has developed important international standards for radiation protection, these contain general, but no detailed, requirements on the security of radiation sources. To increase the protection of radiation sources, the IAEA proposes a number of measures to strengthen regulatory control and to update its standards and expanding programmes in respect to terrorism threats.

Nuclear Facilities. The report says the robustness of nuclear power plants and other nuclear facilities (such as fuel fabrication, enrichment, reprocessing and waste management plants, and research reactors) against acts of sabotage and other acts of extreme violence varies worldwide. Agency assessments of facility design and operational measures can contribute to preventing and/or mitigating the impact of malicious acts. The Agency also is revising safety standards related to the safe construction and operation of nuclear facilities.

Board Members

Member States represented on the IAEA Board for 2001–2002 are Argentina, Australia, Brazil, Bulgaria, Burkina Faso, Canada, Chile, China, Colombia, Egypt, Finland, France, Germany, Ghana, India, Ireland, Islamic Republic of Iran, Japan, Libyan Arab Jamahiriya, Kuwait, Mexico, Morocco, Pakistan, Peru, Philippines, Romania, Russian Federation, South Africa, Spain, Switzerland, Thailand, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America.



Serving as Board Chairman for 2001–2002 is the Ambassador from Australia, Mr. Max Hughes. He has been Australia's Ambassador to Austria and Representative to the UN Organizations in Vienna since March 2000. He previously served as Ambassador to Germany.

Technical Cooperation for Security

The needs of nuclear security must be balanced with the pressing demands of human security, IAEA Director General Mohamed ElBaradei said in his statement to the IAEA Board's Technical Assistance and Cooperation Committee in November.

"Nuclear security should not be strengthened at the expense of our efforts to improve human health, ensure clean water, or achieve food security," he said. "These are all urgent priorities that require urgent attention."

Many IAEA technical cooperation activities focus on key elements of nuclear security, he said. They include ensuring the physical protection of nuclear materials; preventing and responding to illicit trafficking in nuclear materials and radioactive sources; enhancing the safety of nuclear facilities; upgrading national radiation protection infrastructures; and helping countries to increase their preparedness to respond to nuclear emergencies. Even as the Agency responds to requests from countries to build up their capabilities in these and related fields, new activities will require additional resources.

As a cornerstone of the Agency's work, the technical cooperation programme — valued at more than $80 million a year — delivers expert services, equipment, and training in support of development goals and objectives. The largest shares of the programme for 2002 are related to projects in the fields of safety, human health, and food and agriculture.

To read more, go to the Web pages of the Department of Technical Cooperation at http://www-tc.iaea.org/tcweb/default.asp

US Secretary of Energy Spencer Abraham (left front) met with IAEA Director General Mohamed ElBaradei and senior staff in late November 2001, and addressed the IAEA Board of Governors on nuclear security and related issues. In his remarks, the Secretary emphasized the importance of strengthening international standards for the protection and accounting of nuclear materials. "The work the Agency does to deny nuclear material and radioactive sources to terrorist and State sponsors of terrorism is an integral part of our effort to stem the proliferation of weapons of mass destruction," he said. (Credit: Calma/IAEA)

To improve the security of nuclear installations, the Agency proposes to expand significantly its current programme to help States to undertake facility specific assessments, implement safety related upgrades, and review guidance on the safety of facilities against external and internal acts of violence.

Emergency Response. The IAEA has the only international response system in position to immediately react and assist countries in the event of a radiological emergency caused by a nuclear terrorist threat. The Agency proposes to upgrade its Emergency Response Centre to improve the speed, efficiency, reliability and quality of the response in case of a large radiological emergency. Its Emergency Preparedness Review Service also can provide thorough appraisals of national emergency response programmes, as well as training to increase a State's capability to respond effectively to the possible consequences of a radiological emergency.

The report also proposes to set up international response standby teams that could be promptly dispatched to States needing urgent assistance.

Next Steps. The Board report comes in response to action by the IAEA's Member States at their General Conference, which held its annual session in Vienna shortly after the September 11th terrorist attacks in the United States. In collectively condemning the attacks, States called for a thorough review of IAEA programmes for nuclear security and resolved to work together on strengthening measures.

Among next steps, the IAEA planned to convene a group of legal and technical experts in early December to draft an amendment designed to strengthen the global Convention on the Physical Protection of Nuclear Material.

The Board next meets on the Agency's ongoing efforts to reinforce its nuclear security programmes in March 2002.

Special Session: Experts Call For Global Response

measures, respectively. The new terrorist threat calls for strong and sustained action, he said, that must be backed with sufficient resources, political commitment, and authority to carry out the work.

