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OPINION – Manpreet Sethi

Great Progress Since Chernobyl—and the Distance Still to Go

A disaster is an event of unanticipated severity and scale that causes damage too great to allow quick recovery. It poses dangers that do not remain within a manageable range. Otherwise, a disaster would not be a disaster—only a crisis.

The key to handling disasters, therefore, is to anticipate—and prepare for—the worst. Fortunately, as science and technology have advanced, so too has human capacity to anticipate and respond to disasters. Nature continues to produce extreme environmental events. But today, the hazardous activities in which human beings engage are generally designed with emergency preparedness and response in mind.

Producing nuclear power is one such activity, but in more than 60 years of operations at power reactors—16,000 cumulative reactor-years—the nuclear industry has witnessed only two disasters, at Chernobyl and Fukushima. And only Chernobyl resulted in fatalities—30 very soon after the event and about two dozen more in the years since, with additional deaths projected in the long term. What these figures indicate is that

Only Chernobyl resulted in fatalities—30 very soon after the event and about two dozen more in the years since, with additional deaths projected in the long term. What these figures indicate is that the nuclear industry attaches due importance to the safety of reactor operations. It well recognizes that even two disasters in six decades, only one of them involving fatalities, have been sufficient to create negative public perceptions of nuclear power.

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There are three primary ways to address this issue. First, the safety of reactor operations can continually be improved. Second, better emergency preparedness and response can be instituted. Third, improvements on both fronts can be communicated to the public. Both the Chernobyl and Fukushima disasters rendered important lessons along all three of these dimensions—but the focus here is improved

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disaster preparedness since the 1980s.

The improvement has been substantive. Chernobyl led to the creation of an international legal framework for emergency preparedness and response, as well as a set of related regulatory processes and official guidelines. Implementing all this is a question of national responsibility. But implementation proceeds in accordance with international benchmarks that were largely created after Chernobyl, and in some cases revised after Fukushima.

Steps Taken: The IAEA has been the lead agency in establishing conventions that specify guidelines for handling emergencies. After Chernobyl, the first such instrument to be adopted was the Convention on Early Notification of a Nuclear Accident. Because Chernobyl had made the transboundary implications of nuclear disasters quite conspicuous, nations brought the Convention into force quickly—by the end of October 1986. The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency was adopted simultaneously, though it did not enter into force until the next year. Both instruments placed specific obligations on states parties, and on the IAEA, to establish arrangements for nuclear or radiological emergencies. These obligations are strengthened by two later conventions—the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. These four conventions cover quite a wide range of nuclear activities.

Over the years, the IAEA has published a series of safety standards meant to enhance national arrangements for safety, preparedness, and response at nuclear power plants. The agency also works to ensure the compatibility of national, bilateral, regional, and international mechanisms

and procedures for disaster response. After Fukushima, the agency's General Safety Requirements were revised to incorporate lessons newly learned. This led to publication of "Preparedness and Response for a Nuclear or Radiological Emergency," a document recommending standards for preparedness and response. Nations can enforce these standards by adopting legislation and regulations; assigning responsibilities to nuclear operators and national and local officials; and establishing regulatory frameworks through which effective implementation can be verified.

But the IAEA is by no means the only agency involved in improving disaster preparedness. In 1986, the Inter-Agency Committee on Radiological and Nuclear Emergencies was created in recognition that cooperation and coordination among agencies is extremely important. Eighteen organizations are part of this mechanism, and they are as diverse as the CTBTO, the WHO, and the International Civil Aviation Organization. The Committee has created a Joint Radiation Emergency Management Plan to harmonize international standards for emergency preparedness and response. The Plan allows for a common understanding of participating organizations' roles, responsibilities, and capabilities—and also provides an overall concept of the group's operations so that quick, coordinated responses are possible.

Steps Still to Take: After Fukushima, nearly all countries operating nuclear reactors undertook reviews of their emergency response systems—and the Japanese government and the IAEA produced reports highlighting several ways in which emergency preparedness could be improved. One such recommendation is that, during an emergency, public officials must have quick access to informed scientific opinion and

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expert judgment so they can make good decisions in extreme time pressure. Certain errors committed during the Fukushima emergency—regarding the timing and extent of evacuations, for example—might have been avoided if officials had had better advice.

A second recommendation is that officials be given the resources to correctly classify the severity of an incident as it occurs. That way, the correct set of standard operating procedures can be activated at the earliest possible moment. Classifying an incident as less severe than it really is—or more—can squander precious time and credibility. Third, the provision of accurate information at all levels is crucial. If operators, for example, attempt to conceal an accident (or its extent) from national or international authorities, an appropriate response is only delayed. At Chernobyl, for example, only limited evacuations from the affected area were ordered—and only after 36 hours had passed. To be sure, Chernobyl's immediate fatalities remained very limited compared to many non-nuclear emergencies. But the disaster was felt across the physical, socioeconomic, political, and psychological spectrum of countries in the region. These effects could have been reduced if accurate information had been available. Finally, emergency capabilities must be coordinated across the local, state, and national levels. But this is only possible if operators conduct periodic drills involving all relevant entities and if deficiencies are conscientiously rectified.

Choosing, Preparing: Energy is the essence of human progress. For countries seeking an energy-rich future, nuclear power is one of many options.

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Nations will make their own sovereign choices, based on their own calculations, about nuclear power. Countries that opt for nuclear power well understand that a great deal of legal and regulatory infrastructure is required if they are to operate nuclear sectors safely and sustainably. One element of this infrastructure is emergency preparedness and response. It is

incumbent on nations to continually improve their capacity for disaster management. Fortunately, international mechanisms for, and national efforts at, disaster preparedness are making this task progressively easier.

Source: Bulletin of the Atomic Scientists, 27 April 2016.

OPINION – K.S. Parthasarthy

The Way Forward at Kakrapar Nuclear Power Plant

Recently, the leakage incident at the Kakrapar Atomic Power Station (KAPS) got wide media coverage. The apparent delay in lifting the plant emergency triggered the fertile imagination of a few. "However, my concerns are more for the workers in the plant," a perennial critic of nuclear power said.

He may not know the robust steps in place to restrict radiation doses to workers in nuclear power plants to less than prescribed limits during their normal operation and to acceptable levels during abnormal events. In KAPS incident, health physics specialists could keep the workers' doses within prescribed limits. An important barrier broke for no known reason, but safety systems worked as per design.

Was there any delay in handling the KAPS incident? NPCIL developed special tools to grab and pull out 12 fuel assemblies, one at a time, applying minimum force, from Q5, the stricken coolant channel. Operators confirmed the overall health of each assembly after transferring them to the inspection bay. After inspecting the special tooling, they used it to retrieve the next assembly.

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Experts from BARC and NPCIL continuously reviewed the progress keeping contingency options ready in case the next assembly removal posed any constraint. Operators recovered the last assembly on 21 March 2016 and arrested the leak by installing the necessary hardware to isolate the channel from the rest of the cooling system. They normalized the reactor coolant system, before the management lifted the plant emergency.

The entire procedure involved mock up trials by dedicated crew, prompt and orderly issuance of work permits and enforcing their conditions, provision of fool-proof protective accessories to workers among other steps. NPCIL's operating and maintenance staff is experienced and capable to handle emergency situations involving radiation exposure. Shri G.R Srinivasan, former Vice Chairman, AERB recalled that radiation exposures were generally satisfactory during en masse coolant channel replacement (which is a good portion of decommissioning) at various plants and during, after and until restart of units after various incidents — end shield repair at Rajasthan Atomic Power Station (RAPS), fire at the Narora Atomic Power Station (NAPS), flooding at KAPS etc. There are not really many incidents in India over 400

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How was this Achieved?:In PHWRs, tritium formed by neutron irradiation of heavy water is an important source of internal radiation as the gas

leaks from the system as tritiated water vapour. When heavy water spillage occurs, NPCIL staff mops it up from sumps. Driers continuously collect tritiated water vapour. Both help to reduce internal dose to workers. The designers reduced the number of valves and made primary transport system in later PHWRs valve-less to reduce leakage

NPCIL reduced activation products in the system by choosing materials containing reduced level of impurities such as cobalt. A discussion with Shri Sanatkumar, former Executive Director, NPCIL revealed several steps taken to reduce radiation levels in TAPP 3&4, the 540 MW PHWRs. During early 1990s when AERB started enforcing lower dose limits for workers in a phased way, doses As Low as Reasonably Achievable (ALARA) became NPCIL's working mantra.

