



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

OPINION – Sitakanta Mishra

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Small Modular Reactors: The Dawn of a New Nuclear Era

In recent days, there is a steady increase of interest and optimism in small modular reactors (SMRs) worldwide because they are a step ahead from the existing world of nuclear power technology. The SMR is relatively a nascent concept, but they can make nuclear energy more scalable and flexible in terms of reliable energy supply, enhanced safety performance, better upfront capital cost, and suitability for cogeneration and non-electric applications. It is projected that “up to 21GW of SMRs could be added globally by 2035, making up approximately 3% of total installed nuclear capacity.” According to the IAEA, more than 70 SMR concepts are currently under development in 18 countries. Meanwhile, the global market for SMRs is expected to be \$300 billion a year by 2040.

The SMRs are nuclear reactors capable of producing power output between 10 to 300 MWe only. Their modular design and small size allow them to have multiple units on the same site as per the demand. Their diversity and simplicity of design allows them to build them in locations not

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traditionally suitable for nuclear power plants. Other advantages of SMRs vis-à-vis the traditional reactors are: economy of series production, short construction times, and reduced siting costs. Most are also designed with high-level inbuilt safety-security features to address malfunction or sabotage. Therefore, they are capable of meeting the need for flexible power generation for a wider range of users and applications, and can replace ageing fossil fuel-fired power units.

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Besides, SMRs make possible for synergetic hybrid energy systems that combine nuclear and alternative energy sources, including renewables. They are smaller than traditional reactors but are complementary, not competing technologies. While large reactors produce huge amounts of reliable, low-cost, low-carbon electricity, the SMRs can widen the range of useful nuclear applications. They “could be used in conjunction with other systems to address non-energy needs, such as providing thermal energy for desalination plants, industrial process heat, or for district heating systems. These non-electric functions are not available from most conventional renewable resources and could help developing nations meet other sustainable development goals (SDGs)....”

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According to the World Nuclear Association, “We are at the dawn of a new era in nuclear technology” as SMRs would help supply electricity to hard-to-reach regions, as well as serve smaller grids and industrial centres; in essence, SMRs are harbingers of the goal of ‘atom for people’. Undoubtedly, the SMRs are among the most promising emerging technologies in the nuclear energy sector. As a result, a series of policy initiatives have been announced worldwide signaling growing support for SMRs.

India, which aspires to play a bigger role in the nuclear energy market, has planned SMRs as the main pillars of its indigenous nuclear programme since its inception. Its indigenous reactor program has been mainly based on SMRs like the PHWRs, PFBR and FBRs, AHWR-300, etc. Only it has to properly formulate the design and deployment strategy to barge into the SMR era.

Wider deployment of SMRs is expected to begin over the next decade, but Russia has been a pioneer in this domain. Two barge-mounted reactor units of KLT-40S design, onboard the Akademik Lomonosov, are already in operation in the Arctic city of Russia. It became the world’s first, and northernmost, floating SMR to enter commercial operation in remote Pevek city (Chukotka region) in May 2020. The reactors are

efficiently catering both heat and electricity to the remote region, meanwhile facilitating the shutdown of the coal-fired Chaunsk power plant. Russia is also developing a land based SMR project planned for commissioning in 2028.

Two other SMR aspirants, Argentina and China, are due to begin operation within the next few years. Similarly, the US, UK, and Canada have also signaled growing support for SMRs last year. India, which aspires to play a bigger role in the nuclear energy market, has planned SMRs as the main pillars of its indigenous nuclear programme since its inception. Its indigenous reactor program has been mainly based on SMRs like the PHWRs, PFBR and FBRs, AHWR-300, etc. Only it has to properly formulate the design and deployment strategy to barge into the SMR era. Given New Delhi’s time-tested nuclear cooperation with Moscow, it would be prudent for

India to kick its collaboration to a futuristic level by drawing a roadmap for SMR joint-venture with Russia.

The rationale for opting SMRs by India is strong. First, to scale up its nuclear energy component in its energy-basket smartly, SMRs would help as they can address all critical issues involved with traditional reactors. Second, many remote places like northern and eastern hilly regions, farthest places like Andaman & Nicobar Islands, that are deprived of grid connectivity, will benefit from the SMRs. Third, as India is planning to diversify the operational and management responsibilities of nuclear plants among other PSUs and government sector companies, SMRs would be the ideal projects. Lastly, in today’s carbon-constrained world, to meet Net-Zero Emission targets prescribed under SDGs, India must appreciate the ecological aspects of nuclear

energy, and pay serious attention to SMRs' utility in its energy transition.

Source: <https://www.financialexpress.com/defence/small-modular-reactors-the-dawn-of-a-new-nuclear-era/2304153/>, 04 August 2021.