"I am confident we will get the resources we need to invest in stronger preventive measures for nuclear security," he said. Over the past decade, Member States have entrusted the Agency with additional authority — which he characterized as "more teeth" — to carry out new nuclear safeguards and safety responsibilities, he noted.

One focus is to strengthen any weak links affecting nuclear security. Levels now are uneven, he said, and measures and international standards are needed that are uniformly applied by all States, then peer reviewed to keep them effective and open to improvement.

"It's not enough that some States have strong systems for nuclear security, while others are weaker," he said. "States that have the resources and know-how will have to help States that do not, so that high levels are achieved everywhere."

Special Session Presentations

Experts from the Russian Federation, United States, Norway and other countries presented their views at the Special Session. They included Mr. A. Nikitin, Russian Federation, who addressed issues of intelligence, police, and border protection; Mr. George Bunn, United States, who focused on the protection of nuclear materials and reactors from terrorists and thieves; Mr. J. Post, United States, who examined the motivations and constraints of nuclear terrorism; Mr. M. B. Maerli, Norway, who reviewed nuclear terrorism threats related to weapons and explosive devices; Mr. G. Cameron, United Kingdom, who addressed threats from the dispersal of radioactive material; Mr. S. Fernandez de Gurmendi, Argentina, who reviewed the international legal framework related to nuclear security; and Mr. M. Gregoric, Slovenia, who reviewed the international Convention on Physical Protection of Nuclear Material.

The IAEA's International Symposium on Safeguards and the Special Session on Nuclear Terrorism attracted delegates and journalists from around the world. (Calma/IAEA)

Overviews of the IAEA's nuclear safety and security programmes were presented by senior Agency staff. Ms. A. Nilsson, Mr. R. Hoskins, Mr. G. Anzelon, Mr. M. Soo Hoo, and Mr. R. Abedin-Zadeh reviewed elements of the programme for the Security of Material. Other presentations were from Mr. K. Murakami, who reviewed experience in building national capabilities for nuclear material and control; Ms. A. Carnino, who addressed safety and security aspects of nuclear installations; and Mr. A. Gonzalez, who reviewed the security of radioactive sources. *(See Viewpoints box for links to papers.)*

Summing Up: An Interdependent World

Mr. Charles Curtis, head of the Nuclear Threat Initiative, a global foundation set up by Ted Turner, CNN founder, and Sam Nunn, former US Senator, summed up the Session by calling upon the international community to respond as one against the terrorist threat.

Excerpts from his remarks:

Viewpoints

Most papers and presentations from the IAEA International Symposium on Safeguards and the Special Session on Nuclear Terrorism are accessible on line, including those noted here. For links, go to *WorldAtom*'s feature pages on Combating Nuclear Terrorism at http://www.iaea.org/worldatom/Press/Focus/Nuclear_Terrorism/ For links to presentations at the Special Session, go to http://www.iaea.org/worldatom/Meetings/2001/infsm367progr_fr.shtml

- *Challenges of Nuclear Non-Proliferation, Arms Control, & Terrorism,* IAEA Director General Mohamed ElBaradei
- *Guarding Nuclear Reactors and Material From Terrorists and Thieves,* George Bunn and Lyudmila Zaitseva, Stanford University
- *The Future of Nuclear Energy in an Era of Environmental & Terrorist Challenge,* John Ritch III, Director General, World Nuclear Association
- *Reducing the Nuclear Threat in the 21st Century,* Charles Curtis, President, Nuclear Threat Initiative
- *The NPT Regime: Progress and Promises,* Jayantha Dhanapala, Under-Secretary-General, UN Department of Disarmament Affairs
- *Reducing the Threat of Nuclear Theft and Sabotage,* M. Bunn and G. Bunn, Harvard University, Stanford University
- *Transcending Sovereignty in the Management & Control of Nuclear Material,* Lawrence Scheinman, Monterey Institute

"One of the founding fathers of my country once advised his colleagues that we should all hang together for surely we shall all hang. He was trying to emphasize the sense of community and responsibility. This is a time I believe that the international community should emphasize the last word in that title, a sense of community, responsibility to each other, and in that I include all States — weapon States as well as non-weapon States.