Actions such as addition of change room facilities, zoning, access control, ventilation arrangements;

remote handling and decontamination facilities and hot-spot management helped to achieve the ALARA objective. Judicious use of time, distance and shielding helps to control radiation exposure to workers. NPCIL and BARC specialists depended on the priceless experience and expertise acquired during normal operation and abnormal events to handle the KAPS incident. Delay was justifiable. Hurry may have been costly. Recovery

effort should not obliterate the possible cause of the event. Let us wait for the results of the root cause analysis.

Source: The writer is a former Secretary, AERB. The Hindu, 23 April 2016.

OPINION – Leonid Nersisyan

These Russian Nukes are Better than America's

US-Russia relations (as well as Russia's relations with NATO) have reached a dangerously low point over the last two years—by far their lowest point since the Cold War. As a result, the issue of nuclear weapons has again come to the fore. It has repeatedly been stated, in extremely serious declarations, that both parties are rehearsing nuclear strikes against each other. For example, NATO Secretary General Jens Stoltenberg recently released his annual report, which claims Russia's air force conducted a training mission in 2013 that was actually a "simulated nuclear attack" on Sweden. The report also revealed that this mission involved Tu-2213 Backfire long-range supersonic bombers, under cover of Su-27 fighters. Meanwhile, NATO member Turkey is just a few steps from war with Russia, which does not make the situation any simpler....

Both Parties are Committed to the New START

Treaty: The New Start Treaty... reduces each country's number of nuclear warheads to 1,550. The number of deployed ICBMs and heavy strategic bombers is limited to seven hundred. According to data published by the US Department of State on April 1, both parties are at or near the stated figures. The US possesses 741 deployed launchers equipped with 1,481 nuclear warheads, while Russia

The US possesses 741 deployed launchers equipped with 1,481 nuclear warheads, while Russia possesses 521 launchers equipped with 1,735 nuclear warheads. The difference is insignificant, and does not affect the strategic balance. Russia has fewer launchers at the moment, but this disparity is due to the fact that ICBMs that carry MIRVs...have a wider range of application—one ICBM can carry up to ten warheads.

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US Land-Based ICBMs are Stuck in the 1970s:

The only land-based ICBM in service with the United States is the LGM-30G Minuteman III. Each missile carries one W87 warhead with a capacity of up to three hundred kilotons (though it can carry up to three warheads). The last missile was produced back in 1978, meaning that the "youngest" is thirty-eight years old. The missiles have been upgraded many times, and are intended to be used until 2030.

The US's new ICBM system, the GBSD (Ground-Based Strategic Deterrent), appears to be at a stalemate in the discussion phase. The US Air Force is requesting \$62.3 billion for the development and the production of new missiles, and hopes to receive \$113.9 million in 2017. However, the White House does not support this request. In fact, many are opposed to this idea. The actual development was moved up a year, and the prospects may depend on the outcome of the 2016 presidential election.

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It is worth noting that the US government is going to spend an astonishing amount of money on nuclear weapons: around \$348 billion by 2024, \$26 billion of which is intended for ICBMs. And \$26 billion is not enough for the GBSD.

Actual costs may be higher, given that it has been a long time since the US produced new land-based ICBMs. The latest missile, the LGM118A

Peacekeeper, was deployed in 1986, but all fifty of them were removed from combat duty on a unilateral basis by 2005—and it is safe to say that the LGM118A Peacekeeper was an improvement in comparison with the Minuteman III, because the Peacekeeper could carry up to ten warheads. Despite the failure of the Start II Treaty, which banned the use of MIRVs, the US gave up MIRVs on its own. Its credibility was lost because of the high price, and the scandal in which it was revealed that the missiles were lacking AIRS guidance systems for almost four years (1984–88). On top of that, the missile manufacturer tried to hide the delay in delivery—all while the Cold War was about to come to an end.

Russian Land-Based ICBMs: Emerging Missile Defense Technologies:

Russia possesses a wide range of land-based ICBMs at the moment, including mobile launcher vehicles. In 2015, the Strategic Missile Troops of the Russian Federation (RVSN RF) acquired twenty-four new RS-24 Yars units (NATO reporting name: SS-27 Mod 2), in both silo-based and mobile versions. This missile can carry up three or four independently targetable warheads capable of penetrating missile-defense systems. It is safe to assume that that the volume of delivery in 2016 will be at least equal to the 2015 level. Russia will be able to replace the Topol missile (essentially equivalent to the Minuteman III) by 2020, with the newest missiles, which are specifically designed to penetrate enemy missile-defense systems.

Russia also possesses heavy land-based, liquid-fuelled ICBMs. The R-36M2 Voevoda (NATO reporting name: SS-18 Mod 5, Satan), which has been in service since 1988, is very well known. It can carry up to ten warheads with a capacity of up to 750 kilotons each. This year the test will be conducted on the RS-28 (also referred to as “Sarmat”), the newest development intended to replace the Satan in 2020 and fully equipped to defeat missile defense systems. First of all, it is expected that the missile will have the ability to

place the warhead in a suborbital trajectory (shorter than the circular orbit that is off-limits under the international agreement) and strike from literally anywhere, even from the South Pole. It forces the suspected enemy to build an integrated missile-defense system, which is extremely expensive, even for the US. Moreover, the warheads will enter the atmosphere at hypersonic speed and move along a larger trajectory, maneuvering at a speed of 7 to 7.5 kilometers per second. Time of pre-launch preparation of the missile will be kept to a minimum: less than one minute after receiving the order.

Russia also has the mysterious RS-26 Rubezh. Not much information is available, but apparently it is a modification of the PS-24 Yars, with the ability to strike at intercontinental and medium range. Its minimum firing range is reportedly two

thousand kilometers, which is enough to defeat the American missile-defense system in Europe. The US opposes it, on the grounds that deploying the RS-26 is a violation of the Intermediate-Range Nuclear Forces Treaty. But this claim does not stand up

to criticism: the RS-26’s maximum firing range exceeds six thousand kilometers, which means that it is in fact an ICBM, not an IRBM.

Given the evidence, the US lags far behind Russia in the development of land-based ICBMs. The US States has one, to be fair very outmoded, ICBM: the Minuteman III, capable of carrying only one warhead, and the prospects of developing a replacement are very indistinct. In Russia, the situation could not be more different. Land-based ICBMs are being renewed on a regular basis—in fact, the process of developing new missiles never really ends. Each new ICBM is designed to penetrate missile-defense systems, which makes the EuroPRO project and Ground-Based Midcourse Defense (the US antiballistic system for intercepting incoming warheads) ineffective against Russia in the foreseeable future.

Source: <http://nationalinterest.org/>, 25 April 2016.

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OPINION – Alan Neuhauser

30 Years after Chernobyl, Anxious Eyes Turn to China

In the nuclear power world, China is king. But as other countries collaborate, it remains secretive, raising safety concerns. In the realm of nuclear power, there is China, and then there is the rest of the world. By any count, the pace of construction is astronomical: Half the reactors built around the world in the past two decades were constructed in the People's Republic of China. Aiming to expand the country's electric grid and clean the air, another 22 are under construction. Still another 42 are proposed.

Yet 30 years after the catastrophe at Chernobyl in Ukraine – the worst nuclear disaster in world history, one triggered by a design flaw that had been known about in Moscow but hidden from the world by Soviet secrecy – discerning the safety risks at China's nuclear plants is akin to trying to peer through a reactor's concrete containment dome. "China is totally nontransparent on these issues," says Albert Lai, founding chairman of the Professional Commons, a public policy think tank in Hong Kong. "The only information we've gotten so far – strangely – is from France."...

Yet the project was soon mired by delays and cost overruns: Regulators discovered flaws in the reactors' concrete foundations in Finland, and there were problems with the French reactor's steel dome and base. Yet in China, the work pressed on – until French regulators pointed out the very same issues there last year. "What if the French did not notify the Chinese authorities?" Lai says. "The nuclear fuel

would have been put into the plant, the plant would have been up and running with the flaw."

China is hardly the only country where nuclear safety is under scrutiny. More than three-fourths of the nuclear power plants in the US have leaked radiation and faced pointed questions about maintenance and security... Even the French nuclear powerhouse Areva, which sells nuclear fuel and builds power plants, went virtually bankrupt in January 2016, inflaming concerns over whether it's able to guarantee the safety and security of sensitive nuclear materials.

...Yet China, between its nuclear building boom and cloak of secrecy, stands alone. China's first-ever white paper on its nuclear industry, released in January 2016 found its ability to respond to an emergency is "inadequate." A visit by a delegation from the IAEA in July 2010 uncovered dozens of safety problems, including a lack of resources for the agency in charge of regulating the country's nuclear plants.