OPINION – Adam Cabot

China's Nuclear Threat Against Japan: Hybrid Warfare and the End of Minimum Deterrence

A video recently released by Chinese media directly threatens Japan with a nuclear first strike. The video states, "When we liberate Taiwan, if Japan dares to intervene by force, even if it only deploys one soldier, one plane and one ship, we will not only return reciprocal fire but also start a full-scale war against Japan. We will use nuclear bombs first". This is a serious threat against a non-nuclear state coming from a power with a long declared 'no first use' nuclear policy. This clearly signals a departure from a strategy of minimum deterrence.

With the level of control possessed by the CCP it would be difficult to argue that the producers of the video went rogue with these threats. According to reports, the video was reposted by a CCP channel, making it likely that the video was intended as a coercive measure. To threaten the use of nuclear weapons in order to achieve a strategic foreign policy objective such as the invasion or "liberation" of a sovereign state is to use the nuclear arsenal potentially as a component of a Hybrid Warfare strategy. This use of nuclear coercion doesn't align itself with a minimum deterrence strategy that aims to deter military aggression. A state employing a minimum deterrence strategy will generally possess just enough deliverable and

survivable nuclear weapons to ensure a successful retaliatory strike.

Hybrid Warfare is defined as "a continuation of foreign policy, utilizing a combination of unconventional hard power and/or subversive instruments to achieve strategic objectives." In the case of China's Hybrid Warfare campaign against Taiwan, it has made nuclear threats against Japan as a warning against allied intervention. It has

consistently conducted incursions into Taiwan's air defense identification zone using fighters and bombers. It has executed numerous cyber-attacks against Taiwan. It has released propaganda threatening Taiwan, and President Xi Jinping has pledged to "reunify" Taiwan with China and

any attempts at formal independence. These measures aim to weaken Taiwan's resistance and alliances, making it easier for the CCP to fulfill its objective of annexing the island.

The ancient Chinese strategist and philosopher Sun Tzu states, "The supreme art of war is to subdue the enemy without fighting". China's display and threats of military power in addition to its propaganda and cyber-attacks aim to demonstrate to Taiwan and its allies that its "reunification" is a fait accompli and that the CCP will use any means,

including nuclear weapons, to achieve this. The ultimate Chinese goals of this strategy, in line with Sun Tzu's supreme art of war, are for the Taiwanese populace to realize that resistance is futile and willingly "reunify" with mainland China without a fight, and for Taiwan's allies to realize that the protection of Taiwan is not worth the cost. What makes China's nuclear threat dangerous is not only the intent but the capability. China has deployed

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What makes China's nuclear threat dangerous is not only the intent but the capability. China has deployed nuclear DF-21 medium-range ballistic missiles and nuclear DF-26 intermediate-range ballistic missiles that have the range to strike any target in Japan.

nuclear DF-21 medium-range ballistic missiles and nuclear DF-26 intermediate-range ballistic missiles that have the range to strike any target in Japan. The use of these missiles against Japan would leave the Chinese arsenal of intercontinental ballistic missiles such as the silo-based DF-5, road-mobile DF-31, and newer DF-41 to be held in reserve in case the United States launches a strike in retaliation for an attack on its ally. China knows that these are calculations that must be made by the U.S., Japan and its allies in defense of Taiwan. So what can be done to counter the CCP's use of nuclear coercion as a component of Hybrid Warfare and its departure from a minimum deterrence strategy?

The first action should be to disregard China's 'no first use' nuclear policy. This is a clear fallacy and must be recognized as such. China is modernizing its nuclear structure and using it to coerce. A 'no first use' policy, which China has allegedly committed to, only allows the use of nuclear weapons in retaliation for a nuclear strike. The U.S. and its allies need to disregard China's 'no first use' claims in order to clearly establish strategies to counter nuclear coercion and deter possible Chinese use of nuclear weapons.

Source: https://www.fairfieldsuntimes.com/opinion/china-s-nuclear-threat-against-japan-hybrid-warfare-and-the-end-of-minimum-deterrence/article_bb8ccdbc-de61-5d9f-8668-8db6d5b5553d.html / , 05 August 2021.

OPINION – Sitakanta Mishra

Radiation Technology the Panacea to Combat Food Wastage Crisis

Though humanity today is technologically capable of trans-planetary voyages, nearly 690 million people on Earth sleep empty stomach, up 10 million since 2019, according to the Food and Agriculture Organization (FAO) of the United

Nations. It is predicted that the COVID-19 pandemic could further add between 83-132 million people to this number, depending on the economic growth scenario in the years ahead.

The reason is not necessarily paucity of food production; today the world produces enough food for everyone. Three decades ahead, when the world population would reach 10 billion, there might be some concern to meet the food and nutrition demands of the rising population. According to UN, global food production will have to increase by 60% through sustainable agricultural practices that preserve Earth's natural resources, our health, and the climate.

