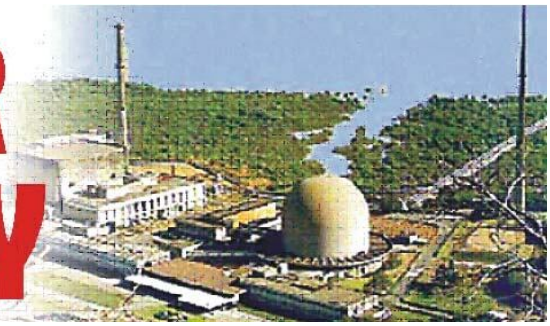
NUCLEAR SECURITY



A FORTNIGHTLY NEWSLETTER ON NUCLEAR DEFENCE, ENERGY AND PROLIFERATION FROM CENTRE FOR AIR POWER STUDIES

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OPINION – Editorial, *Daily Pioneer*

Nuclear Reactor at Kalpakkam: World's Envy, India's Pride

Hidden from public, on the shores of the Bay of Bengal at Kalpakkam near Chennai, Indian nuclear scientists are in the final throes of starting a high-tech giant stove more than 15 years in the making. This novel nuclear reactor is a kind of an 'akshaya patra', the mythical goblet with a never-ending supply of food. The DAE is getting ready to commission its ultra-modern indigenously designed and locally mastered fast breeder reactor. Experts say to make nuclear energy sustainable, one sure shot way is to make fast breeder reactors mainstream.

Yukiya Amano, Director General of IAEA, Vienna, says "fast reactors can help extract up to 70 per cent more energy than traditional reactors and are safer than traditional reactors while reducing long lived radioactive waste by several fold." Easier said than done, since these reactors are also notoriously unstable and hence difficult to run reliably over long periods. Called a 'Fast Breeder Reactor', these are a special kind of nuclear reactors that generate more atomic fuel than they consume as they work. India has been running an experimental facility called a FBTR now for 27 years. This is a small nuclear reactor a forerunner for the monster that India has constructed at Kalpakkam called the PFBR. This will generate electricity commercially using the fast breeder route.

Indian nuclear scientists are in the final throes of starting a high-tech giant stove more than 15 years in the making. This novel nuclear reactor is a kind of an 'akshaya patra', the mythical goblet with a never-ending supply of food. The DAE is getting ready to commission its ultra-modern indigenously designed and locally mastered fast breeder reactor.

The world's only commercially operating fast breeder reactor is situated in the Ural Mountains of Russia at the Beloyarsk Nuclear Power Plant, not far from Russia's fourth largest city Yekateringburg. The Russians today are the global leaders in fast breeder reactors having operated a fast breeder reactor called BN 600 since 1980. In 2016, the Russian nuclear agency Rosatom commercially commissioned its big brother — the BN 800 fast

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breeder reactor. This reactor produces about 800 MW of electricity and supplies it to the Ural region including the city of Yekateringburg. While electricity that is produced is no different than any other electricity but the global community of atomic boffins is suitably chuffed about this unique achievement. M Chudakov, now with the IAEA and well-known Russian fast breeder expert, calls "these reactors a bridge to the future as they can supply an almost unlimited supply of electricity".

Arun Kumar Bhaduri, Director of the IGCAR, Kalpakkam says, "fast breeder reactors are far safer than the current generation of nuclear plants and that all efforts are being made to kickstart within this year India's first commercial fast breeder reactor at Kalpakkam." Such is the interest in fast breeder reactors that more than 700 of the best atomic scientists from over 30 countries gathered at Yekateringburg in IAEA's conference on the 'next generation nuclear systems for sustainable development.

All eyes are now on southern India where another global nuclear milestone is likely to be crossed this year. Arun Kumar Bhaduri, Director of the IGCAR, Kalpakkam says, "fast breeder reactors are far safer than the current generation of nuclear plants and that all efforts are being made to kickstart within this year India's first commercial fast breeder reactor at Kalpakkam." Such is the interest in fast breeder reactors that more than 700 of the best atomic scientists from over 30 countries gathered at Yekateringburg in IAEA's conference on the 'next generation nuclear systems for sustainable development'. The scientists deliberated on how to make nuclear energy last for several centuries. Given India's expertise, the co-chair of the conference was Suresh Chetal, one of the early pioneers of fast breeder reactors who helped tame fast breeder reactors for New Delhi when he was at the IGCAR.

Many countries have dabbled with fast breeder reactors and have given up, first off the block was the US but it gave up since inherently American governments have an allergic response with re-processing of nuclear waste in addition since USA has enough supplies of fissile material there is no hunger to maximally extract energy from uranium. Japan and France both had robust programs with fast breeder technology but repeated failure to safely handle liquid sodium forced them to more or less give up on fast reactors. China is more than a decade behind India in trying to master this complex beast. Russia invested heavily in developing the fast breeder technology but since it commissioned its first fast breeder reactor BN 600 in 1980 it suffered an economic meltdown as the former Soviet Union broke up and only recently Russia could gather enough resources to complete its upgraded fast breeder reactor BN 800. Today the BN 800 is a flagship reactor that uses both uranium and plutonium as fuel and generates electricity that is supplied to the grid. A visit to the facility reveals a squeaky clean reactor where seasoned operators like Ivan Sidrow are also experimenters as they go about trying to design a bigger 1200 MW fast breeder reactor.

Fast breeder reactors are called such not because they run faster but because the neutrons that sustain the atomic chain reaction travel at a much higher velocity than neutrons that help run the traditional atomic plants. These are called breeders as they generate more fuel than they consume a fact hard to fathom since they seem to defy the laws of conservation of energy.

India's own PFBR is unique and rather different from the Russian fast breeder reactor though both use the same basic principle of physics. Fast breeder reactors are called such not because they run faster but because the neutrons that sustain the atomic chain reaction travel at a much higher velocity than neutrons that help run the traditional atomic plants. These are called breeders as they generate more fuel than they consume a fact hard to fathom since they seem to defy the laws of conservation of energy. But a very

unique quirk of elemental uranium makes this possible. Nuclear reactors use a flavour of uranium called U-235 which unfortunately constitutes a minuscule quantity even in super purified uranium. The larger component is what is called U-238 this flavour is the bulk but is essentially a waste product as the atomic reaction cannot be sustained by this elemental flavour. In a fast breeder reactor the very special fast neutrons interact with the so called wasted uranium U-238 and converts it into a valuable resource. This is why fast breeders are akin to an 'akshaya patra'.

India's fast breeder reactor is even more unique as within it the country also deploys special rods of thorium which when they get exposed to or irradiated by fast neutrons they generate U-233 and a normally benign thorium turns into a valuable atomic material. It is well known that India is very energy hungry and as economic growth takes place mega quantities of electricity will be required. Unfortunately, nature has not been bountiful on India as the Indian land mass is not endowed with enough uranium but on the other hand the country has the world's second largest store of thorium. Today the country in a well thought out strategy is mastering fast breeder reactors that can be an effective via media for utilising the vast thorium reserves.

Source: *http://www.dailypioneer.com, 02 July 2017.*

OPINION – Tharanga Yakupitiyage

Nuclear Ban Approved, Now What?

More than seven decades after the deployment of deadly atomic bombs in Japan, the UN has passed a historic treaty banning nuclear weapons around the world. Though it has sparked hope for a future without nuclear weapons, uncertainty in the success of the treaty still lingers.

More than 122 countries, representing two-thirds of the 192-member UN, adopted the historic treaty banning nuclear weapons after months of talks. "We have managed to sow the first seeds of a world free of nuclear weapons...the world has been waiting for this legal norm for 70 years," said Elayne Whyte Gomez, Permanent Representative of Costa Rica and the president of the UN conference which negotiated the treaty.

Nuclear Disarmament Program Manager for the civil society organization PAX Susi Snyder similarly highlighted the importance of the occasion to IPS, stating: "People have been working for decades on the issue, myself included, and to have a moment that you know, to the very tips of your toes, that history is being made? That's a moment to feel all the feelings."

The new instrument is an explicit prohibition on the direct or indirect use, threat of use, possession, acquisition, and development of nuclear weapons. It also for the first time includes obligations to provide assistance to victims of nuclear weapons testing and use as well as environmental remediation of areas contaminated a result of nuclear weapon activities.

There are approximately 15,000 nuclear warheads globally, more than 90 percent of which belong to the United States and Russia. Unlike the 1968 NPT which allowed five countries to possess such arms, the new instrument is an explicit prohibition on the direct or indirect use, threat of use, possession, acquisition, and development of nuclear weapons. It also for the first time includes obligations to provide assistance to victims of nuclear weapons testing and use as well as environmental remediation of areas contaminated a result of nuclear weapon activities.

"This normative treaty highlights the humanitarian consequences of nuclear weapons—it is a huge achievement especially for the Hibakusha, the survivors of Hiroshima and Nagasaki," Arms Control Association's (ACA) Researcher Alicia Sanders-Zakre told IPS.

Reference to such consequences can be seen throughout the treaty, including the deep concern "about the catastrophic humanitarian consequences that would result from any use of nuclear weapons" and the persistent risk to humanity posed by the "continued existence of nuclear weapons."

Though the awareness of nuclear weapons' devastating humanitarian ramifications is certainly not new, both Snyder and Sanders-Zakre noted that states still legitimize nuclear weapons in their security approaches.

"Some states negotiating the treaty would say that by having a security doctrine of nuclear deterrence, nuclear weapons states legitimize nuclear weapons and distract from their humanitarian consequences...which are often not in the forefront of the security stage," said Sanders-Zakre. The new treaty aims to strip nuclear weapons of their prestige by making them unacceptable under international law.

Not Without a Fight: The world's nine nuclear-armed states as well as the majority of the NATO members boycotted the negotiations, except for the Netherlands which voted against the document. Among the most vocal critics is the United States who, since the beginning of the talks, said that the process was not "realistic," especially in the wake of rising tensions between the North American nation and North Korea.

"There is nothing I want more for my family than a world with no nuclear weapons, but we have to be realistic. Is there anyone who thinks that North Korea would ban nuclear weapons?" asked US Ambassador to the UN Nikki Haley.

