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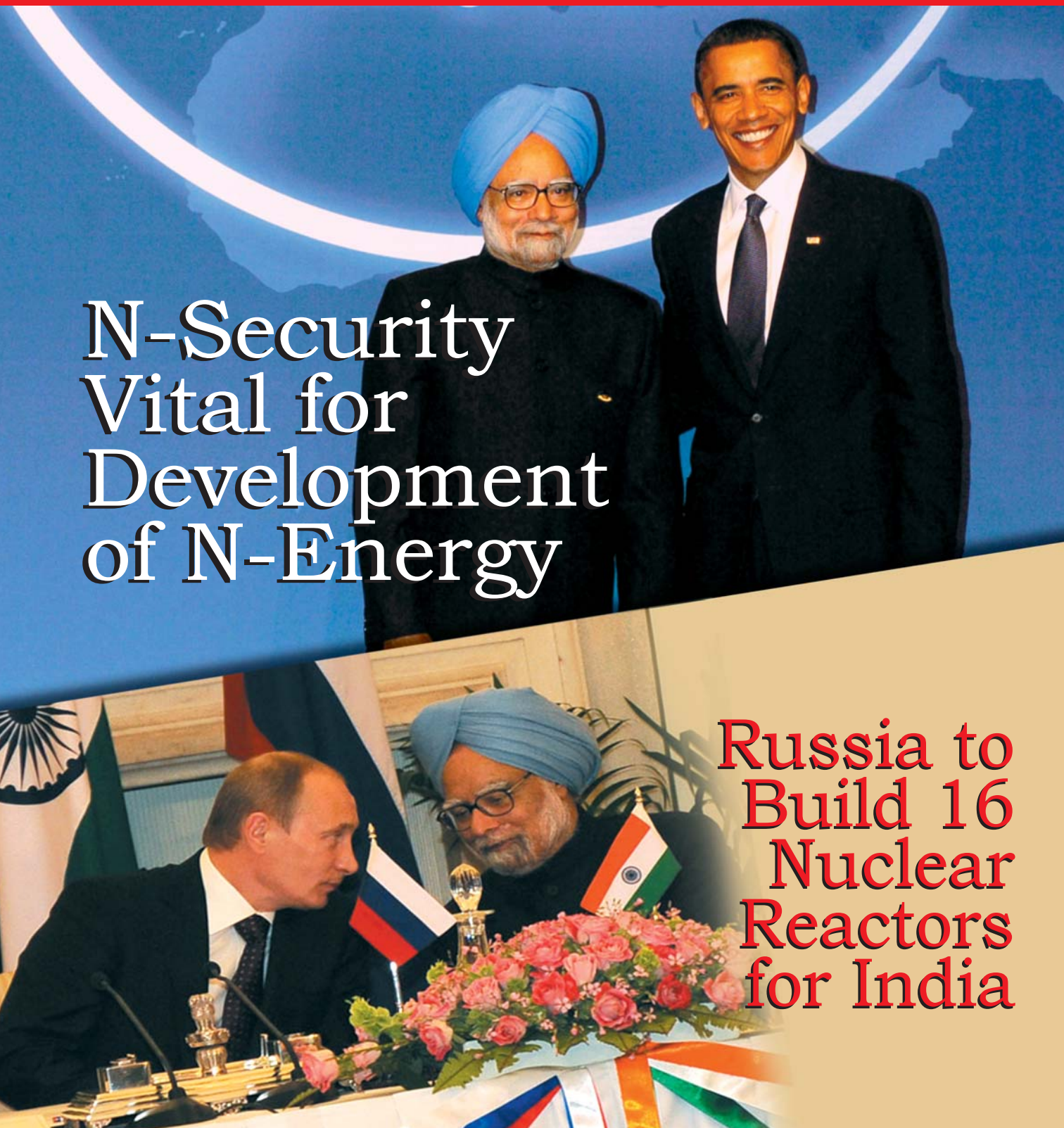
ASIAN NUCLEAR ENERGY

Powering Global Nuclear Commerce

Vol. 2 Issue 4 May - June 2010



N-Security Vital for Development of N-Energy

Russia to Build 16 Nuclear Reactors for India

In This Issue

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Printed & Published by
Satya Swaroop and printed at: Jayant Printery 352/54, Girgaum Road, Thakurdwar, Mumbai 400002 and published from New Media House, 1 Akbar Villa, Near Old State Bank, Marol-Maroshi Road, Andheri (East), Mumbai 400 059. India
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EDITORIAL

Dear Reader,

Greetings. The Nuclear Security Summit was held in Washington on 12 and 13 April, 2010. As the world moves towards greater nuclear energy participation, nuclear security has become an issue of the utmost importance. As Indian Prime Minister Manmohan Singh aptly pointed out at the Summit, "…without ensuring security, we will not be able to harness nuclear energy for our developmental purposes." In the end, the summit turned out to be a great success. All 49 countries and 3 international organizations called for strong nuclear security measures to prevent terrorists and other unauthorized actors from acquiring nuclear materials. Further, Russia announced the closing down of its last weapons-grade plutonium production reactor; Chile, Ukraine and Mexico decided to give up their entire stockpiles; and many other nations announced cutbacks, while strengthening security. These are landmark developments. Not surprisingly then, this forms our cover story. We have also highlighted Prime Minister Singh's announcement at the summit of the setting up of a Global Centre for Nuclear Energy Partnership in India in participation with the IAEA and other international bodies. Interestingly, for India, these have been a few months of vigorous nuclear commerce. Just prior to the eventful summit, Russian Prime Minister Vladimir Putin had arrived in India with his deputy Sergei Ivanov for some serious nuclear business. Deals worth $10 billion were signed, mostly in nuclear commerce, and Russia is to build 16 nuclear reactors across India in the years to come. We have the full story. The International Atomic Energy Agency finally got a new Director General in Yukiya Amano, who steps into the big and illustrious shoes of Dr. El Baradei. Mr. Amano made his first speech to the international community at the Nuclear Security Summit. He asserted in no uncertain terms that nuclear power must be accessible to developing countries, so they can meet their growing energy demands. We carry a report. We also report on the decision made to site the Allegro advanced nuclear reactor in central Europe. France, Japan, Switzerland and the rest of the EU are all partners on the ambitious Allegro project. 'A Day with the Atom' is a feature about how every action in our lives today has a provenance in nuclear science. We are sure you will find the feature as delightful to read as it is illuminating. Another feature lists all the frequently asked questions related to radiation, especially in the light of the mishap in Delhi recently (which we cover separately). We also carry a report of the US Energy Information Administration which projects a 50% rise in global energy consumption in the next 25 years. Besides these, we also have interesting stories on electric cars, Japan restarting a controversial nuclear reactor after 14 years and planned nuclear parks in Andhra Pradesh worth many billion dollars.

Wish you happy reading

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N-Security Vital to Tap N-Energy for Development

-Prime Minister Singh

The Prime Minister, Dr. Manmohan Singh with the US President, Barack Obama, at the official welcome for the Nuclear Security Summit, in Washington.

India's Prime Minister Manmohan Singh has asserted that nuclear security is essential for harnessing nuclear energy for developmental purposes.

Addressing a press conference at the end of the two-day Nuclear Security Summit held in Washington on 12 and 13 April, 2010, Prime Minister Singh said that India welcomed the initiative taken by President Barrack Obama in organizing the event to focus the attention of the international community on the issue of nuclear security.

"This is an important issue for us because without ensuring security we will not be able to harness nuclear energy for our developmental purposes," the Prime Minister said.

In a landmark development, as many as 49 countries and three international organizations, which participated in the historic conference, called for strong nuclear security measures to prevent terrorists, criminals, or other unauthorized actors from acquiring nuclear materials.

In a communiqué issued in Washington, the signatories identified nuclear terrorism as "one of the most challenging threats to international security."

"In addition to our shared goals of nuclear disarmament, nuclear nonproliferation and peaceful uses of nuclear energy, we also all share the objective of nuclear security. Therefore those gathered here commit to strengthen nuclear security and reduce the threat of nuclear terrorism. Success will require responsible national actions and sustained and effective international cooperation," the Communique said.

The Summit welcomed the initiative of US President Barrack Obama to secure all vulnerable nuclear material within four years in order to enhance nuclear security.

The goals of the Summit were to come to a common understanding on the threat posed by nuclear terrorism, to agree on effective measures to secure

nuclear material, and to prevent nuclear smuggling and terrorism. The Summit focused on the security of nuclear materials, leaving other broad topics such as nonproliferation, disarmament, and peaceful nuclear energy to different forums.

Prime Minister Singh said that India participated actively in the preparatory process and was satisfied with the Communique and Work Plan that had been adopted by the Summit.

"I have announced that India will establish a Global Centre for Nuclear Energy Partnership. This will be owned and managed by the Government, but will be open to international participation in terms of academic exchanges and R&D efforts. This initiative is the next logical step in India's engagement with the world after the opening of international civil nuclear cooperation with India," he said.

The Prime Minister said India's statement at the Summit outlined the country's approach to the issues of nuclear security, nuclear terrorism, clandestine proliferation and global disarmament.

"After listening to the world leaders at the Summit, I feel a sense of vindication of India's position. The intersection of international terrorism and clandestine proliferation affects our security directly. The concerns that we have been expressing for decades on the dangers of proliferation and risk of nuclear materials finding their way into the wrong hands are today finding widespread acceptance," he said.

The Prime Minister recalled the time in the 1950s when India pressed for the total elimination of nuclear weapons. Its voice was not heeded. "Today the world is veering around to the vision we had put forward of a world free from nuclear weapons. The world is beginning to see merit in pursuing universal, non-discriminatory and complete nuclear disarmament. We will continue to persevere in our efforts in this direction," he added.

Prime Minister Singh had bilateral meetings with various key leaders during the Summit. He said that he had fruitful discussions with President Obama on a host of issues relating to Indo-US bilateral relations, the regional situation, and the world economy, adding, "We look forward to hosting President Obama in India later this year."

The Prime Minister said that his discussions with other

The Prime Minister, Dr. Manmohan Singh with the Heads of the Delegations at the Nuclear Security Summit, in Washington.

global leaders focused largely on the future role of the G20 in the post-crisis phase of the global economic recovery. "I will be visiting Canada for the next G20 Summit in June. I conveyed to President Sarkozy of France that we are looking forward to his visit later this year to India," he added.

President Obama, the Summit's host, summing up the outcome of the event said it was enormously productive. "I can report that we have seized this opportunity, and because of the steps we've taken as individual nations and as an international community the American people will be safer and the world will be more secure," he said.

Thanking the 49 leaders who participated in this historic Summit, President Obama said at the end of the event, "Today's progress was possible because these leaders came not simply to talk, but to take action; not simply to make vague pledges of future action, but to commit to meaningful steps that they are prepared to implement right now."

Obama said he was glad that all the nations represented at the Summit had endorsed the goal that he outlined in Prague one year ago to secure all vulnerable nuclear materials around the world in four years' time.

"This is an ambitious goal, and we are under no illusions that it will be easy. But the urgency of the threat, and the catastrophic consequences of even a single act of nuclear terrorism, demand an effort that is at once bold and pragmatic. And this is a goal that can be achieved," he said.

Obama listed concrete examples of the decisions announced by various countries during the summit. Canada agreed to give up a significant quantity of highly enriched uranium. Chile has given up its entire stockpile. Ukraine and Mexico announced that they will do the same. Other nations such as Argentina and Pakistan announced new steps to strengthen port security and prevent nuclear smuggling.