However, only snowballing food production would not guarantee food security. Food wastage is an important reason for food shortage and difficulty of supply. One strategy for increasing the availability and smooth supply of food to meet the demands of

the ever-increasing population is to ensure better utilization of the food produced. Food preservation by increasing shelf-life of agro products can enable smooth distribution to remote places. This is increasingly critical in the case of populous countries like India.

Agricultural yield has registered steady increase in India over the last few decades for the application of advanced farming techniques. However, the country is yet to achieve success in preserving the harvest for long duration as many of the products perish before they reach the consumer. India, the second largest agro-based economy with year-round crop cultivation, experiences huge amount of agricultural spoilage. According to estimates, nearly 40% of the food produced in India is wasted in the post-harvest stage, largely because of inadequate storage and speedy transportation facility. These losses not only impact the producers and consumers, but also impact adversely the overall food security goal of India.

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Therefore, there is an urgent need for sustainable food processing method starting from micro-level entrepreneurs to big industrial houses. Merely strengthening cold storage chain, dehydration centres, etc. will not make much difference as perishable goods get spoiled during transit. Therefore, along with adequate storage and fast transportation provisions, application of cutting-edge technique like nuclear irradiation to treat agro products will help minimize post-harvest spoil to large extent.

Food irradiation, or use of radiation technology, to extend shelf-life of food crops (pulses, serials and oil seeds), delay ripening and disinfestations of fruits, sprouting inhibition, reduction of number microorganism in spices, etc. is one of the safest and most cost-effective methods of food preservation. In comparison to the traditional 'heat and chemical treatment', irradiation process is more effective and appropriate technology to destroy food borne pathogens. Controlled exposure of food grains to ionizing radiation can kill parasites or microorganisms such as moulds, yeasts and bacteria that cause food spoilage or poisoning. Therefore, food irradiation can eliminate the need for pests and preservatives during storage or transportation of food crops. Besides, irradiation process can make available mutation breeding seeds for better yield. The global food market is estimated to account for US\$ 298.1 Mn by end of 2027, Says Coherent Market Insights (CMI).

Public health agencies worldwide are also are convinced that food irradiation method is safe and posing no risk to the consumers. More than 60 countries worldwide have regulations allowing the use of irradiation for one or more food products.

In many European countries, irradiation has been in use for many decades. In addition, food irradiation has received official endorsement from international organizations, including the WHO and the IAEA.

In 1994, the Government of India has approved food irradiation in India for onions, potatoes and spices for internal marketing and consumption. India has aptly harmonized national food irradiation rules with the international regulations. The BARC has developed 42 high-yielding seed varieties by inducing mutations and cross breeding through Gamma irradiation for commercial exploitation. But only around 15 Food Irradiation Plants are in operation in India and a few more are under construction or planned. India must popularize irradiation technology and laydown country-wide infrastructure to eliminate food wastage, which in turn will ensure national food security.

India has been self-reliant in application of radiation technology in civilian sector though the pace is slow. But it would be prudent to expedite this endeavour with adoption of global best practices and India-Russia collaboration would be

ideal. Both countries are already in discussion for joint partnership for application of nuclear technology in non-energy areas such as composite materials. Russia, beside nuclear energy joint ventures, can extend its cooperative hand in the field of radiation sterilization in medicine and industry, including food irradiation.

The Russian expert, Dr. Alla A. Oudalova strongly believes that "Irradiation technology can open the door also for Indian exports of fresh fruits by extending their shelf life and enabling protection of meats and condiments from microbes, bacteria

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and moles parasite". While speaking at an event organized by Rosatom South Asia, in collaboration with the Russian Center of Science and Culture in Mumbai last year, Dr. Oudalova said, "pre-sowing irradiation improves seeds germination and activates growth processes for plants, while radiation also stimulates embryogenesis and further growth and development in animals."

Further he added that vegetables like potatoes and salads can have a growth stimulation of 10-40%, whereas agro products like wheat and corn can have a growth stimulation of 10-15%. Irradiation technology can also cut down losses due to germination, which otherwise would account for 50% of food wastage.

Application of radiation technologies can bring significant improvements in agriculture, healthcare, ecology, and industrial processes. With the use of radiation treatment of food products and reducing food wastage, meeting the UN Zero Hunger Challenge and achieve sustainable development goals. Its only a matter of perception how smartly the humanity can make use of nuclear / radiation technology which is potential of addressing major global problems like climate change, energy insecurity, food crisis and health issues.

Source: <https://health.economictimes.indiatimes.com/news/industry/radiation-technology-the-panacea-to-combat-food-wastage-crisis/85232277>, 11 August 2021.