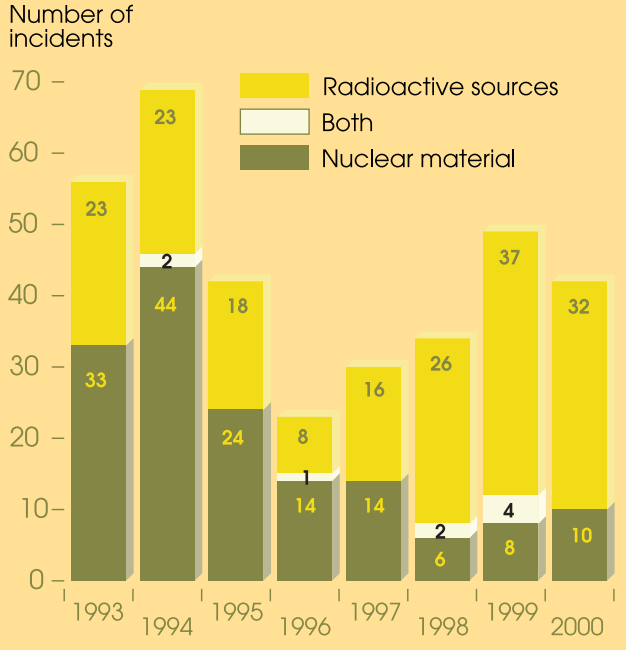
"Eighty nations lost citizens in the attack at the World Trade Center. The economic effects are rippling and rolling through markets and they have already extracted a very significant price and they threaten worldwide recession. Imagine yourselves in another meeting in this room in the week after our worst scenarios which now, because thresholds have been crossed in terms of the number of lives taken in an attack on a civil population, thresholds have been crossed in terms of using biological agents in an attack on a civil population. We can now imagine our worst scenarios.

"Do we have a reason to be concerned? I think after the presentations we have heard today, every person in this room must conclude we have a reason to be concerned and we have a challenge that we must respond to to strengthen the safeguards and the security system which must be, if not well co-ordinated, well integrated to protect against the loss of these materials to these evil purposes. Post 11 September we should all be concerned.

"What we heard also in these presentations and what we must keep in mind is that we have a very strong foundation to build on, but we know it will be hard. Voltaire once advised that the perfect should not be the enemy but the good. Our safeguards system is good, it needs to be better. A material protection system is not yet good and it needs to be even better than good. So we have much work to do.

In the end I go back to an earlier admonition — our nuclear future and safety depend on the skills of the people in this room and the strength of your voice. So I ask you again to continue your work in your home venues because I think we all know how important and how dependent global security is on your efforts."

Nuclear Trafficking



Since 1993, the IAEA has tracked reports of illicit trafficking in nuclear and radioactive materials.

Bookmarks

See the following information links on *WorldAtom* and the Web:

- UN Security Council Resolution on Terrorism, General Assembly Condemnation
  http://www.un.org/News/ dh/20010912.htm#20
- IAEA General Conference Resolutions on Security of Nuclear Material and other topics
  http://www.iaea.org/worldatom/About/Policy/GC/GC45/ Resolutions/gc45res14.pdf
- Reports to the IAEA General Conference on Radiation Safety, Security of Nuclear Material, Safeguards, and other topics
  http://www.iaea.org/worldatom/About/Policy/GC/GC45/Documents/index.html
- Radiation Safety & Security of Radioactive Material, reports on IAEA Conference in Argentina
  http://www.iaea.org/worldatom/Press/Events/RadSources/radsources_part1.shtml
- Security of Nuclear Material & Radioactive Sources, report on IAEA Conference in Sweden
  http://www.iaea.org/worldatom/Press/P_release/2001/prn0110.shtml
- Treaty on the Non-Proliferation of Nuclear Weapons (NPT)
  http://www.iaea.org/worldatom/Documents/Legal/npt.shtml
- Convention on the Physical Protection of Nuclear Material
  http://www.iaea.org/worldatom/Documents/Legal/cppn.shtml
- Nuclear Threat Initiative, global foundation
  http://www.nti.org/index.html
- Institute for Science & International Security
  http://www.isis-online.org/
- Institute of Nuclear Materials Management *http://www.inmm.org/*
- Nuclear NGOs & Related Organizations on the Web
  http://www.nti.org/g_links/g_index_r3.htm
- International Nuclear Information System (INIS), sample bibliography on nuclear terrorism
  http://www.iaea.or.at /inis/

E-Beams & Mail Safety

Health and safety authorities in many countries have turned to radiation technology to sanitize medical supplies, foodstuffs, and other commodities moving in national and global trade. Now US officials are applying the technology for scanning postal mail to protect workers and citizens from health threats posed by anthrax-tainted letters and parcels.

More than 50 countries have approved the use of irradiation to guard against food-borne diseases, processing a range of food products and ingredients to eliminate targeted bacteria and pathogens. Other applications include sterilizing pharmaceuticals and pre-packaged hospital and medical supplies, from gloves to syringes, to meet stringent health-care standards.