In a joint statement, the US, United Kingdom, and France announced that they do not ever intend to sign, ratify, or become party to the treaty. "A purported ban on nuclear weapons that does not address the security concerns that continue to make nuclear deterrence necessary cannot result in the elimination of a single nuclear weapon and will not enhance any country's security, nor international peace and security," they stated, reiterating their continued commitment to the NPT.

Snyder told IPS that it was not surprising that such nations did not participate due to a desire to retain the political power associated with nuclear weapons. However, she criticised the joint move as it may be in violation of the NPT.

Article 6 of the NPT, which the majority of member States have signed, states that each party must "pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at at an early date and to nuclear disarmament."

Snyder noted that negotiations were considered by the majority to be an "effective measure" in the pursuit of disarmament. "While this prohibition is not the final effort to achieve and maintain a nuclear weapons free world, it is certainly a key element of a world without nuclear weapons. It was an absence that is embarrassing for the nuclear armed states, demonstrating their commitment to inhumane weapons over humanity," she continued.

However, nuclear-armed nations would argue that they are not violating the NPT as they do not consider that the prohibition will result in the elimination of nuclear weapons and is thus not an "effective measure," said Sanders-Zakre. The treaty reflects a growing divide between nuclear and non-nuclear weapon states on visions of disarmament.

Between a Nuke and a Hard Place?: Additional frustrations have arisen concerning the treaty's prohibition on the stationing, installation or deployment of nuclear weapons on territories as it puts many NATO members in nuclear sharing agreements in a sticky situation.

Five nations, including Germany and Turkey, currently host US nuclear weapons as part of NATO's nuclear sharing policy. In order for NATO members to join, they will have to reverse or withdraw from their obligations. "One the one hand, the treaty seeks to be universal to include many members. But at the same time, it is a prohibition treaty and having a member of a prohibition treaty that has nuclear weapons on their soil would be contradictory," Sanders-Zakre told IPS.

But can a Nuclear Ban Treaty be Successful without Such Nations? Snyder and Sanders-Zakre say yes. "The treaty sets a norm, and the nuclear armed states have a history of following norms even when they don't sign up to the treaties

behind them," said Snyder, referencing the CTBT which, despite not being ratified by all nations and not entering into force, has set a norm in which nuclear testing is condemned. "That norm will grow from this treaty as well, and will likely result in ongoing substantive condemnation of the activities of the nuclear armed states that are not disarmament," Snyder continued.

Sanders-Zakre noted that there might be some obstacles in the way before the treaty's entry into force, including potential lobbying by nuclear weapon states to dissuade others from ratifying the instrument or a general decrease in political momentum. But, with or without the nuclear weapon states, the treaty will mark a significant normative step towards disarmament if all 122 states which negotiated the instrument sign and ratify.

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"My hope is that this treaty will be the first step towards more productive disarmament dialogue, and that it will serve as a wake-up call to nuclear weapon states that have not seriously been pursuing disarmament negotiations for quite some time," Sanders-Zakre said.

Snyder similarly described the historic occasion as the first step of many, stating: "This treaty will help towards the elimination of nuclear weapons—it's not the last thing that will get them out of the world forever, but it helps by reaffirming the complete illegitimacy of such inhumane weapons and offers a pathway for elimination."

In 2017, there were approximately 14,935 nuclear weapons, a slight reduction compared with 15,395 in early 2016. The report notes that both the US and Russia have failed to commit to further reductions. Just nine states possessed these weapons: the US, Russia, the UK, France, China, India, Pakistan, Israel, and North Korea.

The treaty on the prohibition of nuclear weapons will be open for signature by member states on 20 September, marking the beginning of the 72nd Session of the General Assembly. It will enter into legal force 90 days after it has been ratified by 50 countries. Earlier this year, atomic scientists set the Doomsday Clock to two and a half minutes before midnight, reflecting a fear that the world is closer to a nuclear disaster than it has been since 1953 after the US and Soviet Union tested hydrogen bombs.

Source: http://www.thecitizen.in/index.php, 14 July 2017.

OPINION – Aamna Mohdin

The Two Countries with Nearly All the World's Nuclear Weapons have No Intention of Scaling Back

The US and Russia, which possess nearly 93% of all nuclear weapons in the world, don't plan to continue reducing their nuclear arsenal, but instead are spending money to modernize and modestly expand their weapons systems. The world's nuclear arsenal has gradually declined since its peak of nearly 70,000 nuclear warheads in the mid-1980s, but reductions have slowed in recent years. According to a new report by the SIPR, an independent think tank, in 2017, there were approximately 14,935 nuclear weapons, a slight reduction compared with 15,395 in early 2016. The report notes that both the US and Russia have failed to commit to further reductions. Just nine states possessed these weapons: the US, Russia, the UK, France, China, India, Pakistan, Israel, and North Korea.

States with nuclear weapons are spending billions on updating their systems and developing weapons. The US will spend approximately $400 billion over a 10-year period to maintain and modernize

its arsenal; the US plans to buy replacement systems and build new nuclear weapon facilities. To maintain strategic parity with the US, Russia is limiting any further reduction in its nuclear arsenal and working to modernize its aging, Soviet-era missiles. The British government is investing £31 billion ($45.2 billion) to maintain its nuclear arsenal, while Pakistan and India are both gradually expanding the size of their nuclear weapon stockpile.

North Korea carried out high-profile tests of its nuclear weapons in the last year. The country has prioritized building a long-range ballistic missile that can deliver a nuclear warhead to the US (experts suggest there's no independently verified evidence that the country currently has the capability to do so). US president Donald Trump has pressed president Xi Jinping of China to address what Trump called the "growing threat" (paywall) posed by North Korea's nuclear weapons.

The United Nations drafted the first-ever treaty to ban nuclear weapons in June 2017. More than 130 countries currently support the initiative that would outlaw nuclear weapons. Unsurprisingly, not one of the nine countries currently possessing nuclear weapons support the proposed measure.

Source: *http:// qz.com, 04 July 2017.*

OPINION – Thuo Njoroge

Nuclear Power as an Enabler of Innovative Development in Africa

Governments across Africa are seeking ways to enhance their existing energy infrastructure and develop new or diverse energy sources that are reliable, affordable and sustainable. Development of a sustainable mix of different energy sources will allow the continent in general to unleash its huge potential for economic growth. Nuclear energy combined with other clean sources can become a major driver for many economic sectors as it is a driver of scientific and technological progress.

It is not only about hi-tech nuclear power plants and about innovative reactors to produce clear and cheap energy, but also about research reactors and scientific centres, nuclear medicine and prerequisite of future innovation development. Nuclear technologies are widely used both in the energy sector and in many non-energy spheres. For instance, in health sector its technology is used in radiology department for scanning and radiotherapy treatment for cancer patients, in security sector nuclear technology is used to enhance security of premises by detecting explosive devices. Its application in production processes helps dealing with various challenges of global development, such as ensuring environmental, energy and food safety and facilitating the advancement of science and thus economic growth.

Social Development: Besides being a source of clean energy, the atom is also instrumental in solving a number of crucial issues in guaranteeing social and economic development. Experience has shown that the development of nuclear power and related infrastructure has a positive impact on the social and economic conditions in adjacent regions. According to Vladimir Leshchenko, Deputy Head of the Novovoronezh city administration (Novovoronezh is situated in Russia and is home to one of the most advanced nuclear power plants (NPP) in the world and the first Generation III+ nuclear reactor), prior to the construction of its first NPP in the 1960s, the town was a very small and poor village. However, the development of nuclear power stimulated the rapid development of the town and the nuclear power plant became a town-forming enterprise. In 2015, tax proceeds from the NPP accounted for almost 25 per cent of the town's budget, which made it possible to implement projects on the construction of schools and sports facilities. Currently, new housing is being built and new jobs are being created, which promotes the welfare of local residents.

Nuclear Medicine*:* Due to the active development of nuclear power, high-tech clusters can emerge in the future; these clusters would integrate a number of industries, medicine, science and technology. In developing countries like Kenya, in addition to building up a country's reputation as a nation with sophisticated and advanced technologies, the development of nuclear also

encourages the creation of high-tech sectors in the economy.

Nuclear technologies make it possible to use nuclear medicine for treatment of cancer and cardiovascular diseases. Radiation technologies make it possible to grow more crops and safely export more domestic products. The science and technology cluster may include the manufacture of special-purpose and civil products, such as equipment for the transport industry and the fuel and energy industry, systems for monitoring, diagnostics and control, metallurgy products, control and measuring devices and medical equipment. Moreover, the cluster ensures the growth of the added value by increasing the competitiveness of the manufactured products on the domestic and foreign markets.

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Besides, experience has shown that marketing and engineering infrastructure facilities and small enterprises operating in related fields begin to emerge near the "core" of the cluster after its creation. In symbiosis with the "core", they increase the investment attractiveness of the region and of the entire country. The integration of new enterprises into a single complex will enable national players to strengthen their positions in the domestic market and to increase their competitiveness on a global level.

Source: *http://* www.standardmedia.co.ke, *05 July 2017.*

OPINION – Max Fisher

European Nuclear Weapons Program Would Be Legal, German Review Finds

A review recently commissioned by the German Parliament has determined that the country could legally finance the British or French nuclear weapons programs in exchange for their protection. The European Union could do the same if it changed its budgeting rules, the study found. The German assessment comes after months of discussion in Berlin over whether Europe can still rely on American security assurances, which President Trump has called into question. Some have called for considering, as a replacement, a pan-European nuclear umbrella of existing French and British warheads.

The assessment provides a legal framework for such a plan. Britain or France, it finds, could legally base nuclear warheads on German soil. The document states that "President Trump and his contradictory statements on NATO" have led to fears "that the US could reduce its nuclear commitment" to Europe. While the review is only an endorsement of the plan's legality — not a determination to take action — it is the first indication that such an idea has escalated from informal discussion to official policy-making channels.