OPINION – Sze-Fung Lee

The Nuclear Future of East Asia

In the face of North Korea and China's continuous expansion and advancement in their nuclear

arsenal in the past decade, the nuclear question for East Asian countries is now more urgent than ever—especially when U.S.'s credibility of

extended deterrence has been shrinking since the post-cold war era. Whether to acquire independent nuclear deterrent has long been a huge controversy, with opinions rather polarized. Yet it is noteworthy that there is indeed gray zone between

zero and one—the degree of latency nuclear deterrence.

This paper suggests that developing nuclear weapons may not be the wise choice for East Asian countries at the moment, however, given the fact that regional and international security in the Asia-Pacific is deemed to curtail, regardless of their decision to go nuclear or not, East Asia nations should increase their latency nuclear deterrence. In other words, even if they do not proceed to the final stage of acquiring independent nuclear deterrent, a latent nuclear

weapons capability should at least be guaranteed. Meanwhile, for those who have already possessed certain extent of nuclear latency—for instance, Japan, South Korea, Taiwan—to shorten their breakout time whilst minimize obstacles for a possible nuclearization in

the future.

The Threat is Ever-Present: The Nuclear North Korea: Viewing from a realist perspective, the geographical locations of Japan, South Korea and Taiwan have always been a valid argument for their nuclearization—being surrounded by nuclear-armed neighbors, namely China and North Korea—these countries have witnessed an escalation of threat on an unprecedented scale since the cold war. Having its first nuclear weapon tested in 2006, the total inventory North Korea

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now possess is estimated to be 30-40. With the misstep of relieving certain sanction during the Trump era, North Korea was able to revive and eventually expand its nuclear arsenal, making future negotiation between the Biden administration and the Kim regime much harder and less effective. Not only has North Korea's missile test on March 25—which is the first since Mr. Biden's presidency—signaled a clear message to the U.S. and her allies of its nuclearization will and stance, Pyongyang's advancement in nuclear technologies also indicates a surging extent of threat.

For instance, North Korea state media KCNA claimed that the latest missile launched was a "new-type tactical guided projectile" which is capable of performing "gliding and pull-up" manoeuvres with an "improved version of a solid fuel engine". In addition to these suspected "new type of missiles" that travels in low-attitude, the diversity of launches Pyongyang currently possess—from SRBMs to SLBMs, as well as the transporter erector launchers (TELs) and the cold launch system—increase the difficulty in intercepting them via Aegis destroyer or other ballistic missile defense system since it is onerous, if not impossible, to detect the exact time and venue of the possible launches. Indeed, the "new type of missile" could potentially render South Korea's THAAD useless by evading radar detection system through its manoeuvres, according to a study from 38 North at The Henry L. Stimson Center. Moreover, the cold launch (perpendicular launch) system used by the North also indicates that multiple nuclear weapons could be fired from the same launch pad without severely damages caused to the

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China's total inventory of nuclear deterrent has reached 320, exceeding United Kingdom and France's possession of nuclear warheads, of which London and Paris's nuclear deterrent were considered as limited deterrence. In spite of the fact that China's current nuclear stockpiles is still far less that what the Russians and Americans have, its nuclear technologies has been closely following the two military superpowers.

infrastructure. Shigeru Ishiba, the former Defense Minister of Japan, has noted that not all incoming missiles would be able to be intercepted with the country's missile defense system, and "even if that is possible, we cannot perfectly respond to saturation attacks".

The Chinese Nuclear Arsenal: According to the SIPRI yearbook 2020, China's total inventory of nuclear deterrent has reached 320, exceeding United Kingdom and France's possession of nuclear warheads, of which

London and Paris's nuclear deterrent were considered as limited deterrence. In spite of the fact that China's current nuclear stockpiles is still far less that what the Russians and Americans have, its nuclear technologies has been closely following the two military superpowers. For instance, the Chinese have successfully developed MIRVs and MARVs—its ICBM DF-41 is capable of equipping up to 10 MIRVs while its MRBM DF-21D

could carry MARV warhead that poses challenges to the BMD systems—these advancement in nuclear technologies are the solid proof that the Chinese nukes are only steps away from Moscow and Washington. Yet China's nuclear arsenal remains unchecked and is not confined by any major nuclear arms reduction treaty such as the New START, of which US and Russia has just reached a

mutual consensus to extend the treaty through Feb 4, 2026.