National and global health authorities back the safety and effectiveness of these irradiation processes, which do not induce radioactivity in processed materials. In the United States, the Postal Service has announced new safety measures that include processing mail with electron beam technology, which uses machines called electron accelerators powered by electricity to eliminate potentially dangerous bacteria. It also is exploring the use of gamma irradiators, which use radionuclides as the energy source. Postal authorities are investing about $30 million in the new tools as part of extensive new safety and security measures. The level of confidence in the technology is at the "highest possible level", the Postal Service says.

Why Irradiation is an Effective Option. One of the most important uses of ionizing radiation is based on the lethal effect it can have on microorganisms like bacteria, parasites and pathogens. The effect is attributed primarily to the energy deposition in the bacteria's critical cell components, such as DNA carrying the genetic code.

On a commercial scale, irradiation is known to be an effective control measure for eliminating pathogenic bacteria and parasites, especially in solid foods. Bacteria like *Salmonella, Campylobacter, Yersinia, Listeria, Shigella,* and *Vibrio E coli 0157:H7* are eliminated from processed products. The technology has been studied in some countries against different species of *Bacillus*, including the anthrax pathogen, *Bacillus anthracis.*

How the Process Works. Two types of radiation are used on a commercial scale in a wide range of sterilization applications: electromagnetic (X and gamma) radiation, which is in the form of waves or vibrations of electric and magnetic fields; and particulate (electron or beta) radiation, which is in the form of rapidly moving subatomic particles. The radiation field can be produced by radioactive material, by X-ray machines or by electron accelerators. Typical sources of gamma radiation are cobalt-60 and, to a lesser extent, caesium-137.

Industrial or commercial radiation facilities must be licensed, regulated, and inspected by national radiological safety and health authorities, many of whom base their rules upon standards and codes of practice jointly established by the IAEA, World Health Organization, and Food and Agriculture Organization. Common features of commercial facilities are an irradiation room or chamber and a system to transport the processed material, such as conveyors or rail systems. Processed materials are exposed to controlled doses of radiation, and they can be handled safely immediately after treatment.

To read more, go to
http://www.iaea.org/worldatom/Press/News/10252001_news.shtml

Brazil Symposium

How accelerators are being applied worldwide, and what applications lie ahead, were prime topics at an IAEA symposium in São Paulo, Brazil, in late November 2001. Experts from more than 30 countries in South America and other regions shared their experience and targeted areas for IAEA-supported collaborative research and development programmes.

More than 10,000 accelerators of different types are being used around the world in medical, industrial, and research fields. By bringing together leading experts, the Symposium served as a prime channel for the IAEA's support and coordination of scientific and technical projects. Presentations included those by experts from Argentina, Austria, Bangladesh, Belgium, Brazil, Croatia, Cuba, Egypt, Germany, India, Israel, Italy, Jordan, Republic of Korea, Lebanon, Mexico, Pakistan, Poland, Romania, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, Ukraine, and the United States.
To read more, go to
http://www.iaea.org/worldatom/Press/News/11192001_news01.shtml

Seizing Opportunities for Sustainable Development



Prof. Sachs, Ms. Catley-Carlson, and Mr. Ramamurthy were among the Scientific Forum's panelists. (Credit: Calma/IAEA)

The time may be ripe for seizing new opportunities and setting more targeted priorities in the tough fight to gain funds and mobilize science and technology for the world's poorest countries, a panel of international experts advised the IAEA's latest Scientific Forum.

"The time for outreach to donors is now," said Prof. Jeffrey Sachs, Director of the Center for International Development at Harvard University in the USA. International development strategies are changing, he said, because old models and approaches are falling to new strategies that are attuned to the critical need for science-based development. He was optimistic that sustained and cooperative actions would encourage donors to fund programmes and projects in health and other fields that seek to mobilize and maximize the benefits of science and technology in developing countries.

Over two days, the Forum examined ways in which "sci-tech" tools, and particularly nuclear-related ones, could be better applied at national, regional, and global levels to solve pressing problems of food, water, and health care. Sessions looked closely at problems countries are facing, and at ways in which nuclear and radiation technologies were being effectively applied in countries where problems are severe.

At the concluding session, a panel of experts looked at the picture in the context of some big barriers being faced today, even though science and technology are known to be driving forces of social and economic progress. Problems go beyond significant economic hurdles, experts said, and extend to national, regional, and international policies; the role of science-based development programmes; the need for reliable technical expertise and support to sustain proven techniques, field projects and vital follow-up actions; and the critical networks acquired through cross-disciplinary partnerships and dialogue in public and private sectors.

IAEA Director General Mohamed ElBaradei commended the Forum's participants for providing "tremendously useful" insights to the Agency's work. IAEA-supported technical cooperation and research programmes are helping poor countries benefit from nuclear technologies that can accelerate progress at local levels towards national goals of sustainable development.