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Few analysts believe that Germany or the European Union is on the verge of pursuing a replacement nuclear umbrella. Most German officials still oppose such a plan, which would face steep public opposition and diplomatic hurdles. Even proponents consider it a last resort. Nonetheless, analysts say, the review indicates the growing seriousness with which Germany is preparing for the possible loss of the American guarantees that have safeguarded and united European allies since World War II....While few are convinced Germany could overcome its taboo against nuclear weapons anytime soon, the existence of the assessment suggests that under pressure from Mr. Trump and growing Russian

aggression, the taboo has eroded to an extent. ...Germany, the assessment finds, could be granted shared control over deploying those warheads under something called a "dual key" system, an arrangement that currently applies to American warheads based there. This would be intended to signal that the weapons would be used to protect all of Europe.

France's nuclear program, larger and more advanced, would be better suited to replace American capabilities, particularly the small, battlefield warheads that would be most useful in repelling a potential Russian invasion. German financing and basing for the program would be intended to demonstrate its function as a guarantor of European security.

The legal review was requested last year by Roderich Kiesewetter, a lawmaker, a former colonel and a foreign policy spokesman with Germany's governing party. Mr. Kiesewetter's office said it was unclear why the assessment was made only now, months later. Mr. Kuhn suggested that the timing could be related to the French presidential election, which elevated Emmanuel Macron, a pro-European centrist who has advocated closer defensive cooperation between France and Germany. Mr. Macron was elected on 07 May 2017. The legal review was concluded on 23 May 2017. It is unclear how long after that the findings were made public. Any version of this plan would likely hinge on French-German cooperation. Britain's nuclear program is small and submarine-based. Its pending exit from the European Union could also preclude British involvement.

While it is unclear whether Japan would have really followed through, the country did develop something called a "turnscrew" capability, which left it only a few months from converting civilian nuclear materials into warheads.

France's nuclear program, larger and more advanced, would be better suited to replace American capabilities, particularly the small, battlefield warheads that would be most useful in repelling a potential Russian invasion. German financing and basing for the program would be intended to demonstrate its function as a guarantor of European security. Officials in Poland, an informal security leader among Eastern European states, have expressed support in public comments. Some versions of the plan, including one floated by Mr. Kiesewetter this winter, would see the European Union co-finance the French nuclear umbrella in order to demonstrate France's commitment to use the warheads in defense of all member states. Still, analysts say that securing legal authority is only a small, initial step, and one that might suggest Germany's desire to avoid, more than pursue, such a drastic option. Mr. Narang compared the document to a review by the Japanese government in the 1960s. Tokyo, fearing the United States might withdraw its protection, issued a report outlining how Japan could build a small nuclear arsenal of its own. Mr. Narang said the Japanese study was intended both to dissuade the Americans from withdrawing and to prepare a fallback in case they did. Germany, he added, today faces a similar dilemma.

While it is unclear whether Japan would have really followed through, the country did develop something called a "turnscrew" capability, which left it only a few months from converting civilian nuclear materials into warheads. "These legal findings are part of that insurance hedging," Mr. Narang said, referring to the technical term for when countries seek alternatives to existing alliances. Even if allies have little intention of breaking from the status quo, he added, the act of planning for a worst-case situation makes it easier to imagine and, if necessary, pursue.

Source: http:// www.nytimes.com, 05 July 2017.

NUCLEAR STRATEGY

China–Russia

Forgotten Fact: Russia and China Almost Started a Nuclear War in 1969

In 1969 the two pillars of the communist bloc, the Soviet Union and the People's Republic of China, nearly went to full-scale war. Years of deteriorating ties between the two countries, once the

staunchest of allies, finally led to skirmishing on the long mutual border between the two countries. While tensions were eventually de-escalated, what if the two countries had gone to war?

On March 2, 1969 Soviet troops patrolling Damansky Island (Zhenbao) on the Ussuri River came under fire from Chinese troops. The attack, just 120 miles from the major Soviet city of Khabarovsk, killed fifty Soviet troops and wounded many more. The Moscow believed that the attack was premeditated, with Beijing bringing in a special combat unit to ambush Soviet forces. Alleged atrocities against wounded Soviet troops made the Soviet leadership furious. Soviet border guards counterattacked Chinese forces in and around the island on March 15, according to the CIA killing "hundreds" of Chinese troops. Clashes continued through the spring and summer, and by August, CIA director Richard Helms had informed the press that the Soviet leadership had been discreetly inquiring with foreign governments about their opinion on a preemptive strike on China.

While the crisis between the Soviet Union and China was eventually de-escalated, what if it hadn't? The Soviet Union regarded China's leadership, as Robert Farley has pointed out, as "abjectly insane," and may have wanted to nip a festering problem in the bud.

While the crisis between the Soviet Union and China was eventually de-escalated, what if it hadn't? The Soviet Union regarded China's leadership, as Robert Farley has pointed out, as "abjectly insane," and may have wanted to nip a festering problem in the bud. (whether that would have increased security in the long term is another question). While China did not appear to want war nor have the resources to prosecute one, the Soviets indeed had the option of doing so. The Soviet Union had been steadily growing its ground forces in the region since the first signs of a split in the early 1960s. The number of ground combat divisions increased from thirteen in 1965 to twenty-one divisions by 1969. While a considerable amount of firepower, this paled compared to the sheer size of the 2,500-mile-long border. Soviet forces in the region were also in large part defense-oriented machine-gun and artillery divisions, and incapable of offensive action. Meanwhile, over the border, the US State Department estimated Chinese forces in Manchuria to consist of two divisions of border guards, twenty-four infantry divisions, two tank divisions and six artillery divisions.

If the Soviet Union had chosen war, it would have had two choices. The first choice would have been a conventional mechanized attack into Manchuria, where much of China's industry was located, coupled with a limited "counterforce" nuclear strike against Chinese nuclear forces and nuclear-research facilities. A Soviet attack into Manchuria in 1969 would have resembled the invasion of the same region in 1945 against Japanese forces, and would likely have followed the same invasion routes. Such an attack would likely have been more modest in scope and focused—the 1945 attack had been carried out by 1.5 million troops by a fully mobilized Soviet Union. An attack in 1969 would likely have been carried out by half as many troops but with more firepower, supported by modern armor, artillery, tactical air forces and possibly even tactical nuclear weapons.

An attack on Beijing by just one Soviet SS-8 intercontinental ballistic missile, armed with a 2.3-megaton thermonuclear warhead, would have obliterated the city and killed more than half of the city's 7.6 million residents.

A second option would have been the same nuclear strikes against China's new nuclear-weapons program without an accompanying invasion of Manchuria. China had tested its first nuclear weapon in 1964 and conducted its first underground nuclear test in 1969. It is not clear whether or not any of China's nuclear weapons would have been useable in a war with the Soviet Union, but Moscow could not have afforded to find out the hard way. One major question is whether or not the Soviet Union would have coupled an attack on China's nuclear weapons with a thermonuclear attack on Beijing and China's leadership. An attack on Beijing by just one Soviet SS-8 intercontinental ballistic

missile, armed with a 2.3-megaton thermonuclear warhead, would have obliterated the city and killed more than half of the city's 7.6 million residents.

On the plus side, Soviet attacks would have played to Moscow's strengths in both nuclear and conventional forces. The Soviet Army would have made rapid gains on the battlefield, pitting modern mechanized forces against poorly equipped Chinese infantry and obsolete tanks. On the minus side, a nuclear strike against China would have earned the Soviets worldwide condemnation. An attack into Manchuria would have also played to China's "People's War" strategy of slowly dissolving invading forces with a combination of Chinese army forces and peasant militias. China's leadership, which had already proven itself bloody minded against its own people, would have had little compunction in sacrificing millions in a war against the Soviets. From the Soviet perspective, a grinding, never-ending war with China had no clearly defined ending. A Soviet attack against China would have been a tactical success but a strategic failure—or worse, an open-ended strategic commitment that would have dwarfed the invasion of Afghanistan.

The de-escalation of the Sino-Soviet crisis in 1969 avoided what could have been yet another large, destructive war of the twentieth century. The current friendship between Moscow and Beijing is a reflection of that crisis and the realization that it's much better for both countries to be allies than enemies.

A war with China would also weaken the Soviet Union in Europe. In order to marshal the forces to fight an offensive war, Moscow would have been forced to send tank armies east from their bases in Warsaw Pact countries and European Russia. This could have emboldened protesters in Poland, Czechoslovakia and Hungary to attempt to throw off the Soviet yoke yet again—with fewer Soviet forces to put down any rebellion. For China's part, there was no upside to fighting a country that had overwhelming conventional and nuclear superiority. China, a massive country with a large standing army and militias, could not lose the war, but it also lacked the offensive forces to actually win. A war that ended with the occupation of Manchuria and a destroyed Beijing would have erased any of the so-called gains of the Great Leap Forward and the ongoing Cultural Revolution. While Beijing would have eventually been rebuilt and Manchuria eventually made Chinese again, there was no upside, only yet another struggle to survive.

The de-escalation of the Sino-Soviet crisis in 1969 avoided what could have been yet another large, destructive war of the twentieth century. The current friendship between Moscow and Beijing is a reflection of that crisis and the realization that it's much better for both countries to be allies than enemies. This is particularly in Moscow's interests: given Beijing's rapid military and economic progress over the past thirty years, next time, the Kremlin may find the tables turned.

Source: *http://www.nationalinterest.org, 02 July 2017.*

GENERAL

122 Countries Adopt Global Treaty Banning Nuclear Weapons

A global treaty banning nuclear weapons was adopted at the United Nations despite opposition from the United States, Britain, France and other nuclear powers that boycotted negotiations. The treaty was adopted by a vote of 122 in favour with one country—NATO member The Netherlands voting against—while Singapore abstained.

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Loud applause and cheers broke out in the UN conference hall following the vote that capped three weeks of negotiations on the text providing for a total ban on developing, stockpiling or threatening to use nuclear weapons.

None of the nine countries that possess nuclear weapons—the United States, Russia, Britain, China, France, India, Pakistan, North Korea and Israel—took part in the negotiations or the vote. Even Japan—the only country to have suffered atomic attacks, in 1945—boycotted the talks as did most NATO countries.