"The speed with which they've been building the nuclear power program is insane," says Mycle Schneider, an independent energy and nuclear policy analyst based in Paris, and convening lead author of the World Nuclear Industry Status Report. It's stretched the country's nuclear workforce, thinly spreading engineers and experts across dozens of different projects, rather than keeping that expertise concentrated at just a handful of plants, Schneider says. And that's occurred just as the plants are in the riskiest stages of their lives.

The reactors at Chernobyl were not some aging, crumbling legacy of the Soviet Union; Unit 4

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exploded just two years after it started commercial operation, as workers were still learning and kinks were being worked out. The same was true at Three Mile Island in Pennsylvania, where a partial meltdown of a new reactor released a plume of radiation in the worst nuclear accident in the US

It's what's known in engineering as the bathtub curve: Danger is most pronounced at the beginning and at the end – before new knowledge becomes institutional experience – and later, when infrastructure begins to crumble. "Where you want to be is one of the countries that has reactors in the flat part of the curve, where the risk is not zero, but lower," Lochbaum says. "China has a lot of plants on the break-in area of this curve."

..."China still has a long way to go before it gets there to inspire the confidence of countries all around the world." After learning about the flaws at the two new Taishan reactors, China's nuclear regulator announced in January that work at the plant would halt completely. Just hours later, there was another press release: The reactors' owner, the China General Nuclear Power Corp., announced it had begun testing – another step toward commissioning the plant.

Source: <http://www.usnews.com/>, 26 April 2016.

OPINION – Yonah Jeremy Bob

Where will Iran Nuclear Deal Loopholes Stand Next Passover?

In the four months since the Iran nuclear deal went into effect on January 16, the first signs of how the deal is going to play out in practice are appearing. Pointing to the treaty's various holes, critics wonder where the deal will stand next Passover, just slightly more than one year into the 8-10-15-25 year deal.

Before getting into how the holes may play out, it is important to also understand the benefits – at least short term – as they will impact how the key parties view those holes. First, surprising many critics, Iran essentially followed the letter of the law for the deal and, whether the deal is good or bad, stepped backward delaying for at least some months how soon it could produce a nuclear bomb.

It shipped out around 8,000 of 8,306 kg of uranium ready to be enriched to higher levels (which could have been enough for at least seven nuclear bombs) to Russia, despite having vowed at earlier stages that it would never do this. It dismantled around 13,000 out of around 19,000 centrifuges for enriching uranium despite having also made a vow never to do that. It disabled key parts of its plutonium producing facility in Arak.

IDF Chief of Staff Lt.-Gen. Gadi Eisenkot has said that Iran's concessions have positively altered the IDF's planning and budget decisions for the next three to five years. The IDF can move from being constantly ready for a potential Iran strike to a lower level of readiness so that the funds can be used for other challenges, he said. The funds are needed for more training for reserves, cyber operations and addressing other threats like Hamas's attack tunnels, and Hamas's and Hezbollah's rockets.

None of this means that the holes that have been noted are not there. But it does mean that critics are recalibrating to focus on the long-term issues with the deal which critics highlighted when the deal was announced. On March 8 and 9, Iran violated UN Security Council Resolution 2231 banning missile tests involving missiles capable of delivering nuclear weapons (even if they can also serve as standard conventional missiles also.) From a strictly technical perspective, these tests did not violate the nuclear deal, which mostly concerns itself with limiting the amount of enriched uranium

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Iran can stockpile, limiting the number of operating centrifuges and limiting activities which have solely nuclear applications.

But the Western powers agreed that Iran has a political obligation not to test either conventional or nuclear missiles for eight years. Absent complying with this political ban, there are heavy suspicions that

Iran will solve all remaining obstacles it was facing to mounting and delivering a nuclear payload on such missiles, while using refraining enriching uranium as a fig leaf to pretend that it is not moving forward to a nuclear bomb.

Critics say that since Iran has mastered the process of enriching enough uranium for a bomb and has only disassembled but not destroyed its centrifuges, that it could continue to work on solving missile delivery problems and after solving those issues, could then more easily breakout.

Western reactions were weak, with Russia and China fighting sanctions and only the US and possibly a few European countries imposing ineffectual sanctions as a response.

By next Passover, we will know if March 8-9 was a blip, and Iran was just doing face-saving tests to assuage domestic criticism for having rewind its nuclear program significantly, or whether it is part of a pattern pushing the envelope on the deal's limits and daring the West to endanger the deal by confronting it.

Iran unveiled parts of its long-awaited S-300 missile defense system from Russia. In the worst case scenario, the S-300 could complicate efforts by the US or Israeli air forces to bomb Iranian nuclear facilities should it suddenly try to break out beyond the nuclear bomb threshold. But this development, could be a serious hole in the ability of the US and Israel to enforce the nuclear deal

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sensitive centrifuge technology could be transferred to Iran inside Russia, while aspects of the transaction take place on Russian soil without oversight. The same is true for China.

Russia has promised to send the rest of the parts of the system by the end of this year, which means that by next Passover it may finally be clear how much the new missile defense system impacts the military option. On April 21, the Institute for Science and International Security (ISIS),

a regular critic of the deal, issued a report warning of possibly the most worrisome abuse of holes in the deal to date.

The deal has a "Procurement Channel" which allows states to sell goods to Iran once the transactions have been vetted by a Joint Commission including Western powers. The purpose is to make sure that there are not hidden violations with exporting goods connected to Iran's authorized nuclear program and related programs.

Ideally, the institute said, the procurement channel can be a valuable tool to verify that Iran is not acquiring good for undeclared nuclear activities or secretly surging in building up nuclear capabilities. Russia and China negotiated that renovations they do at the Fordow and Arak facilities are exempt from the procurement channel. The report said that sensitive centrifuge technology could be transferred to Iran inside Russia, while aspects of the transaction take place on Russian soil without oversight. The same is true for China.

By next Passover, it will become clearer if the joint Iran-Russia-China moves merely are to cut through bureaucracy or are a means to exploit the deal's holes in ways which could make Iran breaking out a concern long-before most of its provisions expire in around 10 years. In short, as many predicted, Iran, along with Russia and China, only a few months into implementing the deal have proven

adept at finding loopholes which could become chasms.

Next Passover, it will be clearer whether the West's current grudging tolerance of these moves is flexibility to preserve a deal that at least has short-term benefits or a dangerous weakness that could endanger the deal's goal of preventing Iran from going nuclear.

Source: <http://www.jpost.com/>, 26 April 2016.

OPINION – Uday Deshwal

Radiological Terrorism – 'Dirty Bombs' and Beyond

In a pre-Nuclear Security Summit activity, the NTI...released a 'Radiological Progress Project Report' on 23 March 2016. The report, while reviewing the progress made by 23 of the participating states (including Australia, Canada, Denmark, Germany, Italy, Japan, Kazakhstan, Republic of Korea, Turkey, UAE, UK, and the US) in their commitments, in accordance with the '2014 NSS Joint Statement on Enhancing Radiological Security', aimed to raise "awareness and urgency to reduce the threat of the use of dangerous isotopes, develop a more effective system for securing radioactive sources, and replace the use of dangerous isotopes..." India was not party to this particular gift-basket from the previous summit.

However, in his visit to Washington for the 2016 Nuclear Security Summit, PM Modi announced several key initiatives taken by the government in the area of nuclear security and nonproliferation...confirmed that India would be "joining the three 'gift-baskets' for this summit in the priority areas of countering nuclear smuggling, nuclear security contact group in Vienna, and sharing of best practices through Centres of Excellence." Additionally, he assured the "strengthening of the national detection

architecture for nuclear and radioactive material, along with a plan of using vitrified forms of vulnerable radioisotopes such as cesium-137."

Before 9/11, the use of radiation and its harmful effects was considered in at least two popular instances: General Douglas McArthur had suggested sowing "dangerous levels of radioactivity" along the Korean-Chinese border to prevent the Chinese from playing any further role on the ground in the Korean War; later, Saddam Hussein, in his efforts to acquire CBRN capabilities, was believed to have experimented with the development of ways to disseminate radioactive material. In the aftermath of the events

More recently, with the rise of the Islamic State (IS) and the increased level of terrorist activities in Europe, the discussion over the level of threat from nuclear and radiological terrorism has once again found some traction in the Western countries. Some have argued that the possible risk of use of nuclear and radiological material might just be higher than it has previously been

of 9/11 and al Qaeda's subsequent announcement of their inclination toward using WMDs, a lot of attention was given to the possible use of so-called 'dirty bombs'. However, as the threat from al Qaeda waned and with no reported activity on the use of the dirty bombs, so did the threat perception surrounding them.