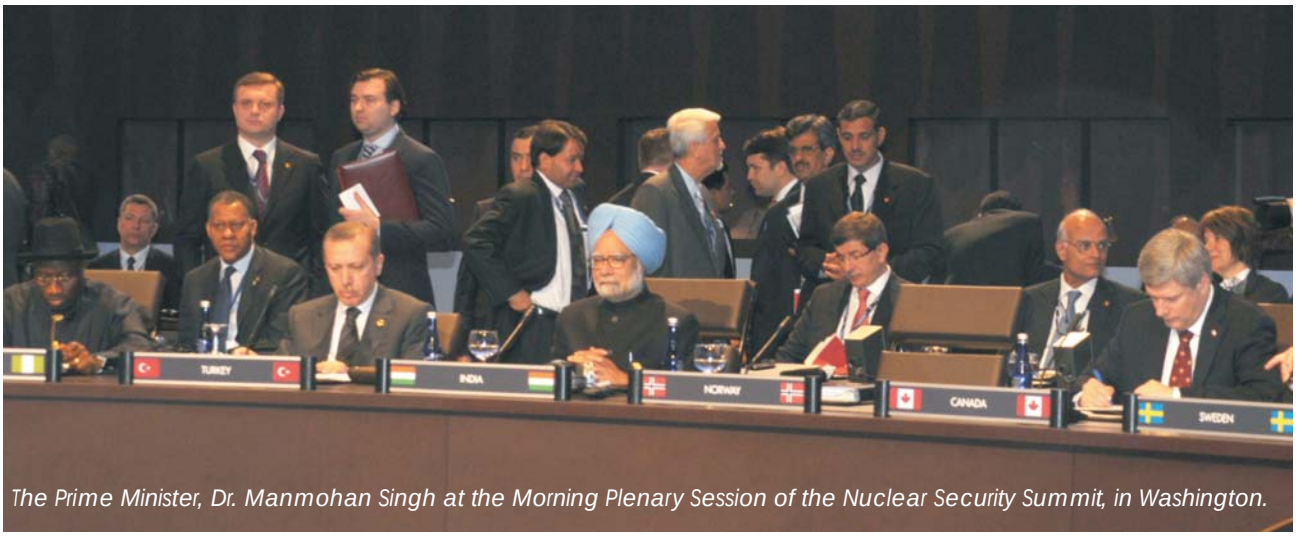
More nations including Argentina, the Philippines, Thailand and Vietnam agreed to join, and thus strengthen, the treaties and international partnerships that are at the core of the global efforts. A number of countries, including Italy, Japan, India and China, will create new centers to promote nuclear security technologies and training. Nations pledged new resources to help the International Atomic Energy Agency meet its responsibilities.

"In a major and welcome development, Russia announced that it will close its last weapons-grade plutonium production reactor. After many years of effort, I'm pleased that the United States and Russia agreed today to eliminate 68 tons of plutonium for our weapons programs - plutonium that would have been enough for about 17,000 nuclear weapons. Instead, we will use this material to help generate electricity for our people," Obama said.

He said that in order to reduce nuclear arsenals, "President Medvedev and I signed the historic new START treaty not only committing our two nations to significant reductions in deployed nuclear weapons, but also setting the stage for further cuts and cooperation between our countries."

Obama said the US was joining with its Canadian partners in calling on nations to commit $10 billion to extending their highly successful Global Partnership to strengthen nuclear security around the world.

Obama said the US would be joining with nations from



The Prime Minister, Dr. Manmohan Singh at the Morning Plenary Session of the Nuclear Security Summit, in Washington.

around the world to strengthen Nuclear Non-Proliferation Treaty (NPT) as the cornerstone of global efforts to prevent the spread of nuclear weapons, pursuing at the same time greater civil nuclear cooperation.

"Because for nations that uphold their responsibilities, peaceful nuclear energy can unlock new advances in medicine, in agriculture, and economic development," he said.

Following is the full text of the Communique, in which the signatories, committed to:

• Reaffirm the fundamental responsibility of States, consistent with their respective international obligations, to maintain effective security of all nuclear materials, which includes nuclear materials used in nuclear weapons, and nuclear facilities under their control; to prevent non-state actors from obtaining the information or technology required to use such material for malicious purposes; and emphasize the importance of robust national legislative and regulatory frameworks for nuclear security;

• Call on States to work cooperatively as an international community to advance nuclear security, requesting and providing assistance as necessary;

• Recognize that highly enriched uranium and separated plutonium require special precautions and agree to promote measures to secure, account for, and consolidate these materials, as appropriate; and encourage the conversion of reactors from highly enriched to low enriched uranium fuel and minimization of use of highly enriched uranium, where technically and economically feasible;

• Endeavor to fully implement all existing nuclear security commitments and work toward acceding to those not yet joined, consistent with national laws, policies and procedures;

• Support the objectives of international nuclear security instruments, including the Convention on the Physical Protection of Nuclear Material, as amended, and the International Convention for the Suppression of Acts of Nuclear Terrorism, as essential elements of the global nuclear security architecture;

• Reaffirm the essential role of the International Atomic Energy Agency in the international nuclear security framework and will work to ensure that it continues to have the appropriate structure, resources and expertise needed to carry out its mandated nuclear security activities in accordance with its Statute, relevant General Conference resolutions and its Nuclear Security Plans;

• Recognize the role and contributions of the United Nations as well as the contributions of the Global Initiative to Combat Nuclear Terrorism and the G-8-led Global Partnership Against the Spread of Weapons and Materials of Mass Destruction within their respective mandates and memberships;

• Acknowledge the need for capacity building for nuclear security and cooperation at bilateral, regional and multilateral levels for the promotion of nuclear security culture through technology development, human resource development, education, and training; and stress the importance of optimizing international cooperation and coordination of assistance;

• Recognize the need for cooperation among States to effectively prevent and respond to incidents of illicit nuclear trafficking; and agree to share, subject to respective national laws and procedures, information and expertise through bilateral and multilateral mechanisms in relevant areas such as nuclear detection, forensics, law enforcement, and the development of new technologies;

• Recognize the continuing role of nuclear industry, including the private sector, in nuclear security and will work with industry to ensure the necessary priority of physical protection, material accountancy, and security culture;

• Support the implementation of strong nuclear security practices that will not infringe upon the rights of States to develop and utilize nuclear energy for peaceful purposes and technology and will facilitate international cooperation in the field of nuclear security; and

• Recognize that measures contributing to nuclear material security have value in relation to the security of radioactive substances and encourage efforts to secure those materials as well;

• Maintaining effective nuclear security will require continuous national efforts facilitated by international cooperation and undertaken on a voluntary basis by States. We will promote the strengthening of global nuclear security through dialogue and cooperation with all states.

• Thus, we issue the Work Plan as guidance for national and international action including through cooperation within the context of relevant international fora and organizations. We will hold the next Nuclear Security Summit in the Republic of Korea in 2012. ■

India to Set Up Global Centre for Nuclear Energy Partnership

Prime Minister Manmohan Singh has announced the setting up of a 'Global Centre for Nuclear Energy Partnership' in India. Addressing the Nuclear Security Summit in Washington recently, Prime Minister Singh touched upon various issues of global concern and India's future role in promoting nuclear security and the programme of harnessing civilian nuclear energy for developmental purposes. Following are excerpts.

The developmental applications of nuclear science in areas such as medicine, agriculture, food preservation and availability of fresh water are by now well established. Today, nuclear energy has emerged as a viable source of energy to meet the growing needs of the world in a manner that is environmentally sustainable. There is a real prospect for nuclear technology to address the developmental challenges of our times.

In India we have ambitious plans for using nuclear energy to meet our growing energy needs. Our target is to increase our installed capacity more than seven fold to 35,000 MWe by the year 2022, and to 60,000 MWe by 2032.

The nuclear industry's safety record over the last few years has been encouraging. It has helped to restore public faith in nuclear power. Safety alone, however, is not enough. The challenge we face today is that of ensuring nuclear security.

The danger of nuclear explosives or fissile material and technical know-how falling in the hands of non-state actors continues to haunt our world. India is deeply concerned about the danger it faces, as do other States, from this threat.

Since 2002, we have piloted a resolution at the United Nations General Assembly on measures to deny terrorists access to Weapons of Mass Destruction. We fully support the implementation of United Nations Security Council Resolution 1540 and the United Nations Global Counter Terrorism Strategy.

The primary responsibility for ensuring nuclear security rests at the national level, but national responsibility must be accompanied by responsible behaviour by states. If not, it remains an empty slogan. All States should scrupulously abide by their international obligations. It is a matter of deep regret that the global non-proliferation regime has failed to prevent nuclear proliferation. Clandestine proliferation networks have flourished and led to insecurity for all, including and especially for India. We must learn from past mistakes and institute effective measures to prevent their recurrence.

The world community should join hands to eliminate the risk of sensitive and valuable materials and technologies falling into hands of terrorists and illicit traffickers. There should be zero tolerance for individuals and groups which engage in illegal trafficking in nuclear items.

Global non-proliferation, to be successful, should be universal,

comprehensive and non-discriminatory and linked to the goal of complete nuclear disarmament. We welcome the fact that the world is veering around to our view that the best guarantor of nuclear security is a world free from nuclear weapons.

Starting with Jawaharlal Nehru over five decades ago, India has been in the forefront of the call for global and complete nuclear disarmament. In 2006 India proposed the negotiation of a Nuclear Weapons Convention. We have also expressed our readiness to participate in the negotiation of an internationally verifiable Fissile Material Cut-off Treaty in the Conference on Disarmament.

Former Prime Minister Rajiv Gandhi had put forward a concrete Action Plan in 1988 for the universal and non-discriminatory elimination of nuclear weapons leading to global nuclear disarmament in a time-bound framework. Today, I once again reiterate India's call to the world community to work towards the realisation of this vision.

We welcome the agreement between the United States and Russia to cut their nuclear arsenals as a step in the right direction. I call upon all states with substantial nuclear arsenals to further accelerate this process by making deeper cuts that will lead to meaningful disarmament.

We are encouraged by the Nuclear Posture Review announced by President Obama. India supports the universalisation of the policy of No First Use. The salience of nuclear weapons in national defence and security doctrines must be reduced as a matter of priority.

The dangers of nuclear terrorism make the early elimination of nuclear weapons a matter of even greater urgency. The Indian Atomic Energy Act provides the legal framework for securing nuclear materials and facilities, and the Atomic Energy Regulatory Board ensures independent oversight of nuclear safety and security. We are party to the Convention on the Physical Protection of Nuclear Material and its 2005 amendment.

India's three stage nuclear power programme which began sixty years ago is based on a closed nuclear fuel cycle. A direct benefit of this is that it ensures control over nuclear material that is generated as spent fuel. At the same time, we are continually upgrading technology to develop nuclear systems that are intrinsically safe, secure and proliferation resistant. We have recently developed an Advanced Heavy Water Reactor based on Low Enriched Uranium and thorium with new safety and proliferation-resistant features.

India has maintained an impeccable non-proliferation record, of which we are proud of. As a responsible nuclear power, India has and will not be the source of proliferation of sensitive technologies. We have a well-established and effective export control system which has worked without fail for over six decades. We have strengthened this system by harmonisation of our guidelines and lists with those of the Nuclear Suppliers Group and the Missile Technology Control Regime. Our commitment to not transfer nuclear weapons or related materials and technologies to non-nuclear weapon states or non-state actors is enshrined in domestic law through the enactment of the Weapons of Mass Destruction Act. We stand committed not to transfer reprocessing and enrichment technologies and equipment to countries that do not possess them.

As a founder member of the International Atomic Energy Agency, we have consistently supported the central role of the IAEA in facilitating national efforts to strengthen nuclear security and in fostering effective international cooperation. We have so far conducted nine Regional Training Courses on Nuclear Security in cooperation with the IAEA. We have entered into a Safeguards Agreement with the IAEA in 2008, and have decided to place all future civilian thermal power reactors and civilian breeder reactors under IAEA safeguards.

We will continue to work with the IAEA and our partners in the United Nations as well as other forums such as the Global Initiative to Combat Nuclear Terrorism to upgrade standards, share experiences and ensure effective implementation of international benchmarks on nuclear security.

I am happy to announce on this occasion that we have decided to set up a 'Global Centre for Nuclear Energy Partnership' in India. We visualize this to be a state of the art facility based on international participation from the IAEA and other interested foreign partners. The Centre will consist of four Schools dealing with Advanced Nuclear Energy System Studies, Nuclear Security, Radiation Safety, and the application of Radioisotopes and Radiation Technology in the areas of healthcare, agriculture and food. The Centre will conduct research and development of design systems that are intrinsically safe, secure, proliferation resistant and sustainable. We would welcome participation in this venture by your countries, the IAEA and the world to make this Centre's work a success. ■

Two-Way Trade to Touch $20 bn by 2015

Russia to Build 16 N-Reactors for India

India and Russia have been strategic partners for decades. The two countries have fortified their relations on both the political and economic fronts year after year during the exchange of visits by their top leaders. Their two-way trade is expected to double to around $20 billion by 2015 from the current $8 billion. The hot topic of their cooperation these days has been civilian nuclear energy in which India is facing a huge deficit. Russia, a global leader in this field, is all set to build as many as 16 nuclear reactors across India in the years to come. Indications to this effect have been given by both Russian Prime Minister Vladimir Putin and his deputy Sergei Ivanov during their recent visit to India.

Russia will build up to 16 nuclear reactors for power stations in India, Russia's deputy premier said recently during a visit to India with Prime Minister Vladimir Putin to reaffirm decades-old ties.

Russia is competing with French and American firms for lucrative contracts to build nuclear power plants for energy-hungry India because Asia's third-largest economy needs to boost its supply to help sustain rapid economic growth.