The panel discussion was moderated by Ms. Margaret Catley-Carlson, Chair of the Global Water Partnership. Participants included the Forum's Chairman, Mr. V.S. Ramamurthy, of India; Mr. W. Stumpf, South Africa; Mr. L. Pinillos-Ashton, Peru; Mr. J. Vargas, Brazil; Mr. John B. Ritch III, World Nuclear Association; Mr. Sachs, United States; Mr. Din Dayal Sood, IAEA; Mr. James Dargie, FAO/IAEA Joint Division; and Mr. Peter Rickwood, IAEA.

In summing up discussions, Ms. Catley-Carlson highlighted the importance of global organizations.

The IAEA and other agencies need to keep serving as a "catalyst", she said, to help countries seek and seize opportunities, strengthen their technical capacities and resources, and form more productive partnerships. Many elements need to fit together, she said, for sustainable development to work in practice. Achievements at the local level are "crucial," she said, because that's where the problems — and solutions — affect people most directly.

To read more, go to http://www.iaea.org/worldatom/About/Policy/GC/GC45/SciProg/sf-report04.html

Scientific Forum on the Web

The IAEA's 2001 Scientific Forum — held during the Agency's General Conference in September — focused on the theme of "Serving Human Needs: Nuclear Technologies for Sustainable Development. Full Web coverage is on a special series of pages on the *WorldAtom* site. The pages include feature stories, video clips, and links to papers, reports, and interviews.

To read more, go to http://www.iaea.org/worldatom/About/Policy/GC/GC45/SciProg/index.html.

RadWaste Solutions: Sharing Experience

Experts from 52 countries met at an IAEA Conference in Malta, 5–9 November, to share experiences in the safe management of radioactive wastes produced from applications outside the nuclear power industry.

The International Conference on Management of Radioactive Waste from Non-Power Applications reviewed progress and problems from technological and safety perspectives related to a range of applications. Nuclear technologies are widely used — for example, in radiotherapy for those suffering from cancer, in isotope hydrology as a tool to manage increasingly scarce water resources, and in plant breeding to improve food production. If these benefits are to be achieved and sustained, radioactive waste must be managed carefully to minimize any risk to people or the environment.

Conference presentations from Austria, Switzerland, Turkey, Netherlands, Cuba, Canada, Kazakhstan, and other countries illustrated both solutions, and lingering problems. In some cases, producers of limited waste amounts, like hospitals, research institutes, and small industries, may not be able to afford the costs for the best types of disposal. The question of building facilities for permanent disposal is common to both small and larger countries, with costs often a key factor. Most are relying on interim storage solutions. Another factor is public opinion, even in the case of low-level radioactive wastes, toward a permanent waste disposal site.

One key IAEA role is to promote the use of sustainable waste management technologies. Mr. A. Bonne, Director of the IAEA's Nuclear Fuel and Waste Technology Division, cited a wide variety of activities, including: consensus-building through the process of developing expert technical documents; capacity-building through training; peer review of facilities and infrastructure; direct assistance by technical experts; and information exchange through conferences and meetings.

The topic remains high on the IAEA's agenda. In December 2002, experts will meet at an international Conference on Issues and Trends in Radioactive Waste Management in Vienna. — *To read more, go to http://www.iaea.org/worldatom/Press/News/08112001_news01.shtml*

Saving a Mother's Life

Radiotherapy can offer new hope for women suffering from cancer in developing countries. Such is the case for Ms. Genet Ashenafi, a 34-year-old mother in Ethiopia. In Ethiopia and most of sub-Saharan Africa, cancer of the cervix — the mouth at the entrance of the womb — is among the most prevalent forms of cancer in women. It is usually fatal because of late detection and the dearth of treatment facilities. Cervical cancer mostly affects women in Ethiopia over 30 years old and peaks among 40-to-45 year olds according to local statistics.

Estimates put the number of women in developing countries who die from the disease each year at 200,000. The rate at which it strikes is more than four times the average incidence in affluent developed countries where routine monitoring, providing early detection, usually leads to simple and effective treatment.

Fortunately, Ms. Ashenafi received treatment at a new radiotherapy center that opened in 1997, a joint project between Ethiopia and the IAEA. In four years the center at the Black Lion Hospital has treated 1300 patients and the number of patients keeps growing. Today, Ms. Ashenafi's chances of being cured are good, says Dr. Bogale Solomon, the center's director.