But more recently, with the rise of the Islamic State (IS) and the increased level of terrorist activities in Europe, the discussion over the level of threat from nuclear and radiological terrorism has once again found some traction in the Western countries. Some have argued that the possible risk of use of nuclear and radiological material might just be higher than it has previously been, and yet there are others who don't want to attach a sense of alarmism to such a threat just yet. In the Indian context, what is alarming is the lack of media or public attention and knowledge on the issue of radiological security and the threat from non-state actor use of radiological materials (i.e., radiological terrorism)...

Radiological Terrorism 101: There are tens of thousands of functioning radioactive sources in over 100 countries, and these sources find applications in multiple medicinal (including

cancer treatment), industrial, and agricultural purposes. While these sources are highly beneficial for mankind, some of these very same sources, however, can also be critical ingredients for a RDD, more generally termed as a 'dirty bomb'....

What is a 'Dirty Bomb'?: A 'dirty bomb' is defined as a crude device that is intended to disperse powdered (or ground) high-risk radioactive material through the detonation of a mixture of said radioactive material and varying quantities of conventional explosives.

What are the High-risk Radioactive Materials?: From a security risk point of view, radioisotopes having what we may call "intermediate" half-lives, i.e., ranging from a few days to about a thousand years are of specific concern. A majority of radioisotopes either have a very short or very long half-life, and so that leaves us with about a couple of dozen radioisotopes that match the criteria of having intermediate half-lives. Add to that the high level of prevalence of use of such a group of radioisotopes in commercially used and widely available radioactive sources, and we are left with no more than a dozen high-risk radioisotopes.

Cobalt-60 (Co-60), cesium-137 (Cs-137), strontium-90 (Sr-90), iridium-192 (Ir-192), among others, are some of the highly radioactive isotopes that are widely used in various medicinal, commercial, and industrial sources of applications including sterilisation and food irradiation, single- and multi-beam tele-therapy, industrial radiography, high- and medium-dose brachytherapy, research and blood irradiators, level and conveyor gauges, radioisotope thermoelectric generators, etc. The IAEA, keeping in mind the potential harm to human health, has categorised the commercially used radioactive sources based on radiation safety hazards as high-risk Category 1, 2, and 3 sources. The relative security threat from each of these isotopes will vary....

Is a 'dirty bomb' the only malicious way of disseminating high-risk radioactive materials? Generally, the threat from radiological terrorism

is almost exclusively restricted to the use of 'dirty bombs' – which is technically just one type of a Radiological Dispersal Device (RDD), which itself is one of the different possible ways of disseminating radioactive materials. While, a 'dirty bomb' may well be the most plausible form of dissemination of radioactive materials, a complete disregard for other forms of dissemination can lead to a misappropriation and limitation of the perceived threat from radiological terrorism.

an there be other radiological weapons?: Drawing from a proposed definition by George Moore, a radiological weapon can more simply be defined as any device or method, except for a nuclear yield-producing device, that intentionally and maliciously uses, or intends to intentionally and maliciously use, radiation from the decay of radioactive materials to cause injury to person or property by unlicensed exposure.

Thus, in addition to a 'dirty bomb', other types of RDDs may comprise the spread of radioactive materials through non-explosive and passive or active means. The design and form of attack of a dirty bomb limits the use of a gamma emitting radioactive material to maximise the external radiation threat. However, in their 2007 study, James Acton, Brooke M. Rogers, and Peter D. Zimmerman have suggested alternative non-explosive forms of radiation dispersal, focussing on terrorist intention to killing by inducing large internal radiation doses (bringing into play a larger number of alpha and beta emitting radioactive materials, which are highly dangerous once inside the body) through what they described as the "inhalation, ingestion, and immersion, or I3, attacks".

The scenarios include the spreading of radioactivity through dissemination of radioactive materials in an aerosolised form to be more effective in getting the targets to inhale them. Sprayers can be used in crowded streets or at iconic sites of a city; airplanes used for crop dusting can also be employed to do the same. The aerosolised material can even be disseminated through ventilation systems in closed places such as theatres, concert venues,

sports arenas, etc. Even the intentional spreading of materials by mail (similar to the Anthrax attacks) would constitute an RDD. If carried out successfully, the 13 attacks can be operationally more useful and at the same time presumably easier to carry out for the non-state actors. Unlike a dirty bomb attack, these attacks may take longer to be identified, leading to a wider spread of contamination. A relevant example here would be the use of Polonium-210 (possibly by the Russian government) to poison Alexander Litvinenko, a former KGB agent. He reportedly died within three weeks of being exposed to the radioactive material. It was already too late by the time it could be successfully detected that he was in fact suffering from radiation sickness.

Radiation Emission Device (RED) is another possible type of radiological weapon, which can include an unshielded stationary or mobile radioactive source that is emitting radiation. This type of device can be used to expose: a large number of people (a large source of highly radioactive material placed in a crowded place or being moved around through a large crowd – for instance, a device placed in a metro or train compartment); or, a specific or a small set of individuals (a smaller source and amount of highly radioactive material placed in close proximity – for example a device concealed in a part of the office of particular high-profile victim/s).

What are the economic effects?: A successful and large-scale RDD attack in strategic and iconic locations in an urban city, can lead to a large-scale economic disruption. Such an attack could lead to a temporarily indefinite shutting down of the affected area, till the area is fully decontaminated and the radiation levels are restored to below the usual background levels. The present decontamination techniques are largely restricted in their effectiveness to say the least and according to relevant US government officials, “existing decontamination techniques and procedures cannot facilitate quick, efficient recovery in a large urban environment” and that

in the case of large-scale radiological terror acts it could take “billions of dollars and years or even decades to complete” decontamination efforts of such a massive scale. Additionally, if the affected area were a commercial hub or a market (shopping or stock), all trade and businesses, small or large, and related economic activity would come to a halt. Depending on the time to completely decontaminate the concerned area, it would be

long before any commercial activity can resume. This resumption could be further affected by the reluctance of people to head back to the area, as the fears of radiation will continue to exist in people’s memories....

What is the scope of the threat in India?:

The potential for radiological terrorism in a volatile region like South Asia, and especially India, can be identified as a sum of: the persistence of terrorist threats and attacks from various non-state actors in the country and the region (where groups have shown a proclivity towards sophisticated means of causing mass disruption and deaths); and, the wide availability of commercial radioactive sources in places with less stringent security measures like hospitals and universities, etc. The possible acquisition pathways of getting hold of radioactive materials/sources can include theft from the various facilities holding such sources, insider threat, fraudulent purchase of radioactive sources, and orphaned sources.

...At worst, radiological terrorism can offer an added dimension of the fear of the unknown and can be a potent way of bringing about mass disruption through deaths, radiation injuries, and a psychological, political, and economic breakdown of society and possibly the breakdown of the state’s machinery.

Having said that, and in assuaging the alarmist fear of the possibility of an act of radiological terrorism, it should also be noted that the list of Indian regulatory, legal, and other official provisions for the safety and security of radioactive sources is exhaustive. On paper, the institutional

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infrastructures are strong, comprehensive, and in accordance with the international standards...

...In conclusion, it can be said that while implementation of provisions to prevent non-state actors from gaining access to radioactive materials, and a perceived lack of motivation among terrorist groups of carrying out such an act of terrorism thus far, suggests that the threat of radiological terrorism may not be as acute as is made out to be at times, yet there is a need for preparedness and public awareness to guard against such a terrible eventuality.

Source: Excerpted. dhttp://thewire.in/, 26 April 2016.

OPINION – Sitara Noor

Nuclear Norms

The Hiroshima Declaration at the end of a two-day meeting of the foreign ministers of the G7 states earlier in April committed to seek “a safer world for all and to create the conditions for a world without nuclear weapons in a way that promotes international stability”. The statement used many euphemisms to justify states’ security compulsions and, as expected, fell short of guaranteeing a world without nuclear weapons. This, once again, highlights the incessant struggle between the normative approach to the complete elimination of nuclear weapons and the politics of national security. This is largely because norms, as a form of behaviour, fall into an idealistic paradigm, while national security is based on realpolitik considerations, thus creating a dichotomy for the decision-maker. This contradiction is even more visible in the domain of nuclear norms, both existing and developing ones.

The non-use of nuclear weapons, or the so-called ‘nuclear taboo’, has emerged as a longstanding nuclear norm over the years. The horrific impact of nuclear bombs dropped on the Japanese cities, killing thousands of people in an instant, was indeed sufficient reason to initiate a counter thought. It is, however, interesting to note that the non-use of nuclear weapons emerged as a

norm only after the Soviet Union had equalised the balance of power and the potential use of nuclear weapons lost its policy value due to the threat of massive retaliation. This established norm managed to give rise to a universal abhorrence towards the idea of nuclear use, but it has not been strong enough to compel any concrete measure towards complete nuclear disarmament, primarily because it has not served the national interests of the weapons-possessing states.