"The agreement sees construction of up to sixteen nuclear reactors in three locations," Deputy Prime Minister Sergei Ivanov told reporters.

Putin pledged to boost banking and technology cooperation with India, seeking to bolster ties with a Cold War ally that has been shifting focus towards the United States.

Russia wants to boost trade with India to $20-billion by

2015 from the current $8-billion. Together with China and Brazil, Russia and India make up the so-called BRIC group of major emerging economies, whose global influence is rising.

The two nations also seek a greater role in stabilising the region because both share security interests emanating from Islamist militant violence and the war in Afghanistan.

"India is our strategic partner … which is an evidence that our geopolitical interests almost fully coincide," Putin told a conference with businessmen in the Indian capital New Delhi.

Setting the tone for his one-day visit mainly aimed at keeping one of the world's biggest arms importers interested in Russian weapons, Putin offered state financial aid for the Indian telecom unit of Russian conglomerate Sistema.

Sistema, controlled by billionaire Vladimir Yevtushenkov, is looking to deepen its investment in Sistema Shyam TeleServices, a joint venture with India's Shyam group.

"We are ready to contribute funds for your joint activity," Putin said in response to a question by a Shyam group official.

Yevtushenkov later said the Russian government would become a shareholder in Shyam.

Putin also vowed to remove hurdles in the banking sector that he said were hampering mutual trade, and signalled that the government was ready to encourage joint ventures and acquisitions in the sector.

India struck a landmark civilian nuclear deal with the United States in 2008, ending the isolation it had experienced since an atomic test in 1974 and giving it access to U.S. technology and fuel, while also opening up the global nuclear market to India.

As India begins to lean more on the United States, Moscow fears losing not only influence over New Delhi but the bulk of its $100-billion defence market as well.

Putin's visit is likely to produce deals worth more than $10-billion mainly in defence contracts, nuclear reactors and trade.

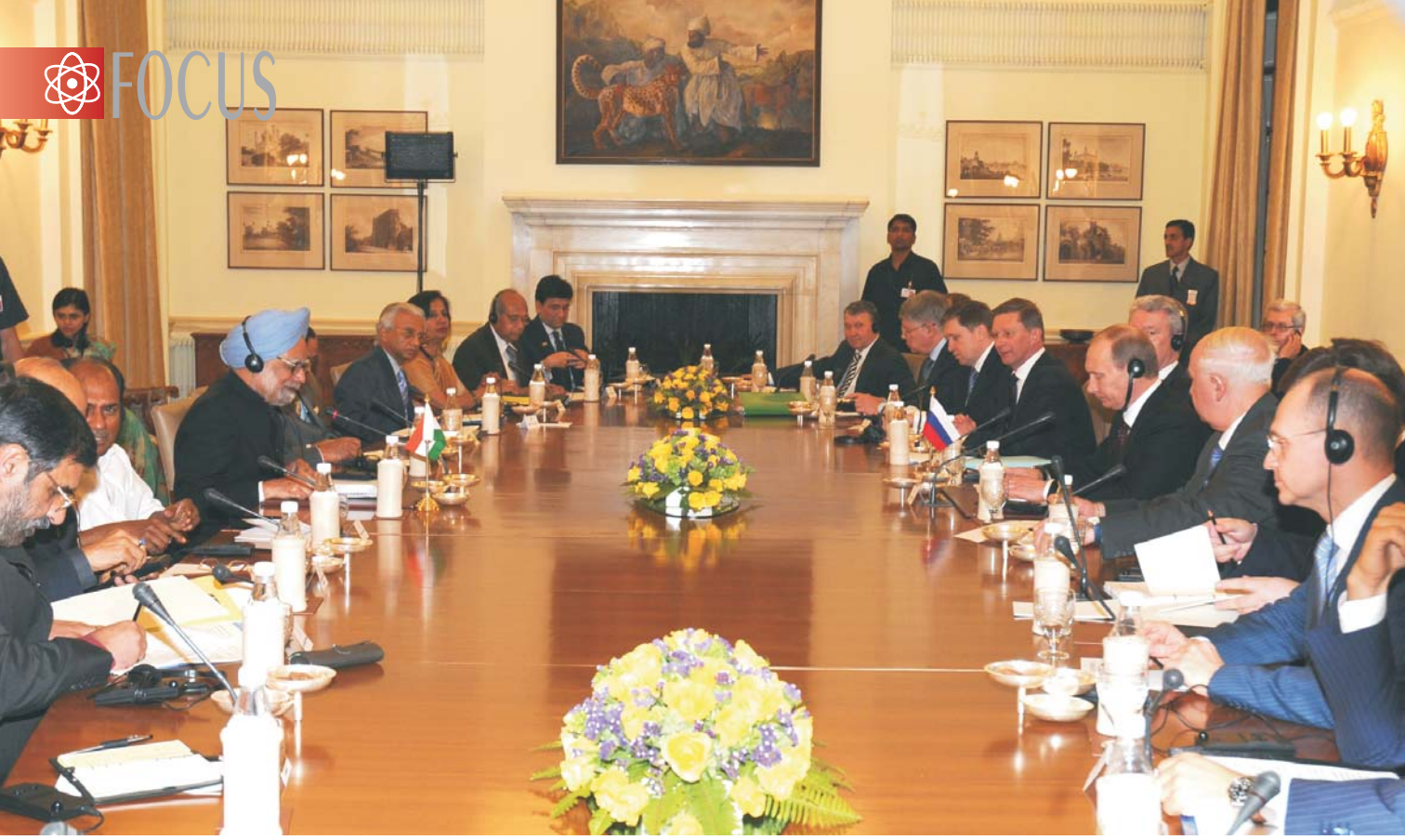
Ivanov also said Russia would deliver the refurbished Gorshkov aircraft carrier to India by the end of 2012, an issue which has troubled relations between the two powers.

Russia and India signed a contract worth $1.5-billion on Friday for Moscow to supply 29 MiG 29 K fighters, the CEO of Russian plane maker Sukhoi, Mikhail Pogosyan, said.

Pogosyan also said he expected a joint venture with the state-run Indian company Hindustan Aeronautics Limited to manufacture around 200 fifth-generation fighter jets.

Fifth-generation jets, such as the U.S. F-22 Raptor stealth fighters which first flew in 1997, are invisible to radar and boast "intelligent" on-board flight and arms control systems and supersonic cruising speeds.

The Deputy Minister of Industry & Trade of Russia, Denis Manturov and the Secretary, Department of Fertilizer, S. Krishnan signing the MoU between the two governments on Cooperation in the Mineral Fertilizers Sector in the presence of the Prime Minister of the Russian Federation, Vladimir V. Putin and the Prime Minister, Dr. Manmohan Singh, in New Delhi



The Prime Minister, Dr. Manmohan Singh with the Prime Minister of the Russian Federation, Vladimir V. Putin, at the delegation level talks, in New Delhi.

Putin sought to assure Indian businessmen that Russian nuclear reactors were safe. Russia has almost completed equipment delivery for two reactors at Kudankulam nuclear power station and is in talks to build two more reactors.

"Our reactors can sustain a crash of a medium-range passenger plane," Putin said, seeking to demonstrate that Russian plants could withstand even Sept.11, 2001-style attacks.

The two countries also agreed to strengthen cooperation in hydrocarbons through greater collaboration between oil and gas companies, but did not announce any firm energy deals.

After the talks between the two countries, Prime Minister Singh, in a statement to the media said that India attached great importance to Prime Minister Putin's visit. Following are excerpts:

"We have just concluded very comprehensive and indepth discussions on bilateral, regional and global issues. I conveyed to Prime Minister Putin that relations with Russia are a key pillar of our foreign policy, and we regard Russia as a trusted and reliable strategic partner.

Ours is a relationship that not only stands independent of any other, but whose significance has grown over time. Our partnership covers areas such as defence, civil nuclear energy, space, science and technology, hydrocarbons, trade and investment.

In the run-up to, and during Prime Minister Putin's visit, we have finalised several important and long pending defence cooperation projects which will deepen our longstanding partnership in this vital sector. We have signed the Inter-Governmental Agreement on Cooperation in Atomic Energy and agreed upon a Roadmap for construction of nuclear power plants.

A Memorandum of Understanding for bilateral cooperation in Russia's satellite navigation system has been agreed upon.

We have agreed to strengthen our cooperation in hydrocarbons through greater collaboration between our oil and gas companies. Agreements have been signed in the areas of fertilisers. We have identified information technology and telecommunications as focus areas for our future economic cooperation.

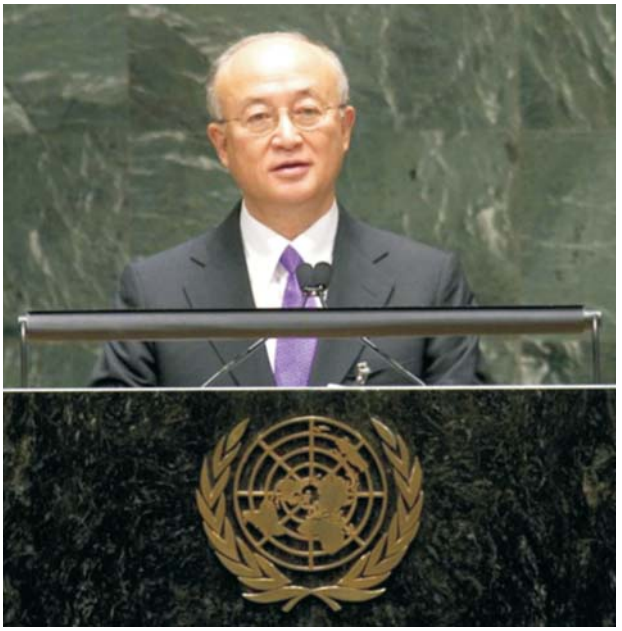
The outcomes of Prime Minister Putin's visit are therefore rich and very substantive.

We had a detailed discussion on regional and global issues. There is much that India and Russia can do together to advance global peace and stability and the process of global economic revival. We have agreed to intensify our consultations on Afghanistan and the challenges posed by terrorism and extremism in our region.

I am very happy to state that my discussions with Prime Minister Putin have reinforced the strong ties of friendship that bind our two countries together." ■

N-Power Must be Accessible to Developing Nations

- IAEA Chief Yukiya Amano



International Atomic Energy Agency (IAEA) Director General Yukiya Amano has said that nuclear power must be accessible not only for developed countries but also for developing countries.

"Nuclear power needs to be efficient, sustainable and profitable. Any expansion in its use must be done safely and securely, and without increasing the proliferation risk," Amano said while addressing a Nuclear Proliferation Treaty (NPT) Review Conference in New York recently.

He said it was for each sovereign State to decide whether or not to use nuclear power, but the IAEA assisted interested countries in establishing a reliable nuclear infrastructure.

Following are excerpts of Amano's address.

As you know, reliable supplies of energy are vital to ensure continued prosperity and sustained development. Nuclear power is enjoying growing acceptance as a stable and clean source of energy that can help to mitigate the impact of climate change. More than 60 countries are considering introducing nuclear power to generate electricity. It is expected that between 10 and 25 new countries will bring their first nuclear power plants online by 2030.

In March this year, with the approval of the IAEA Board of Governors, I signed an agreement with Russia to establish a low enriched uranium reserve to help assure supplies of nuclear fuel to Member States. Other possible assurance of supply mechanisms are under discussion.

Nuclear technologies provide unique tools to meet the basic needs of human beings. To take one example, nuclear medicine and radiotherapy are very effective in the diagnosis and treatment of cancer. The IAEA is now helping developing countries to fight cancer through our Programme of Action for Cancer Therapy (PACT).

The application of nuclear technology in plant breeding, food irradiation, animal health and pest control is making valuable contributions to enhancing global food security. Nuclear technology is also useful in water management and environmental monitoring.

In any use of nuclear technology, safety and security must always be ensured. While the primary responsibility lies with Member States, the Agency has an important role to play in these areas.

Great progress has also been made in making nuclear and radioactive materials more secure. This has helped States to counter the risk of nuclear terrorism, which remains a real and immediate threat to international security. The IAEA is widely recognized as the focal point for strengthening efforts in this area. The support expressed for our work by many heads of state and government at the recent Nuclear Security Summit in Washington was very encouraging.

The Final Document of the 2000 NPT Review Conference called for expanded use of the Agency´s Technical Co-operation Programme. The programme has grown since then, and the annual resources of the Technical Cooperation programme now amount to more than $100 million. We implement projects in more than 120 countries and territories. However, more efforts are needed to achieve sufficient, assured and predictable funding of technical cooperation.