Ethiopia has only one radiotherapy machine, and one radiation oncologist, to serve a population of more than 60 million people. The European standard, by contrast, is one machine for every 250,000 people. Recognition of the discrepancy, and the rising threat of cancer in developing countries, is growing, says Vic Levin, head of the IAEA Section of Applied Radiation Biology and Radiotherapy. The perception that there is less chance of getting cancer in developing countries is proving increasingly false, Levin says. Cases have risen from two million in 1985 to five million in 2000 and are projected to reach 10 million in 2015. Experts say that the rise is mostly related to increased life expectancy. The bottom line, he says, is that more radiotherapy centers and trained physicians are needed in developing countries.

At the Black Lion center, the waiting list for treatment is lengthening. It now remains open late into the night and treats more than 50 patients every day. There are plans to install radiotherapy units in regional hospitals, including the new Mek'ele hospital in the north of Ethiopia, to relieve pressure on Black Lion's center and bring the chance of cure to more patients.

To read more, go to http://www.iaea.org/worldatom/About/Policy/GC/GC45/SciProg/sfradiotherapy.html

Nourishing Healthier Lives in Latin America

Poor men, women, and children in Latin America are getting the chance to lead healthier lives with the help of nuclear science and technology.

Through an IAEA regional technical cooperation project, the countries' scientists are using isotopes — forms of chemical elements such as iron and zinc — and nuclear analytical techniques to evaluate how well foods fortified with nutrients and minerals sustain the body's health and growth. The information is critical to the success of school and community nutrition programmes in which billions of dollars are invested in Latin America.

"We're taking the science and applying the tools to solve some real problems of nutrition and health, especially in children," says Dr. Ricardo Uauy, Director of the Institute of Nutrition and Food Technology (INTA) in Chile and Principal Coordinating Counterpart of the IAEA project in Latin America.

"About 80 million poor people in the region are covered to some degree by national nutrition programmes costing billions of dollars," he notes. "But without careful monitoring of the body's intake and use of vitamins and minerals, the programmes cannot be as effective."

Nuclear and isotopic techniques have yielded key data for reviews of national policies and — for the first time — to set baseline nutritional guidelines tailored to local conditions and needs.

In Chile, dramatic gains have been made since the IAEA project began in 1999, notably in combating anaemia in malnourished children. Evaluations based on isotope studies contributed to the government's decision to modify its policies for pre-school programmes supplying food and milk fortified with iron and zinc. Within a year, anaemia was reduced from 30% to less than 5% among a sample of 300 children in Chile's nutrition programme. Chile spends about $300 million a year for large programmes that supplement the nutritional needs of 1.3 million people. Programmes especially target pregnant women, infants, and pre-school children.

In Mexico, researchers are establishing baseline nutritional guidelines for four million people, focusing on expectant and nursing mothers, as part of its $2 billion national nutrition campaign. The country's Social Security System has equipped a laboratory with two mass spectrometers dedicated for nutritional measurement and analysis. Mexico's laboratory is the third in Latin America — alongside labs in Chile and Brazil — that today is dedicated to nutritional analysis using isotope techniques.

Results of project studies on energy expenditure of young children in Cuba and Chile are being used by the Expert Committee of the Food and Agriculture Organization, World Health Organization, and United Nations University to set new recommended standards for the region. Before the IAEA project, no data existed from Latin American countries to provide a scientific basis for formulating nutrition programmes suited to local conditions.

"Just following the book has proved to be the wrong approach for developing countries fighting malnutrition," says Chile's Dr. Uauy. "Now we're beginning to see the benefits of applying the best scientific tools to reach regional solutions."

"We're beginning to see the benefits of applying the best scientific tools to reach regional solutions."
Dr. Ricardo Uauy, Chile

To read more, go to http://www.iaea.org/worldatom/Press/ News/ 08312001_news01.shtml. Also see the Web pages of IAEA Technical Cooperation at http://www-tc.iaea.org/tcweb/default.asp for a report on the Agency's contribution to the global programme of action on nutrition.

A Better Start

Newborn babies in Thailand and other countries are getting a healthier start in life through an IAEA-supported project. With the help of nuclear-based analytical techniques, they are being screened for signs of thyroid problems that, if left undetected, would threaten their healthy growth. More than 1.4 million babies have been screened under a nationwide programme of the Thai National Institute of Health. About one of every 900 newborns in Thailand is diagnosed with iodine deficiency, while one in 1800 are born with congenital thyroid disease.

To read more, go to http://www.iaea.org/worldatom/About/Policy/GC/GC45/SciProg/sf-report03.html

The Silent Menace

Supporting the Search for Landmines

People living in more than 70 countries, mostly in the developing world, daily face the "silent menace" posed by an estimated 60 million buried and abandoned landmines. Nuclear techniques may help the search to find them before the explosives claim more lives. IAEA-supported projects in Croatia and other countries are helping to point the way forward.