In addition to China's expansion of military capabilities and ambition in developing hypersonic glide vehicles (HGVs) and new MARVs, there is no lack of scepticism of its no-first use policy, especially with Beijing's coercive diplomacy and provocative actions in the East and South China Sea, regarding "freedom of navigation" and other

sovereignty rights issues. These all raise concerns and generate insecurity from neighboring countries and hence, East Asia states i.e., Japan, South Korea and Taiwan would inevitably have to reconsider their nuclear option. In spite of having advanced BMD system, for instance, Aegis Destroyer (Japan), THAAD (South Korea), Sky Bow III (Taiwan), the existing and emerging nuclear arsenal in Pyongyang and Beijing still leave East Asian states vulnerable under a hypothetical attack as mentioned above. Future could be worse than it seems—merely having deterrence by denial is not sufficient to safeguard national security—particularly with a shrinking credibility of U.S.'s extended deterrence since the post-cold war era.

America's Nuclear Umbrella and the Alliance Dilemma:

Theoretically speaking, alliance relations with the U.S. assure a certain extent of deterrence by punishment against hostile adversaries. For example, U.S. is committed to defend Japan under the 1960 Mutual Defense Treaty. Yet in reality, security could never be guaranteed. In a realist lens, state could not rely on others to defend their national interests, especially when it puts

Even if alliance relations and credibility of extended deterrence is robust at the moment, but the bigger question is—could and should East Asian countries shelter under America's nuclear umbrella forever? If they choose not to go nuclear, these states would be constantly threatened by their nuclear-armed neighbors, without a credible direct (nuclear) deterrence to safeguard national security; and forced to negotiate, or worse, compromise in the face of a possible nuclear extortion.

America's homeland security at risk. Is U.S. willing to sacrifice Washington for Tokyo? Or New York for Seoul? Strong rhetoric or even defense pact would not be able to ensure collective security, let alone strategic ambiguity, which is a strategy adopted by Washington for Taipei that is neither a binding security commitment nor the stance is clear. Regardless of the prospect of a better future than mere war and chaos, state should always prepare for the worst.

Besides, with Trump's American First policy continuously undermining alliance relations in the past four years, East Asian countries may find it hard to restore mutual trust since diplomatic

tracks are irreversible, despite Biden's administration intention and effort to repair alliance and U.S.'s integrity as the global leader. Moreover, even if alliance relations and credibility of extended deterrence is robust at the moment, but the bigger question is—could and should East Asian countries shelter under America's nuclear umbrella forever? If they choose not to go nuclear, these states would be constantly threatened by their nuclear-armed neighbors, without a credible direct (nuclear) deterrence to safeguard national security; and forced to negotiate, or worse, compromise in the face of a possible nuclear extortion. Undeniably, horizontal nuclear proliferation is always risky. Not only is it likely to deteriorate diplomatic relations with neighboring countries, but also generates a (nuclear) regional arms race that eventually trap all nations into a vicious circle of security dilemma

due to the lack of mutual trust in an anarchical system, which will consequently lead to a decrease in regional, as well as international security.

Yet with the expansion and advancement of Pyongyang and Beijing's nuclear arsenal, regional and international security is deemed to curtail, regardless of East Asian countries' decisions to go nuclear or not. As the official

members of the NPT, Japan's and South Korea's withdrawal may encourage other current non-nuclear weapon state to develop nukes. However, current existence of the NPT has already proven futile to prevent North Korea from acquiring its own nuclear weapons; or Israel, India and Pakistan, who are UN members but have never signed any of the treaties, to join the nuclear club.

The major concern about nuclear proliferation is never about the amount of warhead one possesses, but if they are in the wrong hands; for instance, a "rogue" state like North Korea. It is almost certain than none of the latent nuclear East Asia states would be considered "rogue" but just developed

nations with rational calculation. In fact, the actual risk for these states joining the nuclear club in reality is not as high as most imagined. It may, indeed, help further bolster alliance relations between US, Japan and South Korea if they are able to come to some mutual consensus in advance—developing independent nuclear deterrent is not an approach of alienating America’s presence as an effective ally but to strengthen security commitment with each other, and that US would support her allies in the Asia-Pacific in such attempt. The current existence of extended deterrence should not be a barrier for nuclearization. Rather, it should act as an extra protection for allied states.

Pave the Way for Future Nuclearization:

Admittedly, the road for any East Asia countries to go nuclear would be tough. Taipei’s attempt to develop nuclear weapons would imaginably trigger provocative response from Beijing, if not impossible, a pre-emptive strike that could lead to an escalation of war. Same situation goes for Seoul and Pyongyang even though the risk is relatively lower. As for Japan, although direct military confrontation is less likely comparing to Seoul and Taipei, the challenges Tokyo face for its nuclear option is no easier than any of them. As the sole nation that has suffered from an atomic bomb explosion, Japan’s pacifism and anti-nuclear sentiment is embedded in its culture and society.