Nuclear-armed states have dismissed the ban as unrealistic, arguing it will have no impact on reducing the global stockpile of 15,000 atomic weapons. "Is there anyone that believes that North Korea would agree to a ban on nuclear weapons?" asked US ambassador Nikki Haley when negotiations began in March. "There is nothing I want more for my family than a world with no nuclear weapons, but we have to be realistic."

But supporters hailed a historic achievement. "We have managed to sow the first seeds of a world free of nuclear weapons," said Costa Rica's ambassador, Elayne Whyte Gomez, the president of the UN conference that negotiated the treaty.

Led by Austria, Brazil, Mexico, South Africa and New Zealand, 141 countries joined in drafting the treaty that they hope will increase pressure on nuclear states to take disarmament more seriously. None of the nine countries that possess nuclear weapons—the United States, Russia, Britain, China, France, India, Pakistan, North Korea and Israel—took part in the negotiations or the vote. Even Japan—the only country to have suffered atomic attacks, in 1945—boycotted the talks as did most NATO countries.

Nuclear powers argue their arsenals serve as a deterrent against a nuclear attack and say they remain committed to the NPT. The decades-old NPT seeks to prevent the spread of atomic weapons but also puts the onus on nuclear states to reduce their stockpiles.

Impatience, however, is growing among many non-nuclear states over the slow pace of disarmament as are worries that weapons of mass destruction will fall into the wrong hands. Disarmament campaigners say the treaty will go a long way in increasing the stigma associated with nuclear weapons and will have an impact on public opinion.

Source: http: // www. livemint. com, 07 Jul 2017.

USA

Let's Not Test the Explosion of a 21st Century Nuclear Arms Race

Deep inside the Pentagon, the Trump administration's nuclear posture review is taking shape. This little known, yet highly consequential process, sets the direction of US nuclear weapons policy. Will this review reflect our "let it be an arms race" Twitter president or something more responsibly restrained? This June 2017, more than 40 members of Congress sent a letter to President Trump urging him to continue in his predecessors' footsteps. The letter explained that "starting with President Reagan's leadership, American presidents have steadily reduced the role of nuclear weapons in our national security strategy, as well as the size of the arsenal." Meanwhile, a small but influential group of analysts are suggesting extremist nuclear weapons policy ideas. An example of this is a Pentagon advisory board proposing strategies for the "limited" use of nuclear weapons. Another example is this same group suggesting the development of so-called "mini-nukes." Further, a cadre of hardliners is pressing this unseasoned, mercurial new administration to resume explosive nuclear testing.

Starting with President Reagan's leadership, American presidents have steadily reduced the role of nuclear weapons in our national security strategy, as well as the size of the arsenal." Meanwhile, a small but influential group of analysts are suggesting extremist nuclear weapons policy ideas.

It was nuclear testing that fueled the 20th century arms race. As countries relied upon nuclear weapons test explosions to prove their new designs, a competitive frenzy of nuclear weapons development flourished. In this era, the United States conducted 1,030 nuclear tests, more than the rest of the world combined. We developed what is today the most sophisticated nuclear arsenal on the planet. The last US explosive nuclear weapons test was a quarter of a century ago. The testing moratorium established with bipartisan legislation during the George H.W. Bush administration remains in place today. With the foundation of testing moratoria in both the United States and Soviet Union, the Clinton administration played a leading role in negotiating and garnering support for the 1996 CTBT. Although the treaty has not yet fully entered into force, it has established a global consensus against testing, with North Korea the sole nuclear tester to break this taboo in the 21st century. The treaty organization also has developed a premier global monitoring and verification system now operating and demonstrating impressive capabilities to detect and deter nuclear testing.

Any nuclear test would be a highly provocative event inciting a reaction that could quickly spiral out of control. In a 21st century security environment with multiple global "hot spots," resumption of nuclear explosive testing now might initiate a cycle with the launch of a nuclear warhead as its tragic end.

Over these past several decades without explosive nuclear testing, the US nuclear weapons laboratories have developed and implemented a robust — and expensive — science-based program that has certified that the US nuclear stockpile is safe and reliable. In fact, laboratory leaders have stated that they have a more fundamental understanding of nuclear weapons than "when we were blowing them up." So what could drive the United States to reverse course, abandon 21st century science, and abdicate global diplomatic leadership to resume nuclear testing? Just one thing: an effort to develop wholly new US nuclear weapons. These novel weapons systems would introduce uncertainty into the US arsenal that could lead to an explosive test to provide full confidence.

There is a fundamental national security flaw in the extremists' proposal. The United States now possesses the strategic advantage: we have most sophisticated nuclear arsenal on the planet, paired with a global norm against nuclear testing. If we conduct an explosive nuclear test, other countries will surely follow suit, using their tests to rapidly develop new nuclear capabilities for their arsenals, and thereby exposing the United States to new threats. What logic would open the pandora's box of a global nuclear testing breakout for the sake of adding of a new nuclear capability on top of our current overkill superiority?

Many of today's policymakers have limited memory of the 20th century nuclear arms race — the constant fear and tension, the "duck and cover" drills, the concerns about nuclear fallout. Maybe it seems just a little unbelievable that this history could repeat itself. But in fact, it might be worse. Today, it's not just Russia and the United States that would embark on dangerous game of one-upmanship, as China, India, Pakistan, and likely others would jump in to develop new and more sophisticated nuclear weapons. Nothing would more effectively throw gasoline on a global nuclear arms race than restarting nuclear testing.

If it is the United States that leads the way to a global nuclear testing breakout, what possible restraint could we influence or enforce upon other nations using diplomatic tools? Any nuclear test would be a highly provocative event inciting a reaction that could quickly spiral out of control. In a 21st century security environment with multiple global "hot spots," resumption of nuclear explosive testing now might initiate a cycle with the launch of a nuclear warhead as its tragic end. US resumption of nuclear testing is a dangerous idea that should be clearly rejected in the president's nuclear posture review. Congress must continue to press for a review and policy that ramps down nuclear dangers rather than incites

them and should specifically decry any plans for US resumption of explosive nuclear blasts.

Source: *http:// thehill.com, 01 July 2017.*

BALLISTIC MISSILE DEFENCE

INDIA

India Successfully Flight Tests Homegrown Missile Off Odisha Coast

DRDO on 03 July 2017 successfully flight tested newly developed short range Quick Reaction Surface-to-Air Missile (QRSAM) from a test facility off Odisha coast. Sources said the sophisticated weapon system was fired from a canister mounted on a rotatable truck-based launch unit at the launching complex-I of Integrated Test Range (ITR) in Chandipur-on-sea at about 11.30 am. The missile is a highly mobile air defence system which can destroy multiple targets at a distance of 15 km. Though the missile is yet to get a name, it is expected to supplement the medium range surface-to-air missile Akash capable of hitting targets 30 km away.

A defence scientist, who witnessed the trial, said the test achieved a 'copy book' success. "All the technologies and sub-systems incorporated in the missile have performed well, meeting all the mission requirements. Radars, electro optical systems, telemetry systems and other stations have tracked the weapon and monitored all the parameters," he said. This was second developmental trial of the homegrown state-of-the-art missile developed by the DRDL. The first test conducted exactly a month ago had validated various parameters, including propulsion performance of the weapon system and its release from the canister.

The missile with its multi-role capability, high frequency and maneuverability will provide considerable advantage to the armed forces. With cent per cent kill probability, it can neutralise aerial targets like fighter jets, cruise missiles and air-to-surface missiles as well as short range ballistic missiles. The missile can also be used as an anti-sea skimmer from a ship against low flying attacking missiles.

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Multi-role Capability: QRSAM can be used as an anti-sea skimmer from a ship against low flying attacking missiles. To supplement the medium range surface-to-air Akash capable of hitting targets 30 km away. Missile is a highly mobile air defence system which can destroy targets at a distance of 15 km.

Source: *http://www. newindianexpress. com, 03 July 2017.*

What India can Gain from Israel's Defence Strategy: All You Need to Know

When PM Modi will touch down in Israel later on 04 July 2017, he will become the first ever Indian PM to visit the Middle Eastern country. Modi will undertake a three-day trip to the Jewish nation till July 6 before travelling to Hamburg in Germany to attend the G-20 Summit. India and Israel share a strong and old diplomatic relationship and PM Modi said he will look to strengthen ties and also discuss common challenge of terrorism with his Israeli counterpart Benjamin Netanyahu.

Israel's defence prowess is even acknowledged by countries like the US and Germany. India too is one of the largest importers of Israeli arms and ammunition. India would like to gain as much as it can on the defence front during PM Modi's

three-day tour. So, what's behind Israel's powerful and foolproof defence system that India would want to learn during PM Modi's historic trip?

***Israel's Defence Budget*:** Despite being a small country, Israel spends a huge sum on its defence system and gives special importance to keep it upgraded with latest technology. Israel earmarked 17.8 billion dollar, which is 5.8 per cent of the GDP, towards its defence needs in 2016. On the other hand, India spent 55.9 billion dollar, GDP's 2.5 per cent, in 2016.

Delilah cruise missile is designed to destroy moving targets. It resembles a mini-Tomahawk land attack missile. The Delilah is an air-launched missile with a range of 250 km. One of the most unique features of Delilah cruise missile is that it is able to loiter and recce an area to identify its target before being activated for action from a remote location.

***Delilah Cruise Missile*:** Developed by Israel Military Industries (IMI), Delilah cruise missile is designed to destroy moving targets. It resembles a mini-Tomahawk land attack missile. The Delilah is an air-launched missile with a range of 250 km. One of the most unique features of Delilah cruise missile is that it is able to loiter and recce an area to identify its target before being activated for action from a remote location. The missile can be launched from F-15/16 fighter jets and also from a range of attack helicopters.