Landmines left behind from armed conflicts kill about 26,000 people every year and maim even more. Most victims are women, children and farmers in developing countries. To put an end to tragic losses, global efforts have intensified to ban landmines and to boost assistance to countries to clear their land of buried explosives. Such "humanitarian demining" is difficult and dangerous, requiring the complete removal of all mines and the return of the cleared minefields to normal use.

Most demining today is done using portable metal detectors and trained dogs. Yet a major problem remains discriminating between a "dummy" object and a landmine. New technologies may improve the chances of detecting explosive objects buried in the ground. Methods include analysis by neutron irradiation for elemental characterization of hidden objects. Indications are that demining operations could be done considerably faster and more efficiently using neutron-based techniques. Countries are assessing the potential through a research project that the IAEA is supporting on the application of nuclear techniques to landmine identification. Twelve research groups from around the world are involved.

In Europe, a selected neutron-based system is being tested under field conditions through IAEA-supported technical cooperation projects, one with a regional focus and another targeted nationally in Croatia, where a laboratory is being established to study nuclear-based demining methods. Nearly 7000 square kilometers of Croatia are thought to house buried landmines and unexploded ordnance. The twin projects aim to significantly improve national and regional capabilities to reduce the threats that abandoned explosives pose to human life.

To read more, go to
http://www.iaea.org/worldatom/Press/News/08132001_news01.shtml

Depleted Uranium

The IAEA is continuing to respond to international concerns about possible health effects of depleted uranium ammunition arising in post-conflict situations.

Recently completed was a training course for national specialists that provided updated information on the risks, health effects, and health standards associated with depleted uranium. The course will enable the specialists to perform independent monitoring and assessments in their home countries.

The training course took place at the IAEA's research Laboratories in Seibersdorf and Vienna, as well as at the Karlsruhe Research Center in Germany. It was intended for countries affected by the release of depleted uranium in the environment and for those which may have deployed humanitarian or peacekeeping forces in areas affected by depleted uranium. Financial support was provided by Germany, Switzerland, and Italy.

Participants were welcomed on behalf of the IAEA by Deputy Directors General Werner Burkart and Qian Jihui, who head the Departments of Nuclear Sciences and Applications, and Technical Cooperation, respectively.

The Agency's *World Atom* site has a special series of pages on the issue of depleted uranium.

To read more, go to
http://www.iaea.org/worldatom/Press/Focus/DU/du_main.shtml

Finding Safe Waters Below

IAEA technical cooperation projects are supporting the search for safe groundwater in Bangladesh and Ethiopia.

Solving the disaster of arsenic contamination in Bangladesh requires the urgent analysis of its groundwater reserves, says Mr. Babar Kabir, head of the country's Arsenic Victims Rehabilitation Trust. At least 20 million people are drinking arsenic poisoned water from millions of so-called tube wells found throughout most of rural Bangladesh.

In some villages the wells provide safe water. "The geological complexities require that every well is screened," he says, since there also is concern that elements besides arsenic may have an impact on health.

The number of contaminated wells remains uncertain. But an estimate puts the number of hand pumps in use in Bangladesh at about 10 million. Tube wells were introduced to eradicate the risk of disease from drinking surface water that, up until the early 1970s, was resulting in the death of nearly a quarter of a million children every year.

Arsenic-contaminated water puts a potential 70 million people from a population of 130 million in Bangladesh at risk, Mr Kabir says, yet only about 10 per cent of the people drinking arsenic contaminated water display visible symptoms.

Credit: FAO/J. Isaac

He said that despite the threat from arsenic, "women who are basically managers of water in rural areas" see little choice but to keep using contaminated wells when alternative sources are a long distance away. With IAEA support, Bangladesh is applying the tools of isotope hydrology to mitigate the effects of arsenic contamination and to identify deep sources of groundwater that is safe.

Rivers for the Future. In Ethiopia, where conditions teeter between flooding and drought, scientists are using isotope hydrology to understand the country's complicated groundwater regime, says Mr. Ahma Mulegeta, head of the Ethiopian Science and Technology Commission. Ethiopia has "vast water resources, 12 major river basins, but knowledge about water resources is very scanty," he says.

The potential for irrigation, in a country where more than 80% of the population is dependent upon agriculture, has not been developed, he notes. Establishing a master plan for better use of its water resources is among Ethiopia's top priorities.

"Given the problems the country faces, no efforts can be spared," Mr. Ahma says. The IAEA is supporting a programme that uses an integrated and comprehensive development approach to study and potentially tap vast river basins.