According to a public opinion poll conducted by the Sankei News in 2017, 17.7% of the respondents agreed that “Japan should acquire its own nuclear weapons in the future” whilst 79.1% opposed to that idea. Despite having the imperative skills and technologies for an acquisition of independent nuclear deterrent (the breakout time for Japan is estimated to be about 6-12 months), Japan also lacks natural resources for producing nuclear warheads and has to rely heavily on uranium

imports. Upholding the three non-nuclear principle since WWII, Japan’s bilateral nuclear agreements with the US, UK, France and Australia specified that all imported nuclear-related equipment and materials “must be used only for the non-military purposes”. Violation of these agreements may result in sanctions that could cause devastated effect on Japan’s nuclear energy program, which supplies approximately 30% of the nation’s total electricity production. These issues, however, are not irresolvable.

Undeniably, it may take time and effort to negotiate new agreements and to change people’s pacifism into an “active pacifism”, yet these should not be the justifications to avoid the acquisition of independent nuclear deterrent as ensuring national security should always be the top priority.

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It is because in face of a nuclear extortion, the effectiveness of a direct nuclear deterrence guaranteed by your own country could not be replaced by any other measures such as deterrence by denial via BMD system or deterrence by punishment via extended deterrence and defense pact. Therefore, if there are too many obstacles ahead, then

perhaps the wiser choice for Japan, South Korea and Taiwan at the moment is to increase their nuclear latency deterrence, shorten the breakout time and pave their way clear for future nuclearization. In other words, to keep their nuclear option open and be able to play offense and defense at its own will when the time comes.

Nevertheless, in addition to strengthening one’s latency nuclear deterrence, as well as obtaining a more equal relationship in the official and unofficial alliance with America, East Asian countries that have similar interest and common enemies should united to form a new military alliance which included security treaty regarding collective defense like the NATO; and focuses more

on countering hybrid warfare like the QUAD. If Japan, South Korea and Taiwan ever choose to go nuclear, a common mechanism could be established to ensure that these states would pursue a minimum to limited deterrence capability that do not endanger each other's security but rather to strengthen it, which would help minimizing the destabilization brought to regional security while constituting a more balanced situation with nuclear-armed rivalries. After all, proliferation may not be the best solution, it is certainly not the worst either.

Source: <https://moderndiplomacy.eu/2021/07/27/the-nuclear-future-of-east-asia/>, 27 July 2021.

OPINION – Gregory Giles

Conventional-Nuclear Integration: Avoiding Misconceptions and Mistakes

What if a nuclear-armed adversary believed that U.S. conventional forces were so vulnerable that using just a handful of nuclear weapons against them would be enough to win a regional conflict? If the Department of Defense did nothing to reduce that vulnerability, wouldn't it be inviting that sort of attack? Alternatively, what if certain U.S. conventional military operations against a nuclear-armed opponent carried a high risk of triggering nuclear use by that enemy? How should the Pentagon mitigate that risk while still achieving U.S. objectives in a regional war? These questions lie at the heart of conventional-nuclear integration, a controversial subject that Biden administration officials should consider carefully as they undertake a new Nuclear

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The Defense Department thinks about the concept as ensuring that U.S. conventional forces can not only survive but also continue to fight during a limited nuclear attack in a regional conflict. The Pentagon combines this focus on conventional force resiliency with ensuring that credible options exist for a limited U.S. nuclear response, should the president call for them.

Posture Review. Within nuclear specialist communities, there will be disagreements about those questions, and these issues are at risk of being misunderstood, distorted, and politicized. To ensure that stakeholders have a serious, rigorous debate going into the review, and to produce sound policy coming out of it, it is necessary to avoid misconceptions and mistakes about the integration of conventional and nuclear planning.

The Pentagon has not publicly offered a definition of such integration. Internally, department officials and military leaders think about the concept in several related ways. Integrating conventional and nuclear planning is actually a subset of the military's broader pursuit of integration across land, sea, air, space, and cyberspace. In that context, the Defense Department thinks about the concept as ensuring that U.S. conventional forces can not only survive but also continue to fight during a limited nuclear attack in a regional conflict. The Pentagon combines this focus on conventional force resiliency with ensuring that credible options exist for a limited U.S. nuclear response, should the president call for them. Additionally, the concept is designed to raise awareness of how certain kinds of U.S. conventional military operations might inadvertently increase an adversary's incentives to resort to nuclear use. Defense Department experts also consider how to deter, counter, and defeat the integration of conventional and nuclear forces by adversaries.

The current policy debate about these issues has

been misleading and incomplete. To rectify that problem, and to enhance the strategic value of the Nuclear Posture Review, it is important to be clear about how conventional-nuclear integration could help reduce the U.S. military's vulnerabilities while also helping to advance various goals of the Biden administration.