In the 2000 Final Document, States party to the NPT recognized that IAEA safeguards are a fundamental pillar of the nuclear non-proliferation regime, play an indispensable role in the implementation of the Treaty and help to create an environment conducive to nuclear disarmament and nuclear cooperation. ■

A Day with the Atom...

By **Dr. Alan E. Waltar**
Former President, American Nuclear Society

So what would our world be like today if radiation had not been harnessed to serve our human needs? One way to gain a small appreciation for this modern servant is to go through a typical day with our antennas particularly sensitized for radiation awareness. Our alarm clock goes off and the day begins. We wearily look at the clock or our wristwatch, now aware that we can see the dial through the darkness because the dial is luminescent. We then flip the light switch, with full expectations of instant illumination. If we live in the United States, there is a 20% probability that the electricity delivered to power those lights comes from a nuclear power plant. In France, that probability would rise to nearly 80%. Even if the power came from coal, the most probable source worldwide, we know that at least some of the pollutants currently discharged directly into the atmosphere might eventually be removed by electron beam processing.

We now go to the bathroom and use the toilet. Whereas most sewage is currently treated by chemical means, gamma rays from radioisotopes can be used to process sewage without generating additional waste streams, since the products can be used for fertilizer.

The recognition that this technology is on the way resonates with our environmental awareness. We then shower and either insert our contact lenses or affix our eyeglasses. The saline solution in which our contact lenses were stored overnight has been irradiated to kill any microbes that may be irritants to our tender eyes. If, instead, we choose to put on our eyeglasses, we now recall that several radiation procedures were used to assure high quality of that glass.

As we put on our clothes, we ponder the fact that the cotton in our undergarments is now grown in a more productive fashion, due to improved cotton strains developed using radioactive tracer procedures. Clothes made from synthetics likely also benefited from radiation tracking processes somewhere in the development phase.

We then trudge into the kitchen and head straight for the refrigerator, thankful that plentiful supplies of electricity allow us to keep our many food products cold and free of excessive spoilage. We proceed to fry an egg on a pan equipped with a special coating--where the thickness of this coating was likely determined by radiation gauges. The ceramic or plastic plate upon which we slide our fried egg undoubtedly benefited from radioisotopes to assure uniformity of the materials of the plate itself. Our silverware likely benefited from radiation thickness gauges both during the making of the sheet metal from which the utensils were subsequently stamped and during the special coating process. For the first time, we become aware that our full package of breakfast cereal was precisely measured by radiation leveling or density gauges to assure us that the weight stated on the cardboard container was accurate.

Making one more trip to the refrigerator, we stare thankfully at the array of fruits and vegetables that we have for selection. Many of these varieties would not have been possible were it not for the greatly accelerated agricultural breeding process made possible by using radioisotopes for either mutation or tracing purposes. As we pour creamer into our coffee or tea, we marvel that this creamer can remain on our shelf for long periods without refrigeration because the container was irradiated prior to being filled to assure the absence of microbes.

As we reach for the morning paper, our mind now flashes back to the paper mills responsible for making such huge amounts of paper available to us so economically. This affordability is largely due to the radiation thickness gauges that allow the paper production process to be precisely and automatically controlled with amazingly high throughput. We then flip on the radio or TV, now cognizant that the wiring in these devices is very likely protected with radiation treated insulation.

After finishing breakfast, we struggle to the medicine cupboard where we take our vitamins and/or our

prescribed medication, now aware that such modern marvels would not be possible without the radioisotope tracers employed in so many parts of the development and testing process.

Before leaving for work, we prepare a sandwich for lunch, again reflecting on the conveniences afforded by shrink wrap or aluminum foil that radiation processes helped to produce. We hope that the slices of turkey, ham, or beef placed in our sandwich do not have salmonella, trichinosis, or E-coli. It should have been sufficiently cooked to remove these dreaded concerns, but we look forward to the day when all such foods have been irradiated--to be absolutely sure they are safe.

It's about time to leave for work, but the baby's cry indicates that a quick diaper change is first in order. Thankfully, the super-absorbent material used in the disposable diaper (a direct result of radiation grafting) makes the job easy, without having to change the bedding. As we get into our car to drive to the office, school, or factory, we are thankful that the engine starts quickly and smoothly. Much of the credit for this vast improvement over earlier models is due to advanced materials for the engine--made possible by using radioisotopes to determine engine wear, lubricant levels, etc. All the steel used in the car benefited directly from radiation techniques, both in the original foundry and in the final metal rolling process. The tires may have been vulcanized by radiation, rather than by the older sulfurization process. All the glass in the vehicle was perfected via radiation moisture monitors in the manufacturing process.

We roll down the window and marvel at the clean air, a rarity in many places. The use of radioisotopes is becoming more widely used everyday to pinpoint the sources of atmospheric pollution, a necessary step for successful abatement programs. With the advent of nuclear-generated electricity, less coal must be burned. In the height of dependency upon coal for heat and electrification of London, 3000 people died from air pollution in 1952 over a period of only four days.

We finally approach our place of work. If we are fortunate, the floor sparkles as it reveals a wood-grain surface hardened for beauty and easy maintenance via radiation-induced cross-linking in the polyethylene materials. We are refreshed that all exits in the building are clearly marked by illumined exit signs, powered by a radioactive source that is 100% reliable (even when the electricity goes off). As we approach the drinking fountain, we are thankful that the best water supplies locally available were likely found by using radioactive tracer techniques to assess the groundwater hydrology.

After work we drop by to visit a friend still recuperating at the local hospital. Our new awareness of nuclear medical advances calls our attention to the fact that one out of every three patients entering such a facility derives direct benefits from radioisotopes. Our friend is doing nicely because his ailment was detected quickly and precisely using radioactive diagnostic methodology. Given this new awareness, we decide to stop by the radiology department and get our annual chest x-ray. We are also reminded that dental care is now much better because of the routine diagnostic x-rays taken prior to performing actual corrective measures.

We then return home for dinner and impulsively turn up the heat or the air conditioner. Again, the electricity delivered for such service could be from a nuclear power plant. Our dinner is seasoned with spices that almost certainly have been irradiated to prevent insect infestation. If we are in a hurry and simply use the microwave oven for cooking, we become mindful that this device depends upon a form of radiation to perform its essential function.

After dinner we buzz over to the airport to pick up a friend. We are thankful that the lights that illuminate the runway are powered by tritium, a radioactive substance that continues to operate independent of any electrical failures or storm conditions. The welds in the wings of the airplanes are routinely inspected using neutrons from special radioactive sources, as are the welds affixing the jet engines to the wings. Likewise, all luggage boarding the aircraft is screened using radiation procedures to minimize the threat of concealed weapons or explosive devices. As a result of these advances, air travel is considerably safer today than any other mode of transportation. Finally, it is time to climb in bed and get a good night's sleep. Such contentment is aided by the knowledge that our trusty smoke detector, which operates with a built-in radioisotope, is 100% reliable throughout the day and night.

As we reflect back over the day, we are no less than astounded by the degree to which radiation processes have already been harnessed to enrich our life. Recognizing this enormous progress, made largely over the past half-century, we can only dream in wonderment over what the future of radiation technology may hold for us and for our children. ■

Braving the Waves

By **Misha Kidambi**
IAEA Division of Public Information

IAEA Works to Protect Nuclear Power Plants Against Tsunami and Flooding Hazards

With many countries having built nuclear power plants in coastal areas, it has become imperative to be prepared for emergencies that may arise as a result of external hazards such as tsunamis.

The rationale behind constructing nuclear power plants in coastal areas is to use the water for cooling these plants which are known to generate a tremendous amount of heat. The 2004 Indian Ocean tsunami, however, exposed the threat that these power plants may face if nature takes a wrong turn.

To respond to such threats, the IAEA´s International Seismic Safety Centre has been working on assessing the hazards generated by external events and on preparedness in cases of emergencies.

"Following the 2004 Indian Ocean tsunami, we worked toward laying out improved safety standards for the nuclear power plants," says Antonio Godoy, the Head of IAEA´s International Seismic Safety Centre. "Also, we are working with the US Nuclear Regulatory Commission (USNRC) and the US National Oceanic and Atmospheric Administration (NOAA) to develop a tsunami occurrence notification system," he adds.

In March this year, the IAEA successfully concluded a project on the protection of nuclear power plants against tsunamis and post earthquake considerations in the external zone (TiPEEZ), which was implemented using the extrabudgetary contributions from the Japan Nuclear Energy Safety Organisation (JNES) and the USNRC. The project, which started in 2007, has been an important step in preparing for nuclear emergency responses in case of tsunamis or earthquakes, says Godoy.

TiPEEZ System is an emergency response information management system that allows evaluation of the post-tsunami state of a nuclear power plant. It also helps evaluate offsite damages, (e.g., possible damages of bridges and roads in the vicinity of installations) and identify evacuation routes considering release behaviour of radioactive materials, location of shelters and arrangements of vehicles for evacuation. The system was developed by the JNES, while the IAEA played a key role coordinating its transfer to Member States.

Along with the TiPEEZ System, a tsunami simulation code (which is a computer algorithm) was also developed and distributed to the Member States. The code was used for computer simulations of tsunami conditions against which the TiPEEZ System was tested.

"India, Indonesia, Japan, Republic of Korea, Pakistan, Turkey and USA were some of the countries that participated in the project," says Godoy. "Through this exercise we not only gained valuable data on the seismic activities in different regions but also demonstrated the effectiveness of TiPEEZ System in emergency response," he adds. The TiPEEZ System has been developed in keeping with the safety standards that have been published by the IAEA. ■

Six Radioactive 'Hotspots' in Delhi, says Greenpeace

Greenpeace says it has detected dangerously high levels of radioactivity near a New Delhi salvage yard where radiation poisoning recently killed a worker and left seven more in hospital.

The environmental group said its experts picked up radiation 5,000 times above normal background levels at the privately owned salvage facility in the city's congested Mayapuri district and its surrounding areas.

"We picked up six hotspots between 20 and 50 metres (65 and 165 feet) from the scrapyard, which means radiation has spread into the streets, which is very dangerous," said Greenpeace radiation expert Van Vande Putte.

"Decontamination has to happen. It is urgent," Belgium-based Putte told a news conference in the Indian capital.

He said the tests were conducted earlier Friday at the salvage yard, where valuable metals are extracted from abandoned machinery and sold in India's flourishing recycling market.

The announcement came after India's Atomic Energy Regulatory Board (AERB) watchdog had just recently certified the dump and surrounding area as safe.

The AERB said all radioactive materials had been recovered from the improper scrapping of a machine from Delhi University that contained a radioactive metal used for radiotherapy in hospitals.

Rajendra Yadav, a 35-year-old worker at the salvage yard, died due to multiple organ failure on April 26. Seven others were hospitalised.

Putte said workers without protective gear in the yard where the machine ended up are receiving in just two hours radiation equal to the annual individual amount permitted by Indian laws.

The claim puts another question mark on growing concerns over toxic waste disposal methods and safety regulations in India, which plans to gradually switch to nuclear energy from coal- and oil-fired power stations.

Yadav had been given a "shiny piece of a white metal" from the machine as a sample to scout for a buyer and had carried it around in his leather wallet, showing it to potential customers.

The International Atomic Energy Agency (IAEA) said it was the worst radiation incident worldwide in four years.

Greenpeace attacked the AERB for declaring the zone safe.

"It was a case of oversight, negligence and the AERB should have done a better job," Greenpeace activist Karuna Raina told the news conference.

Radiation expert Putte said the toxic radioactive particles were too small to be seen with the naked eye, but that did not mean they were not lethal.

"It may not immediately cause loss of hair or deaths but the risk here is more of developing cancer over tens of years after contamination," the expert warned.

Meanwhile, a related report says the radioactive machine was purchased in Canada more than 40 years ago.

The University of Delhi purchased the machine a gamma cell that contains the radioactive substance Cobalt-60 from Atomic Energy of Canada Ltd. in 1968.

Delhi police said that the scrap dealer died while trying to recover the steel and lead cladding by prying open and melting the radioactive cell.

The machine had not been used since 1985. It was auctioned away to scrap dealers last February and later found its way to a metal scrap market in West Delhi.

The case has raised fears about the unregulated disposal of hazardous material in India, where dangerous chemicals and even radioactive waste are often sold to scrap dealers. ■

India and Japan Working Towards Civilian N-deal

India and Japan are quietly working on an inter-governmental agreement on civilian nuclear energy so that the 123 Agreement between India and the US, currently in the last lap of political negotiation before the US Congress, can be fully implemented on the ground in India.