It, however, gave rise to subsidiary arrangements, such as non-proliferation, which was later codified into a formal Treaty of Nuclear Non-Proliferation, which included an article with a categorical commitment to nuclear disarmament. Despite the failure of nuclear disarmament to develop as a practiced norm due to the possessing states’ national security concerns, non-proliferation has emerged as a new normative approach. The norm of non-proliferation achieved momentum and successfully managed to constrain the number of weapons-possessing

states and reach near universality. Nevertheless, one major challenge to non-proliferation is the selective approach taken by leading states to incorporate so-called ‘outlier states’, without a criteria in the non-proliferation regime. It is, therefore, imperative that efforts should be made to strengthen existing

nuclear norms and to avoid making country-specific concessions with detrimental effects on the non-proliferation regime.

With the commencement of the Nuclear Security Summit (NSS) process in 2010, nuclear security had the potential to emerge as a new norm. Notwithstanding the criticism on its exclusive nature, the NSS process has created the opportunity for the adoption of a normative approach towards nuclear security. Nuclear security challenges pose a threat to global security, but this is an area where states are reluctant to enter into legally binding commitments. But the NSS process has laid the groundwork for recognition of the threat and has encouraged states to take voluntary action that, in turn, will ensure global security. As a direct result of

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commitments made at the last three sessions of the NSS, 12 countries have eliminated HEU, or separated plutonium from their territories. Twenty-seven states have removed approximately 3,000 kgs of HEU and separated plutonium. Fourteen countries have opted for using low-enriched uranium in 24 reactors. While many may argue that the NSS process outcomes did not match the hype created around it, it remains a fact that the successful legacy of the NSS process has been the recognition of the challenge and adoption of nuclear security as a desired form of behaviour by the states. This is also manifested in the entry into force of the amendment to the Convention on Physical Protection of Nuclear Material and Facilities.

In the nuclear domain, one major challenge remains: emerging threats are outpacing the counter measures adopted by the states. While it takes longer to establish and agree on legally binding commitments to control nuclear behaviour, the establishment of new nuclear norms and consolidating existing ones may serve as a temporary substitute to deal with the emerging challenges.

Source: <http://tribune.com.pk/>, 26 April 2016.

NUCLEAR STRATEGY

INDIA

INS Arihant, India's Only Indigenous Nuclear Submarine, to Debut as Soon as May

INS Arihant has completed all trials and weapon launch tests, and is soon going to be inducted in India's Navy fleet. This is a big fillip to PM Modi's Make-in-India campaign as INS is India's first indigenously developed nuclear armed submarine. Top government sources said Modi is likely to announce the formal induction in the Indian Navy anytime soon.

Sources said the induction of this 6000 tonne plus indigenous nuclear submarine should coincide with the completion of Modi government's two years in office on May 26 2016. "The submarine has passed all deep water and other tests and is

ready for induction. It is just a matter of time that its formal induction (which is closely being monitored by the Prime Minister's Office) will be announced," said a source close to the development.

With the induction of INS Arihant, India will join one of the few super powers in the world that possess the knowledge of designing, engineering and operating a nuclear submarine. Arihant is the lead ship of the five nuclear powered ballistic missile submarines launched in 2009.

Built at Vishakhapatnam, Arihant has been designed, developed and engineered by various agencies including the DRDO, the DAE and the Submarine Design Group of the Directorate of Naval Design, besides private companies such as L&T.

As against a conventional diesel-electric submarine, nuclear submarines have

the capability to stay out at sea longer and without the need to come up to the surface. Arihant draws its design from design consultations with Russian design bureaus and possesses capabilities to be equipped with short range missiles as also the K4 long range ballistic missile. "The indigenous nuclear submarine has passed all major tests," sources said. India currently operates Russian-origin nuclear-powered submarine INS Chakra, which it leased for 10 years from Russia in 2012. However, the INS Chakra does not carry nuclear weapons.

Source: <http://www.businessinsider.in/>, 25 April 2016.

UKRAINE

Why Ukraine's New Tactical Missile is Little More than Flying Hunk of Metal

The Ukrainian Defense Ministry reported that it has successfully tested a new tactical ballistic missile. Officials boast that the missile has a range of up to 300 kilometers, and can be armed with various types of warheads, including nuclear. But military experts suggest that the 'new' weapon is actually just an upgrade of an old Soviet design.

...According to RNBO First Deputy Secretary Oleg

Gladkovsky, who supervised testing, the missile can be equipped with various types of warheads, including nuclear ones, and has a range of up to 300 kilometers. The Ukrainian media has since added that the missile itself is believed to be maneuverable, and that a full volley can be launched in only 38 seconds.... RNBO Secretary Oleksander Turchynov emphasized that the restoration of a missile shield was "one of the priorities for the defense and security of our country."

...The Security and Defense Council has not offered details on the type or even the class of the new missile, but experts at the Russian Center for Analysis of Strategies and Technologies, analyzing photo and video material, concluded that the missile was launched from a MAZ-543 self-propelled launcher, which is the same vehicle used by the Smerch Multiple Launch Rocket System (MLRS). ...According to Turchynov, the new missile is not the only such project being developed by the Ukrainian military industry. "We are preparing powerful and effective missiles, which will reliably defend our country," the RNBO secretary emphasized.

...The military analyst added, the touted 300 kilometer range of the new missile is, "by modern standards, very modest. Yes, the first Soviet-era Smerch MLRS had a range of just 90 kilometers; but later, warheads were transferred to missiles using a high-performance composite solid propellant, which reduced their weight and significantly increased flight range." Unfortunately, "this solid propellant is not manufactured in Ukraine. Therefore, it will be difficult for the Ukrainians to increase the missile's range."

..."Furthermore, it's not enough to simply design a missile. It must also be produced. Meanwhile, Yuzhmash, the leading Ukrainian enterprise charged with the production of rocket and space technology, has factually been left to die. Ukraine severed its military-technical cooperation with Russia long ago. This led to a situation where we stopped ordering rocket boosters from Ukraine, and other countries too have since abandoned the use of Ukrainian rocket technology. As a result,

Yuzhmash is on the verge of bankruptcy, and its equipment has either been mothballed or sold off."

Producing a short-range missile, Murakhovsky emphasized, requires vast resources, including the existence of a production chain. "Since Soviet times, Ukraine has had a substantial portion of this production, but many components, aggregates and assemblies were received from Russia. Now, understandably, these channels have been blocked," and alone it will be very difficult for Ukraine to create anything qualitatively new.

Finally, regarding the missile's much-touted ability to carry a nuclear round, Murakhovsky noted that of course, in principle, it is possible.

The Declaration of State Sovereignty of Ukraine dated July 16, 1990 clearly states that Ukraine must 'not take, produce or transfer nuclear weapons'

"But in this case Kiev would break the provisions of the Treaty on the Non-Proliferation of Nuclear Weapons, to which it is a party. Moreover, the

Declaration of State Sovereignty of Ukraine dated July 16, 1990 clearly states that Ukraine must 'not take, produce or transfer nuclear weapons'. If Ukraine violates these agreements, they would immediately become a pariah state in the international community, and face the same fate as North Korea."

...For his part, Center for Analysis of Strategies and Technologies director Ivan Konovalov was more blunt, telling Svobodnaya Pressa that "lately, the Ukrainian defense industry has been repackaging Soviet designs and passing them off as something new." "In September 2014, the Ukrainian military demonstrated the 'Korshun', the first anti-ship missile of its own design. It was constructed at the Yuzhnoe Design Office, and in a fairly short period of time." Soon, it was discovered that the Korshun "was very similar to the Russian Kh-55 long-range cruise missile, produced at the Kharkov State Aircraft Manufacturing Company since at least 1986. Most likely, the necessary documentation survived, and came in handy for designers at Yuzhnoe."

As for the new missile, Konovalov noted that while it could actually be regarded as a modest success for the Ukrainian defense industry, "the Security and Defense Council's statements are always more about politics than about military-technological achievements and common sense."...

Source: <http://sputniknews.com/>, 24 April 2016.

BALLISTIC MISSILE DEFENCE

IRAN

Iran test-fired an advanced rocket system in the Dasht-e Kavir desert, according to Russian and American officials, in what some considered a cover for intercontinental ballistic missile research. The Simorgh, as the rocket is known, is ostensibly designed to launch satellites into orbit. However, the technology involved is "practically identical" to intercontinental ballistic missiles, or ICBMs, and could be used to launch a nuclear device at targets thousands of miles away, according to Amir Toumaj, a research analyst at the Washington-based Foundation for Defense of Democracies think tank.