What Some Analysts Fail to Grasp About Conventional-Nuclear Integration: Precisely because there is no publicly available Defense Department definition of conventional-nuclear integration, nuclear deterrence skeptics have interpreted the concept in ways that support their views about the role nuclear weapons should play in American national security strategy. Those analysts have failed to understand a series of important points related to what convention-nuclear integration is, the challenges it addresses, and what benefits it offers to the U.S. military.

'Sole Purpose' should not be the 'Sole Driver': As vice president, and again during the 2020 election campaign, President Joe Biden proposed that the United States adopt a nuclear declaratory policy of "sole purpose," which would involve stating that the only role for American nuclear weapons is to deter nuclear use and, if necessary, respond to it. Some have suggested that a "sole purpose" policy should drive the integration of U.S. conventional and nuclear planning. That approach would risk hollowing out America's nuclear deterrent by focusing too much on conventional forces. It would undermine the central purpose of conventional-nuclear integration, which is to reduce an adversary's incentives to initiate nuclear use by demonstrating that the U.S. military has a balanced and integrated menu of credible nuclear and non-nuclear response options. To achieve that, the administration should pay equal attention to, and ensure consistent pacing among, all aspects of the concept — conventional, nuclear, and

integration. The Defense Department should retrain conventional forces to operate on a nuclear battlefield, ensure that combatant commanders with geographic areas of responsibility are prepared to conduct limited nuclear strikes if called upon, and achieve greater planning and operational cohesion between these force elements so that no seams are left for adversaries to exploit.

Conventional-Nuclear Integration Will Not Lower the U.S. Threshold for Using Nuclear Weapons: Making sure U.S. conventional forces are not paralyzed by an adversary's limited nuclear use does not diminish America's natural reluctance to use nuclear weapons. In fact, having

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more resilient U.S. conventional forces reduces an adversary's incentive to initiate a nuclear attack on them in the first place. U.S. readiness to conduct limited nuclear strikes in a regional conflict also reminds an adversary it will face substantial penalties for crossing the nuclear threshold. By helping to deny adversaries a clear

path to victory, more closely integrated U.S. conventional and nuclear planning will bolster deterrence of regional aggression. If the U.S. military conducts such planning in a more holistic way, it will also better position itself to identify and mitigate situations in which its conventional operations might inadvertently lead to nuclear escalation by an adversary.

Integrating Conventional and Nuclear Planning Is Not Cold War Thinking: The Pentomic Division and the Davy Crockett short-range nuclear rocket were early attempts by the U.S. military to integrate conventional and nuclear weapons. No one in the U.S. government is advocating a return to such Cold War experiments and excesses. To link such anachronisms to contemporary planning and thinking, and to imply a rediscovered U.S. enthusiasm for nuclear warfighting, is wrong and

misleading. Indeed, senior military leaders have repudiated this connection explicitly. Lt. Gen. Richard Clark, while serving as the Air Force's deputy chief of staff for strategic deterrence and nuclear integration, noted that today's conventional-nuclear integration "is different than a Cold War mentality where we had nuclear artillery, we had short-range [nuclear] rockets, where we had [nuclear] weapons that would allow us to fight tactically in a conflict." Clark added that:

The current wave of Pentagon interest in conventional-nuclear integration began during the Obama-Biden administration. It surfaced in the 2014 Quadrennial Defense Review as a concern that adversaries could try to escalate their way out of failed conventional aggression. Acknowledging these roots helps frame the debate for how the Biden-Harris administration can derive the most benefit from integrating conventional and nuclear planning.

Today, really what we're trying to prepare ourselves to do is to respond with whatever force is necessary in a nuclear environment ... really the ultimate goal here is to deter. We want to raise that threshold of use of nuclear weapons, whether strategic or non-strategic...to the highest level possible. The current wave of Pentagon interest in conventional-nuclear integration began during the Obama-Biden administration. It surfaced in the 2014 Quadrennial Defense Review as a concern that adversaries could try to escalate their way out of failed conventional aggression. Acknowledging these roots helps frame the debate for how the Biden-Harris administration can derive the most benefit from integrating conventional and nuclear planning.

The notion that the military could reduce its vulnerabilities in this area without setting stretch goals and exacting requirements for the services and combatant commands is unrealistic and only invites complacency. Worse, such half-hearted support for joint force integration of conventional and nuclear planning will sustain adversary interest in lowering the nuclear threshold.