To read more, go to
http://www.iaea.org/worldatom/About/Policy/GC/GC45/SciProg/sfsafewater.html

Tomorrow's Nuclear Plants

Work on evolutionary and innovative approaches to the design of tomorrow's nuclear power plants — including those coupled to desalination systems for producing potable water from the seas — is moving ahead. At the international level, the IAEA, along with the Nuclear Energy Agency (NEA) and International Energy Agency of the Organization for Economic Cooperation and Development, is jointly reviewing innovative reactor designs and identifying options for collaboration. Additionally, the US Department of Energy is promoting the Generation IV International Forum (GIF), in which both the IAEA and NEA are participating as observers. The President of the Russian Federation also has called upon IAEA Member States to join efforts in creating an innovative nuclear power technology to further reduce nuclear proliferation risks and resolve the problem of radioactive waste.

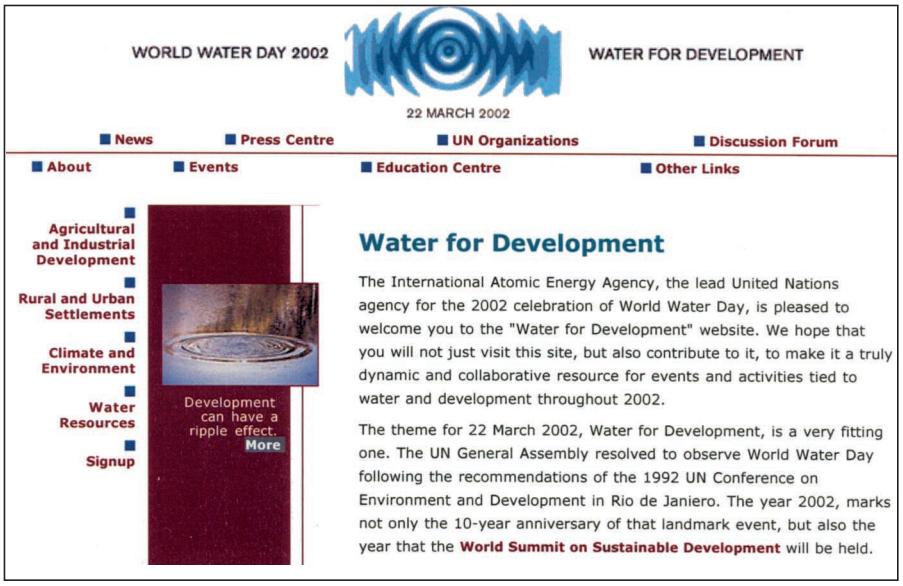
The IAEA's International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) — launched in 2001 — seeks to bring together interested countries. A main aim is to consider the actions for achieving innovations in nuclear reactors and fuel cycles that use sound and economically competitive technology, and are based – to the extent possible – on systems that have high levels of safety, minimize the risk of proliferation, and curb environmental impacts. INPRO's focus is on the long term, with cooperation foreseen over several decades. As of September 2001, INPRO members include Argentina, Canada, China, Germany, India, Russian Federation, Spain, Switzerland, The Netherlands, Turkey and the European Commission.

To read more, go to INPRO's Web pages at http://www.iaea.org/ programmes/ne/nenp/nptds/newweb2001/inpro/entirelyinpro.htm

World Water Day 2002

Water for Development is the theme for World Water Day 2002, which the IAEA is coordinating for the United Nations system. The international community has observed the event on 22 March each year since it was launched ten years ago. As part of activities, the IAEA is hosting a Web site designed as an interactive resource for news and information about the issues related to water and development around the world. Organizations now are being invited to submit their events and activities to the Web site that are keyed to World Water Day. Special emphasis is being placed on exchanging news and views on activities that are making a difference in countries facing serious water problems.

To read more, go to http://www.waterday2002.iaea.org



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Upcoming Events

- International Symposium on Cardiovascular Nuclear Medicine, *27–31 May 2002, Beijing, China*
- International FAO/IAEA Symposium on the Use of Mutated Genes in Crop Improvement & Functional Genomics, *3–7 June 2002, Vienna, Austria*
- International Conference on Occupational Radiation Protection: Protecting Workers Against Exposure to Ionizing Radiation, *26–30 August 2002, Geneva, Switzerland*
- 19th IAEA Fusion Energy Conference, *14–19 October 2002, Lyon, France*
- Conference on Safe Decomissioning for Nuclear Activities, *14–18 October 2002, Berlin, Germany*
- Conference on Issues & Trends in Radioactive Waste Management, *9-13 December 2002, Vienna, Austria*

For other listings, go to http://www.iaea.org/worldatom/Meetings/

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