Iran is called upon not to undertake any activity related to ballistic missiles designed to be capable of delivering nuclear weapons, including launches using such ballistic missile technology" until October 2023. That has not stopped Iran from carrying out four tests of ballistic missile technology.

The rocket launch was initially detected by two separate Russian radar stations at 9:33 a.m. GMT on 19 April 2016, Russian media reported, and it was later confirmed by US sources who first disclosed the test fire to the Washington Free Beacon....

...According to the UN decision, "Iran is called upon not to undertake any activity related to ballistic missiles designed to be capable of delivering nuclear weapons, including launches using such ballistic missile technology" until October 2023. That has not stopped Iran from carrying out four tests of ballistic missile technology, including this most recent one, since the nuclear deal was adopted on 18 October 2015. Though some US officials confirmed news of launch, the US State Department spokesperson

refused to publicly acknowledge it, saying only he'd "seen these reports."

...It was not immediately clear if the launch was a success, in large part because the exact purpose of the test was not known. The rocket did not exit earth's atmosphere, which prompted some US officials to tell *Fox News* that Iran had not achieved its goal. However, if the intent of the launch was not to put a satellite into orbit, but rather to test just the first stage of the rocket test may indeed have fulfilled its mission, which was Toumaj's assessment of the launch.

...The rocket, dubbed the Simorgh after a griffin-like creature in Persian mythology, was first unveiled in 2010, but was mothballed for a few years, "possibly due to budgetary issues," according to Toumaj, whose research focuses on Iranian issues. It is a liquid-fueled rocket similar to the North Korean Unha, which makes sense considering "the cooperation between Tehran and Pyongyang on ballistic missiles is well-documented"....

...Iran is on track to develop an operational ICBM by the year 2020, Admiral William Gortney of the North American Aerospace Defense Command told the US Senate Armed Services Committee earlier in April. "Iran's continuing pursuit of long-range missile capabilities and ballistic missile and space launch programs, in defiance of UNSCR, remains a serious concern," Gortney added.

...Iran's Foreign Minister Mohammad Javad Zarif brushed off the threat of UN action in March, saying the resolution was non-binding. According to Zarif, the wording of the decision — that Iran is merely "called upon" not to test ballistic missiles — does not make it legally obligatory. Moreover, since Iran does not yet possess nuclear weapons, the Islamic Republic "[does] not design any missiles to carry things we do not have," Zarif said during a press conference in Australia. This is

something of a fatuous argument, as “these ballistic missiles are inherently nuclear-capable,” Toumaj said, whether they are specifically designed to carry an atomic device or not.

Source: <http://www.timesofisrael.com/>, 26 April 2016.

NUCLEAR ENERGY

CHINA

China to Develop Floating Nuclear Power Plants

All the radar systems, lighthouses, barracks, ports and airfields that China has set up on its newly built island chain in the South China Sea require tremendous amounts of electricity, which is hard to come by in a place hundreds of miles from the country’s power grid. Beijing may have come up with a solution: floating nuclear power plants.

A state-owned company, China Shipbuilding Industry Corporation, is planning to build a fleet of the vessels to provide electricity to remote locations including offshore oil platforms and the contentious man-made islands.

A state-owned company, China Shipbuilding Industry Corporation, is planning to build a fleet of the vessels to provide electricity to remote locations including offshore oil platforms and the contentious man-made islands.... The paper quoted an executive at the company, Liu Zhengguo, as saying that “demand is pretty strong” for the floating power stations, which would be built by one of its subsidiaries.

...Mr. Xu said at the time that developing China’s nuclear power-generating capacity was part of the country’s five-year economic development plan, which runs through 2020. China has more civilian nuclear power stations under construction than any other country.

...Typhoons regularly cross the South China Sea, and ships and submarines that run on nuclear power generally have the means to quickly sail away from a storm. It is unclear how mobile or

seaworthy these reactor ships will be. Safety regulations for the seaborne reactors are being drawn up and reviewed, Global Times said, quoting Tang Bo, an official at China’s National Nuclear Safety Administration. David Lochbaum, a nuclear engineer and the director of the Nuclear Safety Project for the Union of Concerned Scientists, said that in the event of a major nuclear accident at a floating barge, like a meltdown of the reactor core, winds could carry radioactivity to large population centers.

“The floating nuke accident scenario also carries with it the potential for molten parts of the reactor core burning through the bottom of the barge to reach the water below,” Mr. Lochbaum wrote in an email. “The water is good for cooling, but not good for containment.”

...China would be placing floating atomic power stations at islands that until recently did not exist in seas claimed by several nations. The artificial islands built by the Chinese in the past two years in disputed waters of the South China Sea have stoked tensions with neighbors, especially the Philippines and Vietnam, and prompted the US to assert its right to transit the area freely by sailing navy ships close to the islands, often shadowed by Chinese vessels.

...Mr. Poling said it was too soon to tell how a possible deployment of the floating nuclear power stations would play out in the complicated politics of the South China Sea, though he said it was “potentially worrisome.” “But it appears that the idea hasn’t gotten any farther than conceptualization yet, so we seem to have years to wait before we find out,” Mr. Poling wrote in an email.

It is unclear how mobile or seaworthy these reactor ships will be. Safety regulations for the seaborne reactors are being drawn up and reviewed.

A rendering of a possible Chinese floating nuclear power station was published on the English-language website of Global Times’s parent company, the Communist Party’s flagship

newspaper, People's Daily. The image showed the small ship or barge next to a pier, surrounded by what looked like floating ice.

Source: <http://www.nytimes.com/>, 22 April 2016.

INDIA

India's Nuclear Power Agency Clears Insurance for Reactors

India's nuclear power agency has cleared a long-delayed insurance policy for all 21 reactors...marking a significant leap in the country's ambitious plans to become one of the world's top nuclear power generators. Officials said the insurance policy was cleared by the board of the NPCIL under the India Nuclear Insurance Pool (INIP), set up in June 2015 to address liability issues for both operators and suppliers.

The insurance policy of suppliers was also finalised on 21 April 2016 and is likely to be cleared in the next meeting between GIC Re, the lead manager of the Insurance Pool, and industry representatives, they added. India plans to build around 60 nuclear reactors with an aim to produce 63,000 MW of power by 2032, from 5,780 MW at present, as part of a broader push to move away from fossil fuels and cut greenhouse gas emissions.

A 2010 law giving the state-run NPCIL the right to seek damages from suppliers in the event of an accident had been putting off suppliers till now. ...India has already deposited its instrument of ratification for the Convention on Supplementary Compensation for Nuclear Damage (CSC) with the IAEA in February 2016. The CSC requires signatories to channel liability to the operator and offers access to relief funds.

An official said the Modi government set up a Rs 1,500-crore insurance pool after putting the liability issue on fast track. Westinghouse Corporation submitted its techno-commercial bid for six nuclear reactors for the 6000 MW Mithi-Virdi power plant in Gujarat in February 2016 and an empowered committee will evaluate the bid on April 28 2016 in Mumbai. The Westinghouse deal is expected to be finalised during Prime

Minister Narendra Modi's trip to the US this June 2016.

Source: <http://www.hindustantimes.com/i>, 24 April 2016.

KENYA

IAEA Approves Kenya Nuclear Power Application

In East Africa, IAEA has endorsed Kenya's application to include nuclear power in its energy mix...the IAEA presented the mining cabinet secretary, Dan Kazungu, with a four-year long nuclear energy review on Kenya's nuclear power application.

According to the media, the planning for nuclear power dates back to 2012, conducted under the leadership of the Kenya Nuclear Electricity Board. "Kenya should utilise nuclear power for it to become a middle-income country in the future," said Mikhail Chudakov, the IAEA's Deputy Director General.

The report of the comprehensive assessment, known as the Integrated Nuclear Infrastructure Review, indicates that the country has made advances, such as conducting a feasibility study, which addressed the 19 main issues considered in a nuclear energy programme. "Kenyans do not fear nuclear power, especially since it can have a very positive impact on tariffs. What they fear is safety concerns that can be allayed by public sensitisation," Kazungu noted.

The media reported that the issues that were addressed included funding, safety and security, stakeholder and industrial involvement, human resource development, legislative and regulatory framework, electric grid, nuclear power plant site and supporting facilities, radiation protection and radioactive waste, among others....The media also reported that Kenya plans to set up its first nuclear power plant with a capacity of 1,000MW by 2027, which is estimated to rise to a total of 4,000MW by 2033.