Tavor/Micro-Tavor Assault Rifle: Tavor/Micro-Tavor assault rifles have been designed and developed by Israel Weapon Industry (IWI). The USP of the assault rifle is that the user can shift between semi-automatic and fully-automatic mode. The firing range of Tavor assault rifles varies depending upon the variants used. TAR-21, GTAR-21, CTAR-21, STAR-21 are some of variants used by the defence forces of several countries.

***Arrow 3-Anti-Ballistic Missile*:** Developed jointly by the Unites States and Israel, Arrow 3 is an exoatmospheric anti-ballistic missile. It can carry conventional, nuclear, chemical as well as biological warheads. One of the killer features of Arrow-3 is that it can change directions to see approaching satellites. According to some reports, the missile can hit a target as far as 2400 km away. With Arrow-3, which is being labelled as an anti-satellite missile system, Israel is one of the few nations having the capability of targeting satellites.

Iron Dome: Considered one of the most efficient anti-missile systems in the world, the Iron Dome missile defence system is designed and developed by Israel. The missile development system is jointly funded by the US. The system uses C-RAM (Counter Rocket Artillery Mortar) which identifies and destroys small rockets and artillery shells before they land inside Israeli territory. The system was developed primarily to counter artillery firing in Gaza. One of the most advanced features of Iron Dome is its capability to determine whether an incoming rocket will land and to only intercept such projectiles that pose threats to civilian areas.

Source: *http://indiatoday.intody.in, 04 July 2017.*

NUCLEAR ENERGY

CHINA

Nuclear Scientist Predicts China could be Using Fusion Power in 50 Years

Earlier this month (July), scientists on the project kept extremely hot plasma at a temperature three times that of the sun's core for more than 100 seconds during an experiment at their Hefei research facility. It was almost double the record set by the team last year they're aiming to sustain the burn for more than 1,000 seconds – using a ring-shaped device known as a tokamak.

Significant progress could be made on artificial sun technology by 2023 – and it could be used to generate clean energy for China in 50 to 60 years, a senior government nuclear scientist says. Song Yuntao, a lead scientist on the country's largest fusion energy project, told the official *Science and Technology Daily* that they expected to double the burn time of man-made sun every 16 to 17 months.

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They're aiming to sustain the burn for more than 1,000 seconds – using a ring-shaped device known as a tokamak – at which point the scientists expect the plasma to produce a self-sustainable nuclear chain reaction, an important step for power generation. That milestone would be less than six years away, based on Song's estimate. "We hope to go into business in 50 to 60 years," he told the newspaper.

At the Experimental - Advanced Superconducting - Tokamak facility in Anhui province, the chain reaction that takes place in the sun to provide life-giving energy is simulated using plasma – two hydrogen atoms merge into one helium and in the process release a large amount of energy. This extremely hot gas – whose temperature can reach up to 10 times that of the sun's core – is contained by a strong magnetic field to prevent it from coming into direct contact with the inner wall of the reaction chamber. The tokamak fusion device was invented by Soviet physicists in the 1950s.

India, like other nuclear nations, has been closely watching the fate of Japanese-owned Westinghouse, which filed for bankruptcy in March 2017 after an estimated $13 billion of cost overruns at two US projects, casting a shadow over the nuclear industry.

The development of fusion technology – particularly the idea of applying it to nuclear reactors to generate clean energy – has been held back by the difficulty of containing the reaction so that heat is released in a slow and controllable way. But Song said the Chinese scientists were a step ahead, in part because they could mass-produce some of the world's most advanced superconducting wires that can create a strong magnetic field using a lot less power than others. Hundreds of tonnes of these wires – which are as fine as hair – are rolled out in Chinese factories every year at a cost of 30,000 yuan (US$4,400) per individual wire. He said the country could start building "within a few years" a large-scale fusion plant to assess whether it was feasible to generate power.

Chinese media reports have previously said construction of the China Fusion Engineering Test Reactor would start in 2020 and it would be fired up to generate electricity six years later. ...

Source: Stephen Chen, http://www.cnbc.com, 14 July 2017.

INDIA

India Gets Update on Westinghouse, Meant to Build Andhra Nuclear Reactors

The US administration has told India that Westinghouse Electric Co will emerge from bankruptcy and be sold by end of year 2017, industry and diplomatic sources have said, raising the prospect of a Washington-supported sale or bailout for the nuclear firm. India, like other nuclear nations, has been closely watching the fate of Japanese-owned Westinghouse, which filed for bankruptcy in March 2017 after an estimated $13 billion of cost overruns at two US projects, casting a shadow over the nuclear industry. There has been debate over potential US support for the reactor maker since owner Toshiba, the laptop-to-chips conglomerate, announced the blow-out at Westinghouse in 2016. Some form of US backing or involvement, industry experts say, could avoid a Chinese or Russian buyer unpalatable to Washington, which would prefer to keep Westinghouse's advanced nuclear technology out of the hands of its foreign rivals. The White House declined comment.

Civil nuclear cooperation has been a cornerstone of US-India relations, and the proposed construction of six Westinghouse AP1000 reactors in Andhra Pradesh, announced in 2016, crowned more than a decade of diplomatic efforts. The achievement was left in limbo by Westinghouse's troubles. Sources familiar with the matter said the statement was backed by US guidance that Westinghouse would be sold to a US investor after emerging from bankruptcy proceedings, in turn paving the way to close the reactor deal in 2018.

"*Massively Important*": Westinghouse and the Department of Atomic Energy did not respond

to emailed requests for comment. The state-owned Nuclear Power Corporation could not be reached for comment. Toshiba said it wasn't in a position to predict when Westinghouse would emerge from bankruptcy. Because the bankruptcy court has not yet approved a restructuring plan, no decision has been taken on searching for a buyer, it said. Mr Perry declined to elaborate on potential acquirers. But former Westinghouse executives have told Reuters that they have been approached by private equity funds to help them assess a possible deal to buy the company.

Toshiba has agreed on a liability cap on one of the US projects, the unfinished Vogtle power plant in Georgia that is being led by Southern Co. If a similar agreement can be reached for the VC Summer plant in South Carolina, which is co-owned by SCANA Corp, that would clear the path to an exit from bankruptcy.

Paving the way for a deal, Toshiba has agreed on a liability cap on one of the US projects, the unfinished Vogtle power plant in Georgia that is being led by Southern Co. If a similar agreement can be reached for the VC Summer plant in South Carolina, which is co-owned by SCANA Corp, that would clear the path to an exit from bankruptcy, say people familiar with the matter. Mr Tellis, a senior fellow at the Carnegie Endowment for International Peace, was instrumental in negotiating a civil nuclear accord with India during the George W. Bush administration although, more than a decade on, it has yet to yield actual nuclear deals. Westinghouse has said it will concentrate on reactors only - and not construction - meaning it would require partners for its Indian and other projects. Westinghouse and the Department of Atomic Energy did not respond to emailed requests for comment. The state-owned Nuclear Power Corporation could not be reached for comment.

Source: *http://www.ndtv.com, 03 July 2017.*

PAKISTAN

Pakistan's Chashma 4 Connected to Grid

Unit 4 at the Chashma nuclear power plant in Pakistan was connected to the grid on 29 June 2017. The Chinese-supplied PWR - the country's fifth power reactor - is expected to enter commercial operation by the end of August 2017. A ceremony was held on 01 July 2017 to mark the unit's grid connection, China National Nuclear Corporation (CNNC) announced ….

Chashma 4 is one of two CNP-300 units built at the site, in Punjab province. Construction began on unit 3 in March 2011. It achieved first criticality on 03 October 2016 and was connected to the grid on 15 October 2016. The unit entered commercial operation in December 2016. Construction of Chashma 4 began in late December 2011. The Pakistan Nuclear Regulatory Authority granted permission on 09 February 2017 for fuel to be loaded into the unit, which achieved first criticality on 15 March 2017. CNNC said the unit was connected to the grid at 11.36am on 29 June 2017 and is expected to be in commercial operation by the end of August 2017.

EDF estimates the cost of the Hinkley Point C nuclear power plant project in the UK to now total £19.6 billion ($25.4 billion), up from its earlier estimate of £18.1 billion. The target date for first operation of unit 1 remains by the end of 2025. The company announced in its 2016 Annual Financial Report that it would carry out a full review of the costs and schedule of the Hinkley Point C project.

The Chashma site - also referred to as Chasnupp - is already home to two Chinese-supplied 300 MWe PWRs: unit 1, in commercial operation since 2000, and unit 2, in commercial operation since 2011. Pakistan also has a 125 MWe Canadian-supplied pressurized heavy water reactor, Karachi unit 1, which has been in commercial operation since 1972. Two 1161 MWe Chinese-supplied Hualong One plants are also under construction at the Karachi site. Construction of Karachi 2 and 3 started in August 2015 and May 2016, respectively. The units are scheduled to enter service in 2021 and 2022.

Source: *http://www. world-nuclear-news.org, 03 July 2017.*

UK

Cost of Hinkley Point Crises by 8%, EDF Says

EDF estimates the cost of the Hinkley Point C

nuclear power plant project in the UK to now total £19.6 billion ($25.4 billion), up from its earlier estimate of £18.1 billion. The target date for first operation of unit 1 remains by the end of 2025. The company announced in its 2016 Annual Financial Report that it would carry out a full review of the costs and schedule of the Hinkley Point C project.

In a statement, EDF said its latest estimate "includes successful operational action plans, in partnership with suppliers". The increase in costs "result mainly from a better understanding of the design adapted to the requirements of the British regulators, the volume and sequencing of work on site and the gradual implementation of supplier contracts". EDF's projected rate of return on the project is now around 8.5% compared with the initial estimate of about 9%.The pouring of first safety-related concrete for unit 1 of will be in mid-2019, EDF confirmed. However, it noted this assumes the final design, "which is on a tight schedule", is completed by the end of 2018. EDF said the risk of deferral of delivery is estimated at 15 months for unit 1 and nine months for unit 2. This risk, it said, would entail an additional potential cost of some £700 million. Under this assumption, the rate of return for EDF would be about 8.2%. EDF Energy's new build subsidiary, EDF NNB Generation Company, "in compliance with its rules of governance, will study and implement the recommendations of the review".