According to the broad contours of this agreement, New Delhi will promise not to conduct any more nuclear tests in exchange for Japanese permission to its companies, Hitachi, Toshiba and Mitsubishi to go ahead and partner with US and French companies seeking to build civilian nuclear plants in India.

The India-Japan agreement, in fact, very much mirrors the 123 Agreement between India and the US. New Delhi's promise not to conduct any nuclear tests in the Indo-US nuclear deal is also accompanied by the vow that it will return all material and equipment to the US in case that happens.

Discussions between Planning Commission Deputy Chairman Montek Singh Ahluwalia and the powerful Japanese minister for economy, trade and industry, Masayuki Naoshima, also resulted in the creation of a sixth working group on civilian nuclear energy. Senior officials from the Ministry of External Affairs will travel to Tokyo to take forward the deliberations of the sixth working group with the director general of the Agency of Natural Resources & Energy, T. Ueda.

Both sides are now hoping that the inter-governmental agreement between India and Japan on civilian nuclear energy issues will be signed when the Japanese foreign minister visits India later this year.

But both sides are equally interested in keeping negotiations under wraps because of the extremely shaky nature of the current Democratic Party-led government under Prime Minister Yukis Hatoyama, whose Socialist party coalition partners have a strong anti-nuclear focus and could even walk out of the government.

Considering Japan is the only country in the world to have experienced the horrors of nuclear war first hand, Japanese public opinion was outraged when the erstwhile Taro Aso government in 2008 allowed the Nuclear Suppliers Group to make an exception for India and allow the Indo-US nuclear deal to go through.

Now, New Delhi is taking this energy relationship to the next level and hoping to formalise it through a bilateral pact.

The incredible importance of Japan's acceptance of the Indo-US nuclear deal is little understood by the lay Indian public. The fact is that the two US companies pushing to build civilian nuclear plants in India, General Electric and Westinghouse Electric Co (WEC), are either partly or wholly owned by Japanese companies. GE and Hitachi came together in a 60:40 per cent international joint venture in 2006, while Toshiba Corp. bought Westinghouse outright in 2006 for $4 billion.

In fact, Japan's Mitsubishi Nuclear Fuel Co was in December 2008 restructured as a comprehensive nuclear fuel fabrication company, with a 30 per cent stake by the French firm Areva, so as to allow it to expand domestic operations into overseas markets.

Since these companies are so intimately tied into the Japanese companies, Tokyo has long been telling New Delhi that the Indo-US deal cannot be fully implemented on the ground unless Japan allows its own companies to further empower its US and French partner companies to sell civilian nuclear technology to a country (India) which has not signed the Nuclear Non-Proliferation Treaty.

Since without Tokyo's permission the 123 Agreement soon to face the US Congress for final ratification cannot be implemented on the ground in India, the need for an intergovernmental agreement had become pressing.

Meanwhile, the government introduced the nuclear liability Bill on the last day of the Budget session of Parliament. The Bill will be scrutinised by the standing committee headed by Samajwadi Party leader Mulayam Singh in the interim months before the monsoon session opens in July.

The US has told India it cannot put the leftover "procedures and arrangements" related to the 123 Agreement before the US Congress unless the nuclear liability Bill is passed by the Indian parliament.

India has already committed to Areva to build a nuclear power plant at Jaitapur in Maharashtra. The US has got two sites in Gujarat and Andhra Pradesh and the Russians, besides expanding the site at Kudankulam in Tamil Nadu will also set up another plant in Haripur, West Bengal. Each country has been allotted the manufacture of approximately 10,000 Mw of nuclear energy so that India can meet its target of 40,000 Mw by 2032. ■

Two N-Energy Parks Planned in Andhra Pradesh

The Nuclear Power Corporation of India Limited (NPCIL) will set up two nuclear energy parks at Kovvada (Srikakulam district) and Nizampatnam (Guntur district) in the southern State of Andhra Pradesh at a whopping investment of more than Rs. 150,000 crore.

Disclosing this to reporters in Hyderabad recently, NPCIL Chairman & Managing Director S.K. Jain said that pre-project activities had begun at Kovvada where six imported reactors of 1,400 MWe would be set up in phases. Land acquisition would start in due course, he added.

Jain was in the city to attend a function where fuelling machine head for Advanced Heavy Water Reactor (AHWR) was handed over by Chief Minister K. Rosaiah to Atomic Energy Commission (AEC) Chairman Srikumar Banerjee. It was manufactured by the city-based MTAR Technologies Private Ltd.

Jain said discussions were on with the State government to firm up the site at Nizampatnam, where it is proposed to establish another six imported reactors of 1400 MWe.

There were also plans to set up two indigenous reactors of 700 MWe at Pulivendula (2x700 MWe) in Kadapa district. Official sources indicated that Nizampatnam site was still under consideration as several feasibility studies were on.

Rosaiah said the government was keen on establishment of nuclear power plants to overcome the acute power shortage. The Atomic Minerals Directorate had carried out exploration for uranium in the Kadapa basin and indicated that uranium-mineralisation extends over a belt of 160 km, he said. Uranium Corporation of India Limited (UCIL) is planning to establish a uranium-based plant in Pulivendula. The government had granted mining lease over an extent of 800 hectares for a period of 30 years, Rosaiah added.

Banerjee said that apart from the location the of Nuclear Fuel Complex which provides various types of fuel to reactors, Andhra Pradesh has the largest reserves of over 60,000 tonnes of uranium. But unfortunately, the State does not have a reactor. Describing it as the "biggest anomaly", he said this would be rectified soon. ■

'Allegro' Advanced N-Rector to be Set up in Central Europe

There have been moves to locate the Allegro advanced reactor in central Europe. The Czech Republic, Hungary and Slovakia have agreed to make a joint proposal to host the project.

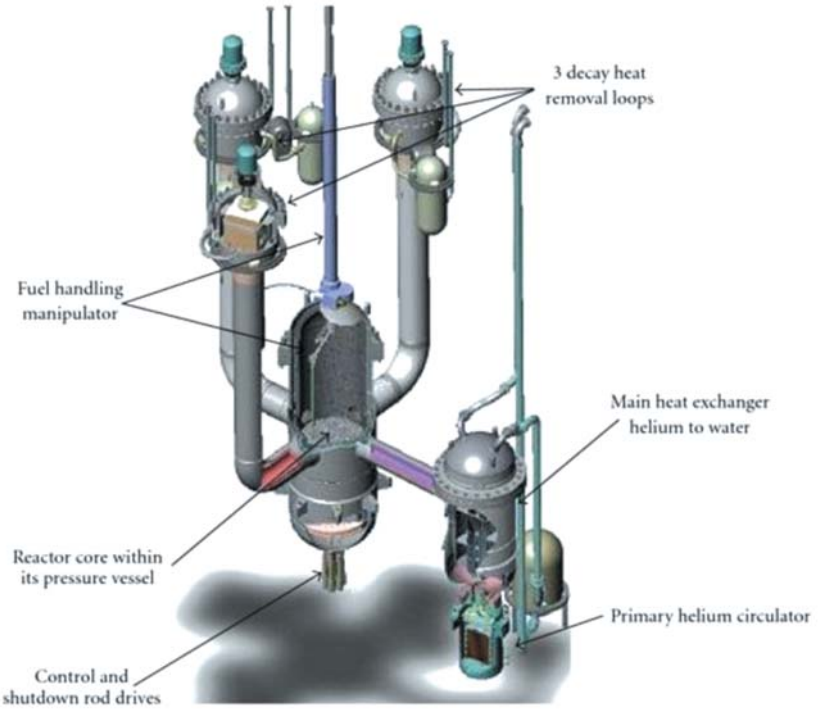
Allegro is to be a gas-cooled fast reactor (GFR) with thermal capacity in the range 50-80 MW. It has funding support as a demonstration project of the Generation IV International Forum, in which France, Japan, Switzerland and the EU are partners on the GFR concept.

It was France that suggested a joint hosting arrangement in central Europe, and the idea has received support from the Czech, Hungarian and Slovakian governments. Recently a memorandum of understanding on cooperation for the preparatory phase of Allegro was signed in Budapest by the countries' lead nuclear research bodies, AEKI Budapest, UJV Rez and VUJE Trnava, respectively.

The MoU covers work for the next two to three years concerning the potential siting of the reactor in the countries, the selection of a specific site and also the overall organization of work for Allegro.

The trio of research bodies have made a joint proposal to have Allegro placed on the road map of the European Strategy Forum on Research Infrastructures - a forum at EU level to support large scale research and development facilities.

They will also prepare basic documents that will form the basis to make a later decision on construction and operation of Allegro in one of their countries. Support for this is coming from France's Atomic Energy Commission (Commissariat a l'Energie Atomique, CEA).



Allegro comes under the EU's gas-cooled fast reactor (GFR) programme among a range of Generation-IV reactors. It is meant to demonstrate GFR technology and establish its potential relative to a sodium-cooled alternative design as part of the Generation-IV International Forum.

Conceptual design and safety work for Allegro was carried out around 2005. The reactor's primary coolant would be helium gas, with pressurized water in a secondary loop. The core would have either ceramic fuel and an outlet temperature of 850 deg C, or uranium-plutonium mixed oxide fuel and an outlet temperature of 560 degrees. The reactor could be built in the period between 2014 and 2022.

Allegro's pilot-scale demonstration would validate the safety reference framework and test the capacity of high-temperature components and heat processes. It would be a step towards a power-generating GFR prototype. ■

All That You Wanted to Know About Radiation

The Good, Bad & Ugly Effects

Most people across the world are ignorant about a phenomenon called radiation, except that it is dangerous to health. In India, the recent mishap in Delhi, in which some people were fatally exposed to radioactive materials carelessly thrown into a rubbish dump, highlights the ignorance prevailing worldwide regarding radiation. Here we reproduce some of the most commonly asked questions regarding the good and the bad of radiation.

Radiation & Pregnancy

What are the risks to my unborn child from dental, mammogram, chest, extremity, head, or CT exams that involve x rays, but don't directly expose my abdomen?

There will be no harm to your unborn child from radiation exposure when x rays are taken of areas other than the abdomen because the x-ray beam is focused only on the area of interest to minimize radiation doses to other areas of the body.

Is it necessary to put a lead apron over my abdomen for x-ray exams?

Some state regulations will require the lead apron when it will not interfere with the exam being done. In reality, with current x-ray exams, it is not likely the unborn child would be exposed unless the abdomen is directly exposed. If you had an x-ray exam of an area outside the abdomen and forgot to ask for a lead apron, it's okay, the unborn child received little, if any, radiation exposure.

Is it okay to stand next to an airport baggage-screening machine?

Yes. The x-ray machines at the airport are shielded. There is no radiation exposure of passengers or the unborn child when standing next to the baggage-screening machines.

Is it risky to fly?

Not because of radiation exposure. The additional radiation exposure from flying is too small to cause harm to the unborn child.

Is it safe to stand close to a microwave oven while it is operating?

Yes. Current models of microwave ovens for general use are shielded to reduce leakage to very low or even zero levels. A microwave emits electromagnetic radiation at a lower frequency than x rays and other ionizing radiation.

Is it safe to use my cell phone?

Yes. A cell phone emits electromagnetic (EM) radiation of moderate frequency (which is lower than the frequency of x rays). EM exposure does not increase risk of harmful effects to the unborn child.

Is it okay to have an MRI exam for back pain?

Yes. There is no evidence that a standard diagnostic MRI

(magnetic resonance image) performed on a woman who is pregnant will cause harmful effects. The Food and Drug Administration (FDA) and other regulatory agencies have strict limits on MRI field strengths at diagnostic levels.

Are there any risks to the unborn child from radiation emitted from computers?

No. Today, it would be difficult to find a computer (the monitor actually) that exposes the user to large or even moderate amounts of electric or magnetic field radiation. It is safe to use a computer when you are pregnant. If you are using a laptop, the answer is still no to the question of risks from radiation; however, pregnant users are cautioned against setting the laptop on their abdomen during pregnancy because of heating.

How long should I wait to try to become pregnant after x-ray exams that have exposed my ovaries or my husband's testes? Can I become sterile after having x rays?

There is no evidence of effects on the ovaries or sperm at radiation doses used in diagnostic x-ray procedures. Radiation doses from routine medical x rays are too small to affect sterility or have an effect on a future pregnancy. Therefore, you do not need to wait after diagnostic x-ray exams before trying to become pregnant.