Source: <http://www.esi-africa.com/>, 25 April 2016.

NUCLEAR COOPERATION

FRANCE–RUSSIA

French and Russian Nuclear Utilities Extend Collaboration

French utility EDF has signed an agreement to extend its cooperation with Rosenergoatom, the operator of Russia's civil nuclear power plants. The companies will cooperate in reactor operations, decommissioning and waste management.

The agreement was signed by EDF's executive director for nuclear power plant operations, Dominique Miniere, and Rosenergoatom's first deputy general director, Alexander Shutikov, in Saint Petersburg on 21 April 2016 during a meeting of the board of governors of the WANO.

Through the agreement, EDF and Rosenergoatom intend to develop cooperation in areas such as the maintenance, modernization and operating period extension of nuclear power plants, as well as decommissioning and radioactive waste management. They will also conduct research and development into operating issues. ...Rosenergoatom is a subsidiary of Russian state nuclear corporation Rosatom. It is responsible for the operation and maintenance of the country's ten nuclear power plants.

Source: World Nuclear News, 26 April 2016.

FRANCE–UK

France's EDF to Decide on UK Nuclear Project in September

French Economy Minister Emmanuel Macron said that French energy giant EDF will give the final green light to the controversial construction of two nuclear reactors at Hinkley Point in Britain in September 2016.

... Final decision had been expected in May 2016,

but EDF, which is 85 per cent owned by the French state, announced a delay saying it first had to consult with an internal committee as demanded by French unions. Such consultations risk setting the project back by several months... the investment in the two reactors at Hinkley Point would be equivalent to a year of investments by EDF... Macron added that the project would promote French technology in the face of American, Chinese and Russian competition.

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Hinkley Point, which EDF is to build in partnership with China General Nuclear Power Corporation (CGN), will be Britain's first nuclear power plant in decades and is to provide seven per cent

of its energy needs by 2025. With a projected cost of 23 billion euros, it will also be one of the world's most expensive nuclear power plants. Questions have been raised about the financial viability of the project as EDF is struggling with a debt pile of more than 37 billion euros. On 22 April, the French government announced that it would inject three billion euros into the energy provider, as part of a four-billion-euro capital increase.

Source: <http://en.rfi.fr/france/>, 24 April 2016.

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IRAN–RUSSIA

Iran in Talks with Russia on Heavy Water Sales

Iran is holding talks with Russia to sell it about 40 tonnes of heavy water from its nuclear program, Iran's deputy foreign minister was quoted as saying by the Fars news agency. Under last year's landmark nuclear deal between Iran and world powers, Tehran is responsible for reducing its stock of heavy water which is a component of making nuclear weapons and producing nuclear energy.

It is not radioactive and the nuclear deal gives Iran the right to sell, dilute or dispose of it under certain conditions. Abbas Araqchi, who is also a top nuclear negotiator, was quoted by the Fars agency as saying that the US had been the first

buyer of Iranian heavy water and some other world powers, including Russia, were now showing an interest. We are negotiating with Russia to sell 40 tonnes of heavy water," he said. The Russian Foreign Ministry later confirmed Moscow was considering the purchase.

In January 2016 Iran removed the core of its Arak heavy water nuclear reactor and filled it with cement as required under a nuclear deal. The US, Russia and China have agreed to participate in the redesign and the construction of a modernized reactor.

Source: Jack Stubbs and Bozorgmehr Sharafedin; Editing by Richard Balmforth and Ed Osmond, <http://www.reuters.com/>, 25 April 2016.

IRAN-CZECH REPUBLIC

Iran Eyes Czech Help in Building New Nuclear Plants

Iran is seeking expertise from European countries to help advance its civilian nuclear program, and is hoping to sign up the Czech Republic to build new nuclear power plants as well as develop cooperation with the EU.

Behrouz Kamalvandi, a spokesman for the Atomic Energy Organization of Iran (AEOI), said that countries with long experience in the field of nuclear energy are of particular interest, the semi-official Iranian Fars news agency reported... "After so many years of not being able to make trips with such aims, we now intend to expand our cooperation with a few European countries that have the nuclear technology," Kamalvandi said.

"Perhaps, there are only 20 countries that have access to nuclear knowledge, and some of them, such as the Czech Republic and Slovakia, have been in the business for decades," he noted. "That's why we want to cooperate with them." ... AEOI chief Ali Akbar Salehi is scheduled to visit the Czech Republic, and then head to Slovakia for talks on proposals for nuclear power plants. Salehi told journalists in Tehran that Iran is holding discussions with the European Union on nuclear cooperation, including a joint project at the Fordo uranium enrichment plant. Earlier in April, Iranian Foreign Minister Mohammad Javad Zarif said nuclear cooperation was on the agenda during a one-day visit by a delegation headed by EU foreign

policy chief Federica Mogherini....

Source: <http://www.timesofisrael.com/>, 25 April 2016.

RUSSIA-JORDAN

Russia, Jordan to Cooperate on Nuclear Regulation

Russia's nuclear regulator and Jordan's Energy and Minerals Regulatory Commission (EMRC) recently signed an agreement to cooperate in the field of nuclear and radiation safety regulation. The agreement was signed through correspondence, with EMRC chairman Farouq Al-Hyari signing the document in Amman on 30 March and Alexey Aleshin - chairman of Russia's Federal Environmental, Industrial and Nuclear Supervision Service (Rostekhnadzor) - signing it in Moscow on 6 April.

Rostekhnadzor said on 7 April that, under the five-year agreement, the two regulators will cooperate in the development of the legislative basis in the field of nuclear and radiation safety. They will also exchange experience in licensing activities as well as exchanging experience in oversight and control activities, including development and implementation of inspection programs.

EMRC and Rostekhnadzor will also exchange experience in safety regulation in the management of used nuclear fuel and radioactive wastes, including their transportation and safe storage. They will also share their experience in the supervision of accounting and control of nuclear materials, radioactive substances and radioactive waste, as well as the supervision of physical protection of nuclear installations, radioactive sources, storage facilities, nuclear materials and radioactive substances.

... In March 2015, Russia and Jordan signed an intergovernmental agreement on cooperation in the construction and operation of the Middle Eastern country's first nuclear power plant. The document envisages construction of two 1000 MWe VVER units in Az-Zarqa, in the central region of Jordan. The document also envisages setting up a project company that will be the customer, operator and owner of the plant, as well as the owner of the electric power it generates.

Source: World Nuclear News, 18 April 2016.

NUCLEAR PROLIFERATION

CHINA-PAKISTAN

Pakistan has a China Connection to Nuclear Trouble

Pakistan held its annual military day parade and displayed its new medium-range nuclear missiles in March 2016, and it barely made a splash in Washington. But at least one analyst was paying close attention.

Richard Fisher, an expert on Chinese military technology at the International Assessment and Strategy Center, began studying the public satellite photographs of the Shaheen III missiles and came to an alarming conclusion: The transport-erector-launcher, or TEL, for the Pakistani mobile rocket matched a Chinese design that Beijing had exported in 2011 to North Korea. Specifically, Fisher found that the Chinese, North Korean and Pakistani TELs shared the same foothold shape, the same chassis slope and the same exhaust processing system over the engine compartment.

Now, two leading Republicans in Congress are asking the Pentagon, the state department and the director of national intelligence to look into Fisher's findings. I obtained a copy of the letter from Representative Mike Rogers of Alabama, chairman of the House Armed Services subcommittee on terrorism and strategic forces, and Ted Poe of Texas, chairman of the House Foreign Affairs subcommittee on nonproliferation and trade.

Poe and Rogers are alarmed. While China and Pakistan have cooperated on military technology for decades, and China's government announced in 2013 it would be assisting with the construction of nuclear power plants in Karachi, the extent of China's cooperation with Pakistan's nuclear

weapons program has always been murky. Since the 1980s, the US government has had its suspicions that China assisted Pakistan's nuclear weapons program. But US presidents have also certified publicly since the 1980s that China was

not a nuclear proliferator. If Fisher's research is confirmed, then it would be evidence that China has been assisting Pakistan's nuclear program and continues to do so to this day. ... The transfer of an item as advanced and significant...would require the approval from the highest levels of China's

government if not also the People's Liberation Army. Such cooperation between the governments of Pakistan and China would represent a threat to the national security of the US and its allies."

...In a letter to Poe and Rogers summarizing his findings, Fisher wrote that if his research is confirmed, it would be grounds to seek new sanctions against China at the United Nations, and would trigger the enforcement of existing US sanctions. He also said that it's a threat in and of

itself if China is exporting such equipment or even the design of such technology, because it could end up in North Korea, which in turn could re-export it to Iran.

This is the kind of diplomatic problem President Obama would likely want to avoid in the final months of his presidency. After all, despite his protests and promises to

refocus America's defensive posture to the Pacific Ocean, the Chinese have moved ahead with plans to militarize islands it built up in the South China Sea. But the rest of the world may not be able to wait this long. The new Pakistani missiles have a range of 1,700 miles, which would cover all of India. If China helped Pakistan with the technology for these weapons, it raises the question what other nuclear programs China is willing to assist.

Source: <http://www.livemint.com/>, 27 April 2016.

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NORTH KOREA

After Missile Failure, Higher Possibility of North Korea Nuclear Test

The likelihood of North Korea conducting a fifth nuclear test, possibly within weeks, has increased because of a failed missile launch that was an embarrassing setback for leader Kim Jong Un, South Korean officials and international experts said.

North Korea holds a ruling Workers Party congress in early May 2016, at which Kim is likely to trumpet his achievements in building up Pyongyang's weapons prowess. South Korean officials and experts say he will be keen to go into the congress with a show of strength, and not a failed rocket launch.

... When asked if the failed missile launch had increased the possibility that Kim would order a nuclear test, the official said the North is likely to "engage in additional provocations." "Such a nuclear test and the missile launch believed to be a failure this morning are both among the provocations that North Korea would have reasonably tried," the official said, speaking on condition of anonymity since he was not authorized to speak to the media on the matter.

...The US Defense Department called the test of the road-mobile missile a "fiery, catastrophic" failure, while North Korea has not made any public comment on the issue.

The senior South Korean official said Kim's military aides would try to compensate for the failed missile launch and another official in Seoul said South Korea's military was on high alert for an additional missile launch, or a nuclear test....

...The missile that failed was likely a Musudan IRBM, experts and South Korean media said. The Musudan has a design range of more than 3,000 km (1,800 miles) that can be fired from a road-mobile launcher. It has never been flight-tested, although many experts believe that the North may launch it as part of its effort to develop an ICBM....

Source: Ju-min Park in Seoul and David Brunnstrom and David Alexander in Washington, <http://www.reuters.com/a>, 15 April 2016.

North Korea Submarine Fires Ballistic Missile Near Coastal Town, Defence Officials Say

North Korea on 23rd April 2016 fired what appeared to be a ballistic missile from a submarine off its northeast coast, South Korean defence officials said, Pyongyang's latest effort to expand its military might in the face of pressure by its neighbours and Washington.

...The Saturday evening launch of what the officials said was presumably a submarine-launched ballistic missile took place near the North Korean coastal town of Sinpo, where analysts have

North is likely to "engage in additional provocations." "Such a nuclear test and the missile launch believed to be a failure this morning are both among the provocations that North Korea would have reasonably tried."

previously detected efforts by the North to develop submarine-launched ballistic missile systems. A successful test from a submarine would be a worrying development because mastering the ability to fire missiles from

submerged vessels would make it harder for outsiders to detect what North Korea is doing before it launches, giving it the potential to surprise its enemies.

...South Korea's Joint Chiefs of Staff said in a statement that the projectile fired by the North flew about 30 kilometres (19 miles). It said that a typical submarine-launched ballistic missile can travel at least 300 km (186 miles).... North Korea has recently sent a barrage of missiles and artillery shells into the sea amid ongoing annual military drills between the US and South Korea. Pyongyang says the drills are a preparation for an invasion of the North. The firings also come as the North expresses anger about toughened international sanctions over its recent nuclear test and long-range rocket launch. Kim Jong Un is mobilizing everyone in North Korea for 70-day campaign leading to first congress in 36 years. North Korean military intelligence officer escapes to South in rare high-rank defection

North Korea's belligerence may also be linked to a major ruling party congress in May meant to further cement leader Kim Jong Un's grip on power.

Promoting military accomplishments could be an attempt to overshadow a lack of economic achievements ahead of the Workers' Party congress, the first since 1980. While South Korean experts say it's unlikely that North Korea currently possesses an operational submarine that can fire multiple missiles, they acknowledge that the North is making progress on such technology.

Source: <http://news.nationalpost.com/>, 23 April 2016.

NUCLEAR SAFETY

BELGIUM–GERMANY

Belgium Rejects German Call for Nuclear Plants Closure

Belgium on 20th April 2016 rejected a request by neighboring Germany to shutter two ageing nuclear plants near their shared border, arguing the facilities met with the strictest safety standards. German environment minister, Barbara Hendricks, requested that the 40-year-old Tihange 2 and Doel 3 reactors be turned off "until the resolution of outstanding security issues".

In response, Belgium's official nuclear safety agency (AFCN) said the two plants "respond to the strictest possible safety requirements." The agency "is always willing to collaborate with their German counterparts ... but only as long as a shared willingness to cooperate in a constructive fashion is demonstrated," it added in a terse statement. Shut old nuclear reactors, says unprecedented alliance of EU cities

The reactor at Tihange is located just 60 km (40 miles) from the German border, while Doel is about 130 km away, and close to Antwerp. The reactor pressure vessels at both sites have shown signs of metal degradation, raising fears about their safety. They were temporarily closed but resumed service last December 2015....

Belgium's creaking nuclear plants have been causing safety concerns for some time after a

series of problems ranging from leaks to cracks and an unsolved sabotage incident. The Doel and Tihange power stations have been in service since 1974-1975, and were scheduled to be shut down in 2015. But the Belgian government in December decided to extend their lives to 2025.

Source: <http://www.theguardian.com/>, 20 April 2016.

JAPAN

Regulator Declares Nuclear Reactors Safe after Quake

Japan's atomic regulator said there is no need to shut down the country's only operating nuclear station on Kyushu, where a series of quakes killed more than 40 people and damaged infrastructure. The Nuclear Regulation Authority said it was monitoring the situation closely at four nuclear power plants, after calling a special meeting of its commissioners.

Sensitivity over nuclear power is high in Japan after the Fukushima disaster of 2011 was sparked by an earthquake and tsunami. There were no safety issues at the Sendai nuclear plant, which has two reactors and is about 120 kilometers south-southwest of Kumamoto city, close to where the quakes struck, NRA Chairman Shunichi Tanaka said at a press conference after the meeting.

The NRA is monitoring Genkai, about 100 kilometers northwest of Kumamoto, and Ikata, about 160 kilometers east-northeast of the quake zone. Sendai and Genkai, which has four reactors, are operated by Kyushu Electric Power, while Ikata is owned by Shikoku Electric Power. The regulator is also monitoring Shimane, a two-reactor plant operated by Chugoku Electric Power, located further away on Honshu.

The country has been taking steps back to nuclear energy since the Fukushima disaster led to the eventual shutdown of all reactors. It turned on

the first reactor at Sendai in August after a two-year blackout and the second at the same station in October 2015. Another plant that began operating later, however, was shut down by a court in March. PM Abe and many in industry say nuclear power is necessary to cut fuel bills despite widespread public opposition, even after electricity bills rose.

Source: <http://www.japantoday.com/>, 18 April 2016.

NUCLEAR WASTE MANAGEMENT

FRANCE–SWEDEN

EDF Buys Swedish Waste Treatment Business

Swedish company Studsvik AB has signed an agreement to divest its waste treatment business, which generated £14.9 million worth of revenue in 2015, to French energy company EDF. The SEK 355 million (£30.3 million) deal will include the company's facilities in the UK and in Sweden and finalisation is dependent upon necessary waste

treatment business licenses and permits being granted.

The move, which is expected to be finalised in the third quarter of 2016, will generate positive cash flow of around SEK 225 million (£19.2 million) and affect Studsvik's net profit by approximately 115 million SEK (£9.8 million). EDF and Studsvik will collaborate in areas of nuclear decommissioning and waste management in the future as part of the deal. Studsvik acts as a radiation protection advice body and provides technical services to the international nuclear power industry. It has four sites in the UK at Gateshead, Preston, Aldermaston and Workington.

The waste treatment side of its business occurs at Nyköping, Sweden and at the Workington UK site where metallic items from low-level radioactive waste are recycled, free released or volume reduced for stabilisation to minimise environmental impact. It is then returned to the client for final storage....

Source: <http://resource.co/>, 25 April 2016.



Centre for Air Power Studies

The Centre for Air Power Studies (CAPS) is an independent, non-profit think tank that undertakes and promotes policy-related research, study and discussion on defence and military issues, trends and developments in air power and space for civil and military purposes, as also related issues of national security. The Centre is headed by Air Marshal Vinod Patney, SYSM PVSM AVSM VrC (Retd).

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