The Need Is Not Based on an Inaccurate Reading of Adversary Strategy: While academics and analysts should debate the issue, America's civilian and military officials — who have access to the most sensitive intelligence — have made clear that the threat of limited nuclear use by adversaries is real. As Clark also emphasized last year: If you look at Russia, for example, they look

at our [conventional] precision weapons, the speed and accuracy of those precision weapons and their inability to really contend with them. So they developed a strategy and a doctrine that perhaps they could use non-strategic nuclear weapons in a regional conflict to set us back on our heels, so that they could actually gain that advantage and escalate that conflict to win ultimately. It's something again that we have not focused on but that we are starting to look at and the threat that Russia poses is driving us to do that. I think

they believe that there's a potential advantage for them [in] a limited nuclear conflict and it is very clear in their doctrine and in the capability, the non-strategic nuclear weapons that they have amassed over the years. It is evident that that's in their planning, in their strategy, and their thought process. American officials — who have the solemn responsibility to protect their nation and its allies — should continue to take steps to address that threat, including through appropriate integration of conventional and nuclear planning.

The U.S. Military Shouldn't Be Discouraged from Reducing Its Vulnerability

to Limited Nuclear Attacks: After decades of neglect, recent gains in joint force nuclear education, training, and doctrine development have been hard-won, but there is still much work to do to make U.S. conventional-nuclear integration an operational reality. The notion that the military could reduce its vulnerabilities in this area without setting stretch goals and exacting requirements for the services and combatant commands is unrealistic and only invites complacency. Worse, such half-hearted support

for joint force integration of conventional and nuclear planning will sustain adversary interest in lowering the nuclear threshold.

Conventional-Nuclear Integration should not be Politicized: Arms control advocates should resist efforts to politicize conventional-nuclear integration as a rationale to cut programs they oppose for other reasons. This politicization will discredit the concept and jeopardize the military's ability to operationalize it over the longer term. In particular, delaying modernization of the B61-12 — the nuclear gravity bomb that has been at the heart of NATO nuclear burden-sharing for decades — under the pretext of trying to “figure out” conventional-nuclear integration will sow division and doubt within the alliance. That would be a mistake at a time when NATO solidarity is most needed to deter Russia — and it would also undermine extended deterrence, which is a top goal of the Biden administration.

To reverse these deficiencies and reduce U.S. vulnerability to limited nuclear attacks, the Defense Department should change mindsets. Commanders with a geographic responsibility facing nuclear-armed adversaries should give greater emphasis to nuclear planning and assessment. Heavily relying on others, such as Strategic Command, to do this inhibits conventional-nuclear integration and reinforces the perception that “nuclear” warfare is someone else’s responsibility, not a routine part of geographic combatant command planning.

The US Military Should Change Mindsets: Limited nuclear use in a regional conflict could look attractive to an adversary, in part, because the U.S. military has left itself vulnerable to it. The Defense Department had de-emphasized education, training, doctrine, planning, and exercises related to surviving and operating on a nuclear battlefield in the belief that it alone would set the terms of future conflict, and could do so in ways that played to its advantages in precision conventional weaponry. Planning by combatant commands and attitudes at all ranks aligned with these views. As the Defense Science Board noted in 2016, “Expertise in the Combatant Commands to assess and plan for U.S. conventional force operations in an adversary generated, limited nuclear environment is lacking.” This reflected a prevailing attitude that, if an enemy introduced

nuclear weapons into a regional conflict, the fight would become Strategic Command's problem. The board also found that, “General knowledge in the military regarding nuclear weapons and the environments they generate, outside of some in the strategic force cadres in the Air Force and Navy and a small group of specialists in the Army, does not exist.”

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The good news is that these attitudes are changing. Senior military commanders have become sensitized to the risks of limited nuclear use by adversaries, and the services are moving forward with new education, training, exercises, and concept development related to conventional-nuclear integration. Moreover, additional resources now exist within the Pentagon to help commanders with a geographic focus build up nuclear expertise within their staffs. But, the emerging mindset should be broadened and deepened. That will only happen when

commanders set the tone and when top leadership holds all ranks accountable for meeting exacting conventional-nuclear integration requirements.

How Does Conventional-Nuclear Integration Align with and Further Biden Administration Priorities? As the administration embarks on preparing the Nuclear Posture Review, it is unclear what approach it will adopt toward conventional-nuclear integration and whether administration officials might oppose it. That lack of clarity is common in the early months of a new administration. But, there are in fact several reasons why conventional-nuclear integration aligns with the major priorities the president articulated in the Interim National Security Strategic Guidance.

American allies, particularly in Eastern Europe and Northeast Asia, are increasingly concerned about nuclear-backed coercion or aggression by Russia, China, and North Korea. The Biden administration's forthcoming strategic review will likely feature close collaboration with allies to elicit their views and offer reassurances in this regard.

Conventional-Nuclear Integration Is Compatible with Reducing U.S. Reliance on Nuclear Weapons and More Constrained Declaratory Policy: Integrating conventional and nuclear planning is entirely consistent with the Biden administration's goal of reducing reliance on nuclear weapons because it entails close scrutiny of the interaction between nuclear and