The British government's plan to withdraw from a seminal European treaty governing the movement of nuclear material is generating alarm that it might hobble Britain's nuclear industry, destroy thousands of jobs and even deny cancer patients treatments that rely heavily on nuclear isotopes.

Under a deal agreed in October 2015, China General Nuclear (CGN) will take a 33.5% stake in EDF Energy's project to construct Hinkley Point C, in Somerset, England. Consisting of two Areva-designed European Pressurised Reactors, it will be the first new nuclear power station to be built in the UK in almost 20 years and will provide about 7% of the country's electricity. The final agreements enabling construction of two EPRs at Hinkley Point C to proceed were signed on 29 September 2016 by the UK government, EDF and CGN. These agreements included the contract-for-difference (CfD) and the Secretary of State Investor Agreement. The CfD - the ratepayer-backed guaranteed price for electricity generated by Hinkley Point C - was originally agreed in October 2013 and guarantees the plant will get £92.50 per MWh for its first 35 years of operation. The signing of the agreements followed a long-awaited and positive final investment decision from the EDF board on 28 July 2016.

The UK EPR design became the first reactor design to complete the country's Generic Design Assessment process and receive a Design Acceptance Confirmation from the Office for Nuclear Regulation (ONR) and a Statement of Design Acceptability from the Environment Agency, in December 2012. In March, the ONR granted its first consent for the start of construction of a nuclear power plant at Hinkley Point C. The consent covers the placement of the structural concrete for the first nuclear safety-related structure at the site. It does not give consent for all elements of construction.

Source: *http://www.world-nuclear-news.org, 03 July 2017.*

UK Plan to Quit European Nuclear Treaty Stirs Alarm

The British government's plan to withdraw from a seminal European treaty governing the movement of nuclear material is generating alarm that it might hobble Britain's nuclear industry, destroy thousands of jobs and even deny cancer patients treatments that rely heavily on nuclear isotopes.

At issue is the six-decades old European Atomic Energy Community, also known as Euratom, a seemingly arcane sounding treaty signed in 1957 with a nevertheless crucial role. It governs the development of nuclear energy and its trade across Europe, funding research and development and assuring that European countries do not divert

nuclear materials to military uses.

Prime Minister Theresa May has insisted that with Britain's decision to leave the European Union, it can no longer be a party to the treaty. But leading members of both the Conservative and Labour parties, the nuclear industry and the medical establishment are lining up against her. The issue could come to a head when the government announces a so-called repeal bill that would enshrine parts of European Union law into British law, a pivotal moment in its decision to leave the European Union.

... The British government sought to reassure industry and Parliament that the country would be able to minimize any problems associated with leaving the treaty. Addressing a debate in Parliament, the energy minister, Richard Harrington, said that maintaining civil nuclear cooperation with Europe and the rest of the world remained a priority, and that the government would publish a paper clarifying its position.

Mr. Harrington warned against alarmism about leaving Euratom, saying that imports of "medical radioisotopes" could continue, and that Britain would keep the other benefits of Euratom. But not everyone agreed, and several lawmakers spoke out in favor of remaining in the treaty. Bob Neill, a Conservative, warned that leaving the treaty would be "cutting off your economic and scientific nose to spite your political face." ...

Source: Dan Bilefsky, https://www.nytimes.com, 12 July 2017.

USA

NASA Reviews Plan to Put Nuclear Reactors on Mars

As NASA makes plans to one day send humans to Mars, one of the key technical gaps the agency is working to fill is how to provide enough power on the Red Planet's surface for fuel production, habitats, and other equipment. One option: small nuclear fission reactors, which work by splitting uranium atoms to generate heat, which is then converted into electric power. NASA's technology development branch has been funding a project called Kilopower for three years, with the aim of demonstrating the system at the Nevada National Security Site near Las Vegas. Testing is due to start in September and end in January 2018.

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The last time NASA tested a fission reactor was during the 1960s' Systems for Nuclear Auxiliary Power, or SNAP, program, which developed two types of nuclear power systems. The first system — radioisotope thermoelectric generators, or RTGs — taps heat released from the natural decay of a radioactive element, such as plutonium. RTGs have powered dozens of space probes over the years, including the Curiosity rover currently exploring Mars. The second technology developed under SNAP was an atom-splitting fission reactor. SNAP-10A was the first — and so far, only — US nuclear power plant to operate in space. Launched on 03 Apr 1965, SNAP-10A operated for 43 days, producing 500 watts of electrical power, before an unrelated equipment failure ended the demonstration. The spacecraft remains in Earth orbit. Russia has been far more active developing and flying spacecraft powered by small fission reactors, including 30 Radar Ocean Reconnaissance Satellites, or RORSAT, which flew between 1967 and 1988, and higher-powered TOPAZ systems. TOPAZ is an acronym for Thermionic Experiment with Conversion in Active Zone.

NASA has funded several nuclear power technology efforts in the 50 years since SNAP, but financial, political and technical issues stymied development. Three years ago, the agency's Game Changing Development program backed Kilopower, with the goal of building and testing a

small fission reactor by 30 September 2017, the end of the current fiscal year. The project is costing about $15 million. "It'll be the first time that we operate a fission reactor that could be used in space since [the] 1960s SNAP program," said Lee Mason, who oversees power and energy storage technology development at NASA's Glenn Research Center in Cleveland. The tests in September 2017 are designed to validate Kilopower's design and performance. After that, NASA would be ready to proceed with developing a higher-fidelity system for testing on Mars or elsewhere, Mason said.

The test reactor, which is about 6.5 feet tall (1.9 meters), is designed to produce up to 1 kilowatt of electric power, but to keep costs down, the test unit does not include a full array of Stirling engines to convert energy generated by the fission process into heat. Thermal simulators will be used for the balance of the engines to verify the reactor's power output, Mason said in an interview with Space.com. NASA's interest in fission resurfaced after a 2010 study that looked at options for RTG systems. "At that point, we were trying to find a small fission reactor that could provide similar power output as the radioisotope power systems," Mason said.

NASA engineers figure human expeditions to Mars will require a system capable of generating about 40 kilowatts of power, which is about what is needed for "about eight houses on Earth," according to the agency. Curiosity's RTG was designed to supply about 125 watts — less energy than what is needed to power a microwave oven — though power levels fall as the radioactive plutonium decays. Solar power is another option, but that would restrict power generation to regions that are exposed to enough sunlight to charge batteries. Inside the moon's Shackleton Crater, for example — a prime candidate for lunar sorties due to its water resources — it is completely dark. The sunniest spots on Mars receive only about one-third the amount of sunlight as Earth does.

"If you want to land anywhere, surface fission power is a key strategy for that," Michelle Rucker, an engineer at NASA's Johnson Space Center in Houston, said during a presentation in December 2016 to NASA's Future In-Space Operations working group. Fission reactors also can continue working in adverse weather conditions, such as Mars' ubiquitous dust storms. "We've landed some really cool things on Mars and they've had some pretty remarkable power systems ... but they're not going to cut it for human missions," Mason said during last month's Humans to Mars Summit in Washington, D.C.

NASA envisions sending four or five small fission reactors, each capable of generating about 10 kilowatts of power, to Mars, Mason said at the Humans to Mars Summit. The units would be launched cold and activated once they reach their destinations.

The biggest power requirement for future human expeditions is running the equipment to produce fuel, air, and water, plus running the habitat and recharging batteries for rovers and science equipment. NASA envisions sending four or five small fission reactors, each capable of generating about 10 kilowatts of power, to Mars, Mason said at the Humans to Mars Summit. The units would be launched cold and activated once they reach their destinations. "They're not operating at launch, whereas once you fuel an RTG, it's operating, and you have to process the thermal output," Mason said. "The reactors also have a very low radiological inventory at launch — less than 5 curies — so it's benign.... There are no fission products until the reactor is turned on, and that's when there will be some radiation." Partners in the Kilopower project include NASA's Glenn Research Center, the Department of Energy, Los Alamos National Lab and the Y12 National Security Complex, which supplies the reactor's uranium.

Source: *http://www.nbcnews.com, 30 June 2017.*

NUCLEAR COOPERATION

INDIA–JAPAN

Japan Evinces Interest in Nuclear Sector in India

Japanese companies are eyeing opportunities in India's nuclear reactors and could be involved in

efforts to revive Westinghouse's plan to build reactors after it filed for bankruptcy earlier in 2017. According to diplomatic sources, "Japan's path to India's nuclear programme has been cleared after country's Parliament, the 'Diet', ratified a civilian nuclear agreement with India, allowing for the export of reactors and components to India despite its weapons programme." Inked by PM Modi and Japanese PM Abe in November 2016, the agreement becomes operational in July 2017.

Several Japanese companies big and small including Hitachi and Mitsubishi have expressed their intent to the Japanese government for exploring the Indian market for the commercial interests related to building of the nuclear reactors.

Ahead of the visit of the Japanese PM later in 2017 for the India-Japan annual summit, there will be meetings between officials from both sides to discuss the commercial aspects of Indian and Japanese companies being keen on supplying the castings of the reactors and other components needed. "Several Japanese companies big and small including Hitachi and Mitsubishi have expressed their intent to the Japanese government for exploring the Indian market for the commercial interests related to building of the nuclear reactors," the source added. The Diet had endorsed the Japan-India civil nuclear cooperation agreement that will allow the nation's firms to export nuclear materials and technology to India for non-military use. The agreement allows Japanese firms to supply nuclear materials, equipment and technologies to India for "peaceful and non-explosive purposes".

The companies may also provide support services for designing, building and operating reactors. In May 2017, the Indian government approved the construction of 10 units of indigenous pressurised heavy water reactors (PHWR), giving a significant impetus to India's nuclear power generation capacity. This envisages an investment of around 105,000 crore in PM Modi's 'Make in India' initiative and will give a major boost to the Indian industry.