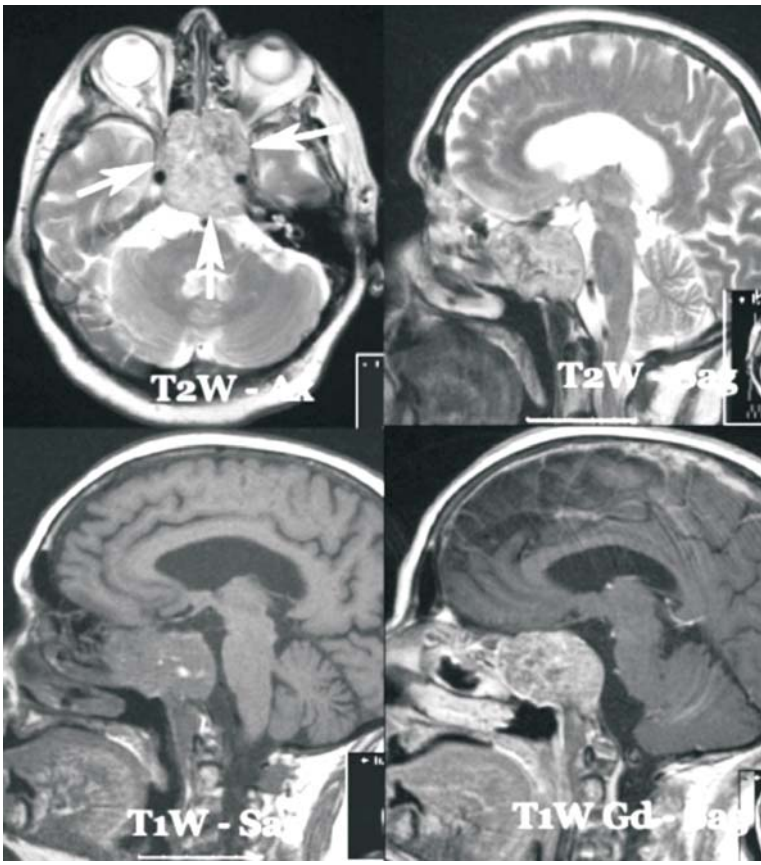
Radiation & Suntanning

Does a tanning bed cause skin cancer and, if so, how long does it take to get cancer?

Yes, tanning bed lights can cause cancer. In studies of individuals who have skin cancer, ultraviolet (UV) light emitted by tanning beds has been associated with an increased chance of skin cancer. Major scientific and medical organizations have agreed that UV light causes increases in skin cancer and recommends limiting your exposure to UV light from natural sunlight as well as from tanning booths. The relationship between UV exposure and cancer risk is not clear except that we know that more exposure increases your risk of cancer so it is not possible to say how long a tanning bed has to be used before causing skin cancer for a specific individual.

Which causes more damage to the skin and is most harmful? Tanning beds or suntanning?

The type and amount of UV radiation emitted from typical tanning beds appear to be similar to that of noontime summer sun. The reaction of a person to UV light from tanning beds or the sun is thought to be similar.



Can tanning beds affect ovaries (eggs), testes (sperm), my unborn child if I am pregnant, or my milk if I am breast-feeding?

No. UV radiation does not travel very far into the body. Therefore, it won't affect ovaries, sperm, your unborn child if you are pregnant, or your breast milk.

If I use sunblock for protection, am I safe from skin cancer?

No. Sunblock will help reduce exposure to UV radiation, but is not totally effective in preventing skin cancer because it wears off and needs to be reapplied. If sunscreen is not applied often enough and thickly enough, it may give a false sense of security, leading to even more time in the sun. The lesson? Apply sunblock often whenever you are in the sun and especially after activities that may have washed the sunblock off (swimming, activities causing you to sweat).

Nuclear Power

During normal operations, do commercial nuclear

power plants release radioactive material?

Yes. Nuclear power plants routinely produce radioactive gases and liquid wastes during normal operations. A plant has tanks designed to store gas and liquid radioactive materials that are generated during normal operation. The radioactive material is held for a period of time to allow for the radioactivity level to decrease before being treated and/or released in a planned, monitored way. This keeps the amount of radioactive material in releases low and within regulatory limits (which are set to ensure releases are well within a safe level of exposure).

Prior to being released, radioactive gases and liquid wastes are sampled and analyzed, and calculations are performed to ensure radioactivity levels are within limits. Once the calculations verify the radioactivity is below regulatory limits, the radioactive material is released in a controlled, monitored process. Advance notifications to the public are not required and are not routinely done when releases are made in accordance with the plant's procedures and regulations. The plants maintain records of all releases. Routine sampling of water from nearby lakes, ponds, etc., performed by the plant operators and independently by states also provides surveillance and detection of any radioactive liquid releases.

Releases that are unexpected, are not made in accordance with procedures, or are above regulatory limits are reported to the Nuclear Regulatory Commission and to the state.

How is radiation and radioactive material that can expose a member of the public measured around nuclear plants? What do the results tell us?

During normal operations, penetrating radiation (like gamma rays and x rays) emitted from the radioactive materials in the reactor and in the systems and buildings of the plant are not able to expose someone outside the boundary of the plant. Nevertheless, radiation monitors are placed on the fence line surrounding the site to directly measure any radiation exposure that might occur.

Radioactive materials that could cause radiation exposure near nuclear power plants are generally monitored by sampling air, food, and water supplies for radioactivity content. Radioactive emissions may be released to both air and water. The radioactive material in the air could be breathed in directly or could settle or deposit on local vegetation. Therefore, samples are taken of the air emissions and food products such as garden vegetables. Some radioactive material could also land on pasture grasses that cows eat, so milk and vegetation are sampled. Nuclear power plants near bodies of water are required to check for radioactive material in all nearby lakes, ponds, and streams, so water samples are taken from the liquid waste stream from the plant. Other water samples are taken from the nearest public water supplies. Samples of fish are caught and analyzed as well. The amount of radioactive material allowed to be released from power plants is strictly controlled by the utility and regulated by the Nuclear Regulatory Commission.

What went on at Three Mile Island and Chernobyl? Were they different?

Yes, the accidents at Three Mile Island and Chernobyl were very different. In the 65 years since the first nuclear reactor became operational, there have been accidents that have affected people. Two events that affected

people outside the immediate plant were Three Mile Island in the United States in 1979 and Chernobyl in the Ukraine in 1986.

Dirty Bombs

What is a dirty bomb and what can happen?

A dirty bomb is a regular bomb (plastic explosive, for instance) combined with radioactive material. When it is exploded, the radioactive material is spread around, creating a radioactive area that needs to be cleaned. A dirty bomb is neither a nuclear weapon nor a nuclear bomb. Injuries or deaths are far more likely to result from the explosion than from exposure from the radioactive material. Radioactive material from a dirty bomb would likely be deposited within a few blocks or less from the site of the explosion, but could cause widespread public fear and panic which is what terrorists are trying to accomplish.

The harm caused by a dirty bomb would be determined by the type and amount of radioactive material involved, the type and amount of explosive, weather conditions, how the individual was exposed to the radiation (external, internal, or both), and how long the individual was exposed to radiation before it was discovered.

Radiation Basics

Is there a difference between an x-ray exam and a nuclear medicine test?

Both of these tests are done with ionizing radiation. The x-ray exam is performed with machine-generated radiation while the nuclear medicine test is generally performed using injected liquid radioactive materials. X-ray exams generally show structure while nuclear medicine scans can show anatomy, function, and disease state.

X-ray machines can be turned off like a lightbulb (the radiation exposure ends when the machine is off) while the radiation in a patient's body from a nuclear medicine test decays over time (it cannot be turned off with a switch).

What is radioactive material?

Radioactive material is just another name for a group of unstable atoms that emit ionizing radiation. These groups of unstable atoms emit radiation because they try to become stable. Radioactive materials emit radiation in a process called radioactive decay.

When one says radioactive "decay," is it like tooth decay where the tooth rots away?

In a way, yes. It is similar because some of the material is actually crumbling or fragmenting (called disintegrating). For example, when a radioactive atom decays, it usually loses a particle from its nucleus and changes into an atom of a different material. On the other hand, it is not the same as decay in a tooth because the material still looks the same physically. If a powder is

radioactive and the radioactivity decays away, we still have the same amount of powder but the radiation is less.

How long does it take for the radioactivity to decay away completely?

Different types of radioactive materials have different decay times, varying from fractions of a second to millions of years. Each radioactive material has a decay rate. The time that it takes for half of the radioactive atoms to decay is called a half-life. For example, the previously mentioned technetium-99m has a half-life of six hours which means that, starting with 100 percent, after six hours, we will have 50 percent left. After six more hours, we'll have 25 percent left (half of the 50 percent that remained after the first half-life). After six more hours, we have 12.5 percent remaining. After ten half-lives, only 0.1 percent of the radioactivity is left.

There are three types of half-life. One is the physical half-life. If you have a container of radioactive material sitting on a counter, the radioactivity decays according to its physical half-life. The second type is a biological half-life. If the radioactive material is in a human, for instance, it gets moved around inside our body just like nonradioactive materials. Sometimes our body will get rid of the material quickly, leading to a short biological half-life. Sometimes the material might go to a spot in our body and stay there, leading to a long biological half-life. The third type of half-life is when you combine the first two. When a radioactive material is inside a biological system, like the human body, it is decaying by its physical half-life and being cleared from our body by its biological half-life. Combining these is called an effective half-life. This is important when we talk about health effects of radioactive materials that are inside our body.

So, after a lot of half-lives, is the radioactive material gone?

Essentially. For all practical purposes, there is only negligible activity left after 20 half-lives.

When the radioactive material is outside the human body and decaying by its physical half-life, two things can occur. The radioactive material might eventually contain too small an amount of radioactivity to be detected so, essentially, the radioactivity is gone and the atoms have become stable. Or, sometimes, the original radioactive material decays and becomes another radioactive material. That material could decay to another radioactive material or become stable.

If the radioactive material is inside the body, remember that it is decaying by its physical half-life and it is also being cleared by the body with its biological half-life. If the biological half-life is short, our bodies will get rid of the radioactive material so no radioactivity is left inside us. If the biological half-life is long and the physical half-life is short, the radioactive material will stay in the body but will no longer be radioactive in a short timeit will either become stable or decay into another radioactive material. If the biological and physical half-lives are long, the radioactive material will stay inside of us and expose us to its radiation for the duration of the biological or physical half-life, whichever is shorter.

Radiation Exposure

One keeps hearing that no amount of radiation is safe. Now this document says that some of it is. Which is it?

Low levels of radiation exposure are safe. The exposure does carry some risk, and the level of risk is the same or less than other day-to-day activities we consider safe or acceptable.

Whether something is truly safe is based on how each individual sees it. Every day we face risks of various sorts without much consideration. The reason? The risk is so very low that we just don't think about it or the risk is something we are willing to take because of benefits we see (like driving your car or walking across a busy street). It is the same with a dose of radiation. When the calculated risk from radiation exposure is the same as risks we routinely take and consider acceptable, we then say that amount of radiation exposure is also

acceptable.

How do we know about the effects at large doses, like skin reddening or cataracts or cancer?

While there have been animal studies, much of our information does come from actual human radiation exposure that was due to accidents and events. Some of the information came from the first people working with radiation, who were unaware there might be possible harmful effects and in some cases were exposed to too much radiation. Some became sick or suffered severe damage to their hands. There also has been follow-up on patients undergoing radiation therapy treatments, research focusing on people exposed to large amounts of radiation by accident, and studies of health effects in the Japanese atomic bomb survivors during World War II and in underground uranium miners.

Does the information on websites apply to children?

The information obtained about high-dose radiation exposures in adults does apply to children. Children are more sensitive to radiation than adults. Generally, when cells, organs or tissues are developing, as they are in children, they are more likely to be affected if radiation interacts with them. When considering radiation exposure to children, it is important to weigh the benefits (diagnosing a broken arm or appendicitis) against the risks (is there enough radiation exposure to increase the cancer risk?).

How can I tell good radiation exposure from bad radiation exposure?

The detemination of radiation exposure being good or bad has more to do with how we each judge its benefit. Is it bad radiation exposure if you have an arm x ray and it shows that no bones are broken? Or is that a good thing because now you know it is only a sprain? The reason for a person to receive a radiation dose from any source should be justified based on the expectation that the activity causing the radiation will benefit the individual exposed or society.

What about women who are pregnant and exposed to radiation?

This is such an important topic that we've chosen to go into more detail in another section. You can also go to the Health Physics Society Web site for information sheets, Q & A pages, and radiation doses to the embryo/fetus from medical exams involving radiation (www.hps.org/publicinformation/ate/).

If I had x rays periodically when I was young (broken arm, sprained ankle, chest x ray, and more), do I need to be concerned?