Sources indicated that there are several opportunities for the Japanese companies to participate in the reactor building in India. One of the major players in India is Larsen & Toubro, which has been at the forefront of developing homegrown capabilities in manufacturing and construction of nuclear power plants since 1972. The civil nuclear deal between the two countries follows a landmark 2006 Indo-US nuclear pact, in which the US had agreed to provide nuclear technology. So far, Japan has concluded nuclear cooperation pacts with 13 countries, including the US, Britain, France, Canada, Australia, Vietnam, Jordan and Turkey.

Source: *http://financialexpress.com, 01 July 2017.*

URANIUM PRODUCTION

AUSTRALIA–CANADA

Uranium: Why It Can Rally Back to $70

Uranium prices may be trading around $20.50 a pound, the highest level in a month, but there is little to celebrate given the nuclear fuel is trading at a fraction of the $150 a pound it fetched in 2007. But RBC Capital Markets has given some hope for uranium bulls that better days are ahead in its third quarter mining and metals outlook.

Near-term, we think prices are relatively range-bound near $20-25/lb U3O8 in 2017- 2018. As cost curve economics take effect and contract coverage declines in 2019-2021, we forecast an increase to $30-40/lb. Post-2021, we believe the market should move towards a deficit and new mine supply may be required, resulting in uranium prices at $50/lb in 2022, $60/lb in 2023-2025 and $70/lb in 2026-2028. Longer-term, we forecast $65/lb based on the marginal cost of production.

While the short term looks tough, production deficits could boost prices over coming years: We forecast uranium prices will increase significantly through our forecast period due to cost curve economics, declining contract coverage, and required incentive price for new mine supply. Near-term, we think prices are relatively range-bound near $20-25/lb U3O8 in 2017- 2018. As cost curve economics take effect and contract coverage declines in 2019-2021, we

forecast an increase to $30-40/lb. Post-2021, we believe the market should move towards a deficit and new mine supply may be required, resulting in uranium prices at $50/lb in 2022, $60/lb in 2023-2025 and $70/lb in 2026-2028. Longer-term, we forecast $65/lb based on the marginal cost of production.

The past decade has been a struggle for uranium producers as the disaster at Fukushima took Japanese reactors offline and dulled the appeal of nuclear energy. However, China is committed to developing more nuclear energy to combat pollution. Low prices have weighed on the shares of big producers, with Canada's Cameco (CCO.CA) (CCJ) down around 30% from its January highs and Energy Resources of Australia (ERA.AU) is down nearly 40% from its February highs. However, the very modest bounce in uranium prices recently has lifted shares in Uranium Participation Corp. (U.CA) by around 7% this month (June).

Source: *http://www.barroms.com, 29 June 2017.*

NUCLEAR PROLIFERATION

NORTH KOREA

How North Korea's Nuclear Programmes Advanced under Three Generations of Kim Family

After North Korea's first test-firing of an intercontinental ballistic missile, the country's leader, Kim Jong Un, has moved one step closer to perfecting a nuclear missile capable of reaching the United States, a weapons programme launched by his grandfather and nurtured by his father.

The three generations of the Kim family have run North Korea with an absolute rule that tolerates no dissent. They have devoted much of the country's scarce resources to its military but have constantly feared Washington is intent on destroying their dynastic rule. They concluded that a powerful nuclear deterrent against potential US aggression would guarantee their survival. A look at how North Korea's nuclear and missile programmes have evolved under each of the three Kims.

The Patriarch: Kim Il Sung (1948-1994): 1948: Kim Il Sung, a former guerrilla leader fighting against Japan's colonial rule, establishes the Democratic People's Republic of Korea in the northern half of the Korean Peninsula.

1950: Kim's army invades South Korea, triggering the three-year Korean War. The United States fights alongside South Korea while China backs North Korea.

1985: North Korea joins the Nuclear Nonproliferation Treaty. But the country doesn't allow inspections required by the pact, arousing suspicions that it's engaging in clandestine work to develop atomic weapons.

1993: North Korea announces its withdrawal from the Nuclear Nonproliferation Treaty, touching off an international nuclear crisis.

July 1994: Kim Il Sung dies of a heart attack at age 82. His son and longtime heir apparent, Kim Jong Il, takes power.

The Son: Kim Jong Il (1994-2011): October 1994: North Korea and the United States sign a landmark nuclear disarmament deal in Geneva. North Korea pledges to freeze and eventually dismantle its nuclear weapons programme in exchange for international aid to build two power-producing nuclear reactors.

1998: North Korea stuns the region by firing a suspected missile over Japan and into the Pacific Ocean.

2002: Assistant US Secretary of State James Kelly says North Korean officials admitted to having a secret nuclear weapons programme during his visit to Pyongyang. The 1994 pact subsequently falls apart and a nuclear crisis flares again.

2003: North Korea attends Beijing-hosted disarmament talks that also involve Washington, Seoul, Tokyo and Moscow. The on-and-off talks continue until late 2008, producing two major now-stalled disarmament-for-aid deals.

July 2006: North Korea launches a three-stage rocket with a potential range of 6,700 kilometers (4,100 miles) but it fizzles after lift-off, according

to US and South Korean officials. North Korea has never acknowledged the launch.

October 2006: North Korea conducts its first underground nuclear test blast, citing "extreme threat of a nuclear war" from the United States.

2009: North Korea conducts its second nuclear test explosion.

2011: Kim Jong Il dies of a heart attack at 69. Kim's youngest son, Kim Jong Un, succeeds him as leader.

The grandson: Kim Jong Un (2011-present): 2012: North Korea puts a satellite in orbit with a long-range rocket. The United States, South Korea and others condemn the launch as a cover for testing long-range missile technology. It is the North's first successful satellite launch.

2013: North Korea carries out its third nuclear test.

January 2016: North Korea says it has conducted a hydrogen bomb test. It's the North's fourth nuclear test, but many outsiders are sceptical that it was a hydrogen bomb explosion.

The missile, called Hwasong-14, is capable of reaching Alaska and beyond if launched at a normal trajectory, according to outside experts. After the launch, Kim says he won't put his weapons programs on the negotiating table unless the United States ends its hostility and nuclear threat.

February 2016: North Korea succeeds in its second satellite launch.

August 2016: North Korea fires a ballistic missile from a submarine that flies 500 kilometres (310 miles) before crashing into waters near Japan. Missiles launched from submarines are generally harder to detect than land-based ones.

September 2016: North Korea stages its fifth nuclear test, its most powerful atomic bomb explosion to date.

February 2017: North Korea tests a new midrange ballistic missile, the Pukguksong-2. It says the missile used solid fuel, an advance that increases a weapon's mobility and makes it harder for outsiders to detect a coming launch. The North tests this missile again in May.

July 4, 2017: North Korea test-fires its first ICBM at an extremely lofted angle. The missile, called Hwasong-14, is capable of reaching Alaska and beyond if launched at a normal trajectory, according to outside experts. After the launch, Kim says he won't put his weapons programs on the negotiating table unless the United States ends its hostility and nuclear threat.

Source: Hindustan Times, 14 July 2017.

US Renews Pressure on China to Keep North Korea's Nuclear Power under Check

The Trump administration is putting renewed pressure on China amid frustration with Beijing's reluctance to deal with North Korea's nuclear threat. In recent days the Trump administration has approved a $1.4 billion arms sale to Taiwan and blacklisted a small Chinese bank over its business ties with North Korea. In addition, the State Department has given Beijing a dismal grade in a new human trafficking report.

American officials had been describing improved coordination with China as the centrepiece of their North Korea strategy. They seek to prevent the North from being able to strike US homeland with nuclear weapons. President Donald Trump and top aides are irritated over China's reluctance to tighten the economic screws on North Korea. Yet the White House insists it's not out to punish Beijing.

Source: *http://www.firstpost.com, 01 July 2017.*

NUCLEAR NON-PROLIFERATION

USA

New Technique 'Sees' Radioactive Material Even after it's Gone

A new technique allows researchers to characterize nuclear material that was in a location even after the nuclear material has been removed - a finding that has significant

implications for nuclear nonproliferation and security applications. "Basically, we can see nuclear material that is no longer there," says Robert Hayes, lead author of paper describing the work and an associate professor of nuclear engineering at North Carolina State University. "For example, we could identify and characterize a dirty bomb based on samples taken from a room the bomb was in a year ago.

"This is a valuable tool for emergency responders, nuclear nonproliferation authorities and forensics, because it allows us to get a rough snapshot of the size of a radiation source, where it was located, how radioactive it is, and what type of radioactive material it is," Hayes says. The technique takes advantage of the fact that radioactive material changes the arrangement of valence electrons - or outer electrons - in insulator materials, such as brick, porcelain, glass - even hard candy. Basically, radiation displaces electrons at defect sites in the crystalline structure of these materials.

By taking samples of multiple materials in a room, applying conventional radiation dosimetry techniques, and evaluating how the electrons at those defect sites are organized, researchers can determine the presence and strength of any nuclear materials that were in that room. "If the samples were taken at regular intervals in a grid pattern, the relative radiation dose profile can be used to triangulate where in the room the source was located, in three dimensions," Hayes says. "It can also provide a very rough idea of the physical size of the source, but that depends on various factors, such as how close the source was to the materials being sampled."

By taking a core sample of the insulating material, and measuring the radiation dose at various depths in the material, researches can also ascertain what type of radiation source was present. This is possible because different radioactive materials have characteristic distributions of gamma rays, X-rays, etc., and each type of energy penetrates materials with different strength. "This is not extremely precise, but it does allow us to answer important questions. For example, distinguishing between different kinds of nuclear material such as naturally occurring, medical, industrial, and 'special' nuclear materials - the latter being used for nuclear weapons," Hayes says.

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"This is a proof of concept," Hayes says. "We're now focused on exploring its detection limitations along with spatial and energy resolution, and how to make use of this approach moving forward. "But this is a big deal for nuclear nonproliferation efforts, because it means you can't handle nuclear material in secret anymore," Hayes adds. "It means the world is now densely blanketed by low-resolution integrating gamma-ray spectrometers, so we can always go back and measure what was present. There's no hiding."

Source: *http:// www.eurekalert.org, 03 July 2017.*

NUCLEAR SAFETY

EUROPE

Nuclear Safety in Europe: Decision-making behind Closed Doors?