No, there is no reason to be concerned about having a variety of routine diagnostic x-ray exams. The total radiation exposure you received is low and well within the lower radiation dose ranges that we call safe.

How do we know that the radiation exposure we received isn't going to cause cancer?

We can't precisely predict whether any one individual will get cancer from radiation exposure. It's like getting in a car to drive to work. We can't predict whether any one individual will be in an accident or not. Even if the person drives very carefully, doing all the right things, we still don't know what will happen. With radiation exposure, it is the same. At lower radiation dose levels, the chance of developing cancer or observing other effects is very low.

Who regulates radiation?

There are many regulators in the United States for various aspects of radiation uses and types of exposures. The Food and Drug Administration (FDA) regulates the manufacture and sale of devices that emit radiation (such as x-ray machines) and state health departments regulate the manufacture and sale of these devices, the use of radioactive materials and releases of radioactive material that could expose the public. The states, the Nuclear Regulatory Commission (NRC), and the Department of Energy (DOE) regulate how people work with various devices and radioactive materials and how much radiation exposure workers can receive.

How do I protect myself?

Before we talk about protection, let's talk about need and benefit because we think it all goes together. We each need to be careful in considering what we are doing or are about to do. If we hurt, we finally decide to go to the doctor who, often, can help us with some type of pill. If we read the package insert for that pill, we will see that there are a number of side effects that can occur if we take it. We choose to take that pill anyway because it will make us feel better and we are either willing to risk the side effects or we have decided that the chance of them occurring is small.

That is how we assess the need and benefit of taking a risk. I need the pill because I hurt, the pill will benefit me by taking away my pain, and I've decided any of the side

effects of the pill aren't worthy of my concern. We need to give the same considerations to the various potential radiation situations. Some situations are easier to consider than others because the benefit is more obvious. We fall out of a tree and have an x ray to see if we broke our leg or just hurt it badly. Here, the benefit is obvious. The x ray will show right away if the bone is broken or not and, with that information, we can decide if we need to do anything else. Sometimes the benefit is obvious, like the bone x ray, and sometimes it is more difficult to determine what the benefit might be. Often, a benefit might be for our society as a whole, but not for us personally.

When something carries a risk that may affect us personally and we have the opportunity to say yes or no to it, it is considered a voluntary risk. Something that carries a risk but is a benefit to society might be considered an involuntary risk if it does not benefit us and we might not be able to say yes or no to it. For example, we voluntarily accept the risks associated with the production and disposal of batteries, computers, carpets, or plastics whether we use them or not because we know of their beneficial purposes. Although their improper disposal has the potential to release harmful products to the environment, we have decided that the benefits outweigh the risks. It can often be that way with nuclear technologies such as the production of electricity using nuclear power plants. There are benefits to society - a cleaner source of electricity to light and heat our homes and the reduction of our dependency on foreign oil - and potential risks if the radioactive waste generated at these plants is not disposed of properly.

To best assess the beneficial uses that might expose you to radiation: (1) be informed, (2) learn why you are going to receive a dose of radiation and what the dose is likely to be, (3) evaluate the concern with that level of radiation, and (4) if the level warrants, evaluate whether there are ways to lower the radiation dose.

Radiation in Small Doses

What is radiation contamination and how does it differ from radiation exposure?

When radioactive materials in liquid, gas, or powder form are not kept contained, they can transfer to other surfaces or can be carried in the air. When radioactive material is "loose" and comes to rest on something, that something is then said to be contaminated. There is now radioactive material on it. If the something is a

countertop, we have countertop contamination. If the radioactive material gets on our skin, we have skin contamination. If it gets inside of us, we are internally contaminated.

We need to know the type of radioactive contamination to determine whether we are being exposed to that radiation. So now it goes back to the discussion of the type of radiation (alpha, beta, gamma) and the energy of that radiation. In general, gamma radiation will expose us if it is an external source, skin contamination, or inside of us. Alpha and beta particles will expose us if they are inside of us. Some high-energy beta particles can expose us if they are on our skin.

A big difference between contamination and exposure comes when we talk about certain devices, like x-ray machines, that expose us to radiation. In this case, we are not talking about a liquid, gas, or powder, so this type

of exposure does not cause contamination. Sometimes people who have an x-ray exam performed wonder if they are radioactive afterward. To become radioactive, you would need to become contaminated (have radioactive materials actually deposited on you or inside of you) and the x-ray machine does not do that.

Can radiation exposure be safe?

Yes. Radiation exposure that leads to small radiation doses for our bodies is safe in the sense that there either is no effect or the effect is too small to observe. There has been no evidence of illness or increased cancer risk at small radiation doses that are similar to the amounts we receive from routine x-ray procedures, natural background radiation (excluding radon), or occupational exposure. Radiation exposure in a short period of time that leads to very large radiation doses to our body can cause health effects within months, days, or even sooner. We know from health effect studies that large radiation doses over a long period of time can lead to an increase in some diseases, like cancer.

What can too much radiation exposure do to me?

Cancer is usually the effect that comes to mind for most people when we talk about radiation exposure and dose, but there is much more than that to talk about, including at what doses we need to be concerned.

Can the radioactive substance have hazards other than the radioactivity, like being poisonous?

Yes, it can. If the substance is hazardous to health anyway, the radioactive piece is an additional hazard on top of the hazard that would exist if the substance wasn't radioactive. An example is uranium. The heavy metal alone can make you sick. Add the fact that it is radioactive and it means you are also being exposed to the radiation it emits. So, if a substance by itself is cause for concern, making it radioactive adds to the concern because it can now potentially make you sick in more than one way. ■

Global Energy Consumption to Rise by 49 pc in Next 25 Years

Economic growth in the world's developing nations will drive world energy consumption up by 49 percent over the next quarter century, according to the latest projections from the US Energy Information Administration (EIA).

Newly released highlights from the reference case in the EIA's International Energy Outlook 2010 predict most of that growth will occur in Asian and Middle Eastern countries outside the OECD: total energy demand in non-OECD countries is seen to increase by 84 percent by 2035. Most nations are expected to return to the rates of economic growth predicted before the economic recession of 2007-2009, and an increase of 14 percent is forecast for OECD countries. India and China will continue to lead the world's energy demand growth, with their combined energy use more than doubling by 2025 by which time they will account for 30 percent of world energy use between them.

In the absence of policy changes to limit their use, fossil fuels and especially coal will still continue to provide the lion's share of world energy consumption in the period to 2035, the report forecasts. With fossil fuels set to meet over three quarters of world energy needs in 2035, world energy-related carbon dioxide emissions are also likely to grow by 43 percent over the projection period. The EIA warns, however, that a "significant degree of uncertainty" surrounds such long-term energy-related emission projections.

World electricity demand growth is set to return to pre-recession rates by 2015 and grow by 87 percent over the period to 2035. Renewable energy use is set to be the fastest growing of all generation options, the report says, growing at 3.0 percent per year and increasing its share from 18 percent in 2007 to 23 percent in 2035. Coal-fired generation will nevertheless continue to grow at a rate of 2.3 percent, legislation notwithstanding.

Rapid world energy price increases from 2003 to 2008, coupled with concerns about greenhouse gas emissions, mean "the long-term prospects continue to improve for both nuclear and renewable energy." Higher fossil fuel prices make nuclear more economically competitive with coal, despite the relatively high capital costs of nuclear power plants. The report also notes the higher capacity utilisation rates reported for many existing nuclear plants and also anticipates that most of the older nuclear power plants both in the OECD and in non-OECD Eurasian countries will be granted extensions to their operating lives.

Nuclear Power

Nuclear generation is predicted to grow at a rate of 2.0 percent per year, reaching a total generation contribution of 4.51 trillion kilowatt hours by 2035, nearly 75 percent up from its 2007 contribution of 2.59 trillion kilowatt hours. Even so, this would represent a slight decrease in nuclear's share of world generation, to 12.8 percent in 2035 from 2007's 13.8 percent. The highest growth rates for nuclear power are predicted to be in non-OECD Asia, particularly China and India, with an average growth rate of 7.7 percent per year over the period to 2035, followed by Central and South America, at 4.3 percent per year.

The EIA is the statistical and analytical agency of the US Department of Energy. The International Energy Outlook 2010 follows on from its recently published Annual Energy Outlook 2010, which focuses on US energy trends. Both reports push the forecast period to 2035, five years beyond the coverage of previous editions. ■

India and Kazakhstan to Sign N-deal

India and Kazakhstan are all set to sign a civilian nuclear agreement that will facilitate Indian investments in mining sector and supply of uranium from Kazakhstan.

Speaking at a joint press conference after holding the foreign ministers' delegation-level talks recently, the External Affairs Minister, S.M. Krishna, had said: "I am confident that an inter-governmental agreement on Civilian Nuclear Energy cooperation will be finalised soon."

"This sector has immense possibilities for bilateral cooperation, including for supply of uranium ore, investment by Indian companies in mining in Kazakhstan, construction of nuclear reactors and others," Krishna added.

Krishna also held discussions with his counterpart Kanat B Saudavayeb on the issue of civilian nuclear cooperation.

Kazakhstan is the world's second largest producer of uranium after Australia.

Australia has refused to supply uranium to India saying it cannot supply the strategic mineral to countries like India, which have not signed the nuclear non-proliferation treaty (NPT).

On cooperation in the oil sector, the Indian government said it was happy with the progress of discussions on India's participation in the Satpayev oil block.

India had already signed an umbrella agreement for this purpose during President Nazarbayev's visit to New Delhi in January 2009.

"We have been assured of an internal agreement between the Kazakhstan oil ministry and the Indian Petroleum ministry after which an agreement would be signed between ONGC Videsh and the Kazakh oil company," Reddy added.

Reddy disclosed that India, having great interest in crude oil import from Kazakhstan, can provide helping hand in oil exploration too. ■

Brazil to Build N-reactor for Nearly $500 Million

BRAZIL is looking to enhance its nuclear energy use by building a US$483 million nuclear reactor to produce radioactive material for medical use as well as industrial-grade enriched uranium.

'The multipurpose reactor has a very important role in the nuclear programme' Science and Technology Minister Sergio Rezende said in the daily O Estado de Sao Paulo.

The reactor will be built in Ipero, 130 kilometre from the south-eastern city of Sao Paulo, in an area where the Brazilian navy is developing a nuclear submarine project and building ultracentrifuges to enrich uranium. The reactor will be used for nuclear medicine, producing what are known as radiopharmaceuticals for diagnosing and treating diseases like cancer, Rezende said, as well as produce industrial-level enriched uranium starting in 2014. Lula had earlier announced that two new nuclear power plants would be built in Brazil's north-east.

Brazil has an ambitious civilian nuclear programme, and for more than 20 years, has had two nuclear plants in Angra dos Reis, in Rio de Janeiro state. The country's constitution bans the presence of nuclear weapons on Brazilian territory.

China, Pakistan N-cooperation 'peaceful'

Amidst growing concerns about nuclear proliferation, China has issued a statement reassuring the international community that its nuclear cooperation with Pakistan is completely 'peaceful' in nature, and in accordance with the safeguards set up by the International Atomic Energy Agency (IAEA).

"The cooperation is subject to safeguards and the supervision of the International Atomic Energy Agency (IAEA). It is in compliance with respective international obligations of the two countries," Chinese Foreign Ministry spokesperson Jiang Yu said while responding to a statement by US Deputy Secretary of State James Steinberg.

Stressing that countries must respect their individual non-proliferation commitments, the United States had said that it was closely observing China's offer to build two nuclear power plants in Pakistan.

Speaking during a forum at the Brookings Institution, US Deputy Secretary of State James Steinberg said Washington is concerned about proliferation issues and is studying China's offer to assist Pakistan with nuclear reactors, adding that Washington has not taken any final decision in this regard.

Steinberg had said that the United States is keeping a close watch on Beijing's offer to build two new nuclear power plants in Pakistan.

"The United States has not reached a final conclusion. But it's something we're obviously looking at very carefully," Steinberg had said.

"I think it's important to scrupulously honour these non-proliferation commitments. We"ll want to continue to engage on the question, about whether this is permitted under the understandings of the International Atomic Energy Agency (IAEA)," he added.

China had earlier built two reactors for Pakistan. But in 2004 Beijing entered the Nuclear Suppliers Group, an association of nuclear energy states that forbids exports to nations lacking strict safeguards set up by the IAEA.

China began building a nuclear reactor in Chashma in Pakistan's Punjab province in 1991 and work on a second reactor began in 2005, which is expected to be completed next year. Under the new agreement, Chinese companies will build at least two new 650-MW reactors at Chashma, a media report had said last month. ■

Russia to Construct Turkey's First N-plant

Turkey's first nuclear power plant will be constructed by Russia. An agreement to this effect will be signed in the near future, a senior Russian official said.

Russian President Dmitry Medvedev paid an official visit to Ankara recently and signed deals including on the construction of Turkey's first nuclear power plant and an oil pipeline.

"A construction contract, which will take all the details into account, will be signed in the near future and then construction will begin," Igor Sechin told a Cabinet meeting.

"The first two reactors must be built in seven years," he said. Russian specialists plan to build four nuclear reactors in the country, each with a capacity of 1.2 GW.

The nuclear power plant is expected to be built near the Mediterranean port of Mersin in the Akkuyu area and put into operation in 2016-2019.

"In the months preceding the president's visit to Turkey, all the details and nuances of this work were coordinated. We established in this agreement economic conditions for operating the plant…that satisfied both the Russian and the Turkish parties," Sechin said. ■

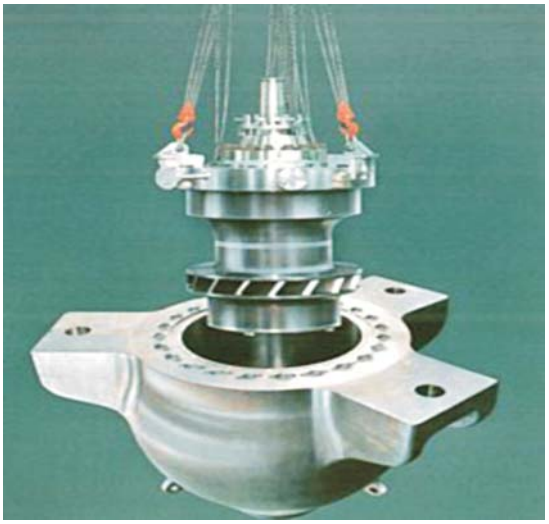
Collaboration Eyes Nuclear Pump Market

UK engineering group Weir is to team up with Japan's Mitsubishi Heavy Industries (MHI) to supply and maintain pumps for new nuclear power plants, initially in the UK, but later throughout Europe.

A joint cooperation agreement between the two was signed on 26 May at MHI's Takasago Machinery Works in Hyogo prefecture, Japan. Under the agreement, MHI will be responsible for pump design and manufacture for nuclear power generation, as well as pumping equipment across the 'conventional island' of a nuclear power plant, while Weir will provide sales support, project management, installation and after-sale services. Weir will also be responsible for the implementation of site health, safety and environmental systems. The partnership will be known as Weir-MHI.

The initial focus of the cooperation agreement will be on the nuclear new-build market in the UK. However, MHI said: "This collaboration is positioned as the strategic move toward strengthening the supply chain in the European region as part of MHI's global supply system."

"This agreement with MHI provides an excellent opportunity to further grow our nuclear offering and build and strengthen customer relationships," said Keith Cochrane, CEO of Weir.



Akira Sawa, general manager of MHI's nuclear energy systems headquarters, commented: "This cooperation will enable us to expand our pump expertise into the UK with a full lifetime offering to the nuclear pump market."

In a statement, MHI said, "Going forward, through collaboration with Weir, MHI looks to secure and maintain a better position in NPP pump business competition in the UK. At the same time the company will further strengthen its vigorous marketing activities for other NPP businesses in order to establish a solid position in the European NPP market, where demand is expected to expand robustly in the years ahead." ■

HCC Bags Civil Works Contract for Two RAPP Units

Hindustan Construction Company (HCC) will undertake main plant civil works of units 7 and 8 of the Rajasthan Atomic Power Project (RAPP) after a Rs 8,880 million ($188 million) contract by Nuclear Power Corporation of India Ltd (NPCIL).

RAPP 7 and 8 will be 700 MWe indigenously designed pressurized heavy water reactors (PHWRs). The units are scheduled to begin commercial operation in June and December 2016, respectively. HCC has constructed all six existing units at RAPP, which are also PHWRs of varying sizes, the first of which began operating in 1973 and the latest earlier this year.

Under the latest contract, the scope of the work involves construction of the reactor buildings, auxiliary buildings and the waste management exhaust ventilation building. It also involves the construction of the heavy water upgrading plant, a new fuel storage building and a waste management facility. HCC will also build an overhead water tank, road infrastructure, and will fabricate and erect structural steel works involving civil, structural and

architectural works. The project is scheduled to be completed in 50 months.

In a statement, HCC said that it has constructed over half of India's nuclear power capacity. Out of the country's total of 19 operating nuclear power reactors, the company has built eleven units, including units 1 and 2 of the Kakrapar plant in Gujarat and units 1 and 2 of the Narora plant in Uttar Pradesh (all 202 MWe PHWRs). It is also constructing two 950 MWe Russian-designed pressurised water reactors (PWRs) at Kudankulam, Tamil Nadu, due to begin commercial operation in 2010 and 2011.

In September 2009, HCC and Amec of the UK signed a memorandum of understanding to establish a strategic partnership under which they would "jointly explore" the application of engineering procurement and construction services, as well as consulting. HCC said it would be strengthened in the areas of mechanical and electrical components by being able to source the latest technologies through Amec. ■

Electric Cars to Drive Up N-Energy Consumption in UK

Electric cars will reduce emissions at point of use, but their green credentials rely on the grid and a new generation mix to charge their batteries, warns the UK's Royal Academy of Engineering. A future UK fleet could need an additional 160 GWh per day.

The academy called on the UK government to develop a strategy for the expected switch to electric vehicles. One requirement for the technological mix is universal high-speed internet connection, which smart grid meters will need to use. Without that, a large number of electric car owners will not be coordinated with the larger grid. Furthermore, those drivers that cannot park on their own property must be accommodated by roadside or car park charging and local grid substations will need to be upgraded.

The actual development of electric vehicles is a lesser issue, with major car manufacturers approaching mass production of electric and series hybrid cars (in which an on-board engine charges the batteries). Nevertheless, these need support - as do the early purchasers of their products. "There is an opportunity to integrate these policy areas and adopt a fully systems-based approach to ensure that all work together and the critical links between them are explicitly recognised," said the academy in its report, *Electric Vehicles: charged with potential*.

An assumed 20 million vehicle fleet averaging 40 km/day and using 200 Wh/km requires some 160 GWh in additional power generation. This translates to an increase of 16 percent on winter loads for the UK and could be accommodated relatively easily if the cars were charged overnight. However, "this ideal is far from being practical," especially if large numbers of drivers are recharging while at work.

The UK already has targets to change its mix to include 20 percent renewable power by 2020 and commercial proposals for up to ten new large reactors, but this does not include the additional 160 GWh of low-carbon generation each day. Meeting this would require a further seven 1000 MWe nuclear power reactors or about six thousand 3 MWe wind turbines.

It is possible, the academy wrote, that the extra burden of charging vehicle batteries could sometimes be met just by renewables and nuclear and therefore bring dramatic emissions savings. However, other times could easily see batteries charged from fossil sources and lead to no significant emissions reduction at all. ■

Japan Restarts Fast-Breeder Nuclear Reactor

Japan plans has restarted its controversial fast-breeder nuclear reactor after operations were suspended for more than 14 years following a sodium leak and a fire.

The facility was shut down in 1995, less than two years after Monju had started generating power, after a special thermometer broke, leaking high-temperature metallic sodium that reacted violently with oxygen. The incident resulted in a fire, but caused no radiation leak.

The public grew fearful of the programme and angry at the operator, who tried to cover up key data from the incident.

The Japan Atomic Energy Agency, which operates Monju, the nation's only fast-breeder reactor, released altered video footage of the fire in a failed attempt to ease public concern about the safety of the facility, located in Tsuruga, Fukui prefecture, 350 km (217 miles) west of Tokyo.

Delays in repairs and strong opposition among some voters have also delayed Monju's resumption.

Fast-breeder reactors have often been billed as "dream reactors" because they make more fuel than they consume, producing plutonium by burning the waste left by the conventional light-water reactors.

Major world economies rushed to develop fast-breeders over the past five decades. But a series of problems, along with fears over the proliferation of plutonium, which can be converted to produce nuclear weapons, have led all Western nations to withdraw from the projects. ■

UNSC's Five Express Grave Concern Over Iran's N-Plans

The five United Nations Security Council permanent members - the United States, Russia, China, France and Britain - have recently said they are seriously concerned by Iran's nuclear proliferation "risks" to the world.

The five permanent members - all of whom are nuclear powers - signed a joint statement to the Nuclear Non-Proliferation Treaty (NPT) review conference in New York, backing the NPT as a fundamental treaty to protect world peace and security.

They raised "serious concern" over Iran's nuclear activities and urged North Korea to resume negotiations over its nuclear programmes.

"We underscore the importance of Iran's full and immediate compliance with its international obligations," said the statement.

"We urge Iran to respond to the concerns of the international community by complying promptly and fully with the relevant United Nations Security Council resolutions and with the requirements of the International Atomic Energy Agency (IAEA)."

Tehran has said that its nuclear programme is for civilian purposes and rejected accusations that it seeks nuclear weapons capability.

The five-powers statement said: "We strongly urge the Democratic People's Republic of Korea to fulfill the commitments under the six- party talks, including the complete and verifiable denuclearization of the Korean Peninsula in accordance with the September 2005 joint statement, and we reaffirm our firm support for the six-party talks," it said. The six countries participating in the talks were North and South Korea, the US, China, Japan and Russia.

The five powers are determined to reach a "satisfactory resolution" on the North Korean nuclear dispute through diplomatic means, they said. The talks had agreed on the possibility of making the Korean peninsula free of nuclear weapons in 2005. But since then the parties had not held serious discussions. ■

UN's NPT Review Meet Calls for Peaceful N-Energy Use

Governments attending the United Nations nuclear review conference have called for measures to meet increasing needs for peaceful nuclear energy.

They were participating in the debate on the Nuclear Non-Proliferation Treaty (NPT) in the UN General Assembly held in New York recently.

Ukraine's Foreign Minister Kostyantyn Gryshchenko, whose country still bears an 'open wound' of the Chernobyl nuclear power plant explosion in 1986, said civilian nuclear energy has become a rising international issue.

'We underscore the vital need of peaceful nuclear technology for sustainable development of nations, provided that nuclear activities are subject to full scope safeguards of the International Atomic Energy Agency,' Gryshchenko said.

Gryshchenko said his country, Russia and Belarus will convene an international conference in April 2011, to mark the 25th anniversary of Chernobyl and discuss progress in returning to normal life in countries and regions affected by the radioactive fallout.

He called for the NPT conference to agree to measures to allocate resources to stop nuclear proliferation and make the world free of nuclear weapons. He said Ukraine, which inherited a nuclear arsenal after the breakup of the Soviet bloc, had abandoned all nuclear ambitions to turn to civilian nuclear energy.

Bangladesh's Foreign Minister Dipu Moni said peaceful uses of nuclear energy would contribute to his country's economic development.

Moni said nuclear technology, in addition to electricity generation, can also help developing countries fight hunger, poverty, pollution and manage natural resources. ■

US Signs N-Energy Cooperation Pact with Vietnam

The United States has signed an agreement with Vietnam concerning the use of nuclear energy for peaceful purposes. The Memorandum of Understanding (MoU) between the U.S. and Vietnam was signed in Hanoi recently by Le Dinh Tien, Deputy Minister of Science and Technology of Vietnam and Michael Michalak, U.S. Ambassador to Vietnam.

In a statement, the U.S. State Department said: "This MoU will pave the way in improving cooperation in such fields as human resource development and infrastructure safety and security, and access to reliable sources in the nuclear fuel, radioactive waste management and fuel usage."

Michalak added, "Vietnam has proven its commitment to responsible expansion of nuclear power through certain stages in cooperation with the United States, among other international partners. A strong nuclear infrastructure development requires monitoring of the spread of the first nuclear power plant in decades ahead."

Speaking at the signing ceremony, Michalak said: "Under the MoU, the U.S. and Vietnam will continue its efforts in developing the regulatory and physical infrastructure needed for security and guarantees for Vietnamese citizens who live around the nuclear power plant. This MoU will facilitate cooperation of two countries in areas of the requirements for power reactors and fuel service arrangements, including the development of a reliable source of nuclear fuel for nuclear reactors in Vietnam in the future, thereby encouraging Vietnam to rely on international markets in fulfilling the nuclear fuel ".

Le Dinh Tien stressed that "the Vietnamese are willing to work with international partners on the basis of respect for national independence, sovereignty, and mutually beneficial cooperation."

Besides the U.S., Vietnam had signed nuclear cooperation agreement and assistance with other countries such as Japan, France, China, South Korea and Canada. ■

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