European citizens don't want to be left out of decision-making over nuclear power. But a recent meeting of the Espoo Convention reveals how concerns over reactor life-time extensions are being sidelined. After Fukushima, you might think that nuclear power is a thing of the past. Or that our focus on climate is the only issue of public concern when it comes to the energy sector. Yet the recent Meeting of the Parties to the Espoo Convention, which deals with environmental impact assessments across borders, was hi-jacked by ongoing disputes over reactor construction and

lifetime extension. In Minsk, 200 participants representing the 45 states who are members to this UN Convention held heated discussions over problematic cases, such as Hinkley Point C (UK), Ostravets (Belarus) and a number of old Ukrainian reactors going through their lifetime extensions.

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This dispute has arisen largely because the rules on who has a say when decisions regarding nuclear operations are made are unclear. Which countries and their citizens should be notified and involved in decision-making on a new nuclear installation such as Hinkley Point C? And how about extending the lifetime of old reactors, like the Yuzhnoukrainsk power plant in south Ukraine? These are questions to be addressed in the framework of the Espoo Convention. The recent Meeting of the Parties to the Espoo Convention was an unfortunate display of the influence that politics and the nuclear lobby have over decisions with severe impacts on health and environment.

The recent Meeting of the Parties to the Espoo Convention was an unfortunate display of the influence that politics and the nuclear lobby have over decisions with severe impacts on health and environment. One of the most important tasks of the Meeting of the Convention parties, which convenes every three years, is to endorse draft decisions on non-compliance.

But are we really solving the dilemma of whether nuclear operations can have a significant transboundary impact, which should, according to the Espoo Convention, trigger communication across borders with potentially affected parties? Or are we witnessing a political game, fueled by self-centered interests of nuclear positive countries and the nuclear business, which is trying to remodel itself by "climate-neutral marketing" of its product?

The recent Meeting of the Parties to the Espoo Convention was an unfortunate display of the influence that politics and the nuclear lobby have over decisions with severe impacts on health and environment. One of the most important tasks of the Meeting of the Convention parties, which convenes every three years, is to endorse draft decisions on non-compliance. These are prepared carefully and over the course of few years by the Convention's Implementation Committee. Such decisions, despite being tailored to each specific case of challenged non-compliance, should have general implications across similar cases, reflecting the principal of an equal treatment. Endorsed decisions should bring needed clarity — in this case clarity concerning rules for nuclear decision-making.

Unfortunately, the Minsk meeting has torn the draft decisions apart with last minute revisions, which were agreed behind the closed doors of "coordination meetings" and "ad hoc working groups". Civil society members, whom this (and some other) UN environmental convention assigns a special role, were closed out from all key deliberations. At some point, shortly before midnight on the penultimate day of the Meeting, most participants lost track of a number of parallel meetings and groups.

At the end of this political show there were too many revisions proposed to be seriously considered. All decisions were postponed for an extraordinary meeting to take place in the course of the next year — just when the clarity on how to proceed with all the nuclear decision-making concerning old and new nuclear installations is much needed. Confusion continues, which lowers efficiency of the Convention on nuclear issues.

The main purpose of the Convention — to be an instrument for a more inclusive decision-making leading to a better protection of environment — was abandoned.

To end on a hopeful note, there are three almost positive developments resulting from the Meeting. First, the mere acknowledgement that there is a lack of clear rules for nuclear decision-making. In Minsk, this became obvious and the issue finally "came out of the closet". Second, delegations as well as other participants seemed to have agreed in principle that when a state is making a decision on a nuclear project, they should send notification to potentially affected countries, and that the fact that a severe accident can cause widespread impacts has to be taken into account.

European citizens don't want to be left out of decision-making. It is important to renew our trust in political governance to feel that our interests are duly accounted for and represented. Thirdly, on the topic of extended operations of old nuclear units past their officially designed lifetime, the Meeting created a working group to clarify the need for transboundary environmental assessments. This particular issue generated significant interest among different mostly EU countries. By expressing their interest to be members of this working-group, states have acknowledged the relevance of this issue. This is hardly surprising: Europe is heading into a decade when 93 nuclear reactors will be (or not) up for their lifetime extension. And one does not need to be a nuclear scientist to understand increased risks associated with any aging technology, let alone nuclear.

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Nuclear safety is a matter of high concern and relevance to all of us. We have a right to be asking questions related to nuclear operation, to receive good quality answers and demand highest possible safety measures. This is all possible in the frame of the Espoo Convention on the environmental impact assessment in transboundary context. What we need now is to make it work. The international working group created in Minsk should make it crystal clear that lifetime extensions of nuclear reactors require broad engagement and public participation across borders. Resistance of some governments and the European Commission to this logical solution to nuclear decision-making is dangerously illogical. If "everything is ok and safe" as we are being assured, then why is wider public participation on decisions with immense potential impact generating so much opposition?

Source: *http:// www.opendemocracy.net, 03 July 2017.*

NUCLEAR WASTE MANAGEMENT

RUSSIA

Russia Begins Cleaning Up the Soviets' Top-Secret Nuclear Waste Dump

When the Soviet Union collapsed a vast store of spent nuclear fuel was abandoned in the Russian Arctic – an environmental disaster waiting to happen. Decades later an international clean-up has finally begun.

The Rossita gets ready to disembark with the first of Andreyeva Bay's Soviet-era spent nuclear fuel to take it to a safer storage. Photograph: Anna Kireeva/Courtesy of Bellona

As the Rossita pulled away from the pier at Andreyeva Bay, sounding a long boom of its horn, a military band struck up a jaunty march. On board the ship were nine sealed metal casks, each four metres high and weighing 45 tonnes, containing canisters of spent nuclear fuel. Dozens of Russian and foreign nuclear specialists looked on applauding, as the chilly rain of a northern summer fell on the bay deep inside the Russian Arctic. The ceremony, held on 27 June 2017 afternoon, marks

the culmination of a long international project to begin removing nuclear fuel from the site, formerly a top-secret Soviet installation. Nuclear specialists say Andreyeva Bay contains the largest reserves of spent nuclear fuel in the world, in fragile conditions that have disturbed the international community for years.

Spent nuclear fuel stored in so-called "bottles" at an open-air site in Andreyeva Bay.

During the Cold War period, nuclear submarines were refuelled at sea, and the spent nuclear fuel was then shipped to Andreyeva Bay, where it was placed in a special storage facility to cool off before being transported to a reprocessing plant at Mayak, in the Urals. But in the early 1980s, leaks sprung up in the storage system, causing high levels of radioactive contamination. When the Soviet Union collapsed, transfers of the spent fuel ceased, and about 22,000 spent nuclear fuel caskets were left at Andreyeva Bay in leaky dry storage units, creating the potential for an environmental catastrophe. "I've been all over the world to pretty much every country that uses nuclear power and I've never seen anything so awful before," said Alexander Nikitin, a former naval officer and environmentalist who has been monitoring the site for years.

'The graveyard of the Earth': inside City 40, Russia's deadly nuclear secret

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"With nuclear material, everything should be done very carefully, and here they just took the material and threw it into an even more dangerous situation."

In the decade after the Soviet collapse, the main concern was that poorly maintained facilities could lead to an onsite disaster. Nearly 250 nuclear submarines were decommissioned in the aftermath of the Soviet collapse, and facilities such as Andreyeva Bay were left in a perilous state. "There wouldn't have been a big explosion, but it could still have been something serious," said Nikitin. "With nuclear fuel, once processes start, you have no way of knowing how they will develop."

Andreyeva Bay in Northern Russia – a formerly secret nuclear waste dump. The tank holding the spent fuel, in the foreground, is leaking and is expected to be extremely costly to clean out. Photograph: Jan-Morten Bjornbakk / SCANPIX/ AFP/Getty Images

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Over the next decade, security fears also increased. "Before 9/11, nobody would really think anyone would be crazy enough to try to handle spent nuclear fuel, but with the new type of terrorist threat we face, this became a bigger worry," said Balthasar Lindauer of the European Bank for Reconstruction and Development (EBRD), which has managed the donor funds from western countries to help with the clean-up....

It might seem odd that, as Russia ploughs more money into its current military budget, western nations who see Moscow as a military threat are helping to fund the clean-up of the mess the Soviet military left behind. 13 countries have provided €165m in funding since 2003 for nuclear decommissioning in Russia's north-west. There have also been a number of bilateral projects, with Britain, Norway and other countries funding a long project to help clean up Andreyeva Bay....

New facilities built at Andreyeva Bay. Photograph: Amund Trellevik/NRK/Courtesy of Bellona

Specially commissioned machinery is used to pack the spent nuclear fuel.

A suite of new buildings has been constructed around the area where the spent nuclear fuel caskets are kept, replacing the decaying

structures that stood there previously. Work to load canisters into the giant protective casks can now be done using specially commissioned machinery. The Rossita, a ship constructed for the task, will take the huge fuel casks to Murmansk, where they will be put on fortified trains which will proceed under armed guard on the long journey from the Arctic to the Mayak reprocessing site. At the Mayak facility, the spent fuel will be recycled and the Russians say they will turn it into fuel to be used in civilian nuclear reactors.

Specialists at the plant estimate it could take 10 years to remove all the fuel. About half of the caskets have some kind of surface damage to their containers and will be dealt with after the non-problematic batches have been removed. "This is the end of a long process, but also the beginning of another long stage in the clean-up," said Marina Kovtun, the governor of Murmansk region. "Despite international tensions, work went on every day. Everyone who was working on this project understood that they were doing this for all of humanity and for protecting our environment."

Indeed, in the current climate of hostility between Russia and the west, it was an unusual tale of bonhomie and cooperation, as the ceremony included the flags of 10 western nations as well as the Russian tricolour. "The Barents Sea is maybe the cleanest sea in the world, and if something had happened here, it would have affected the whole Arctic," said Brende. "This process is not completely without risk, but compared to doing nothing, the risks are now much lower."

Source: *http:// www.theguardian.com, 02 July 2017.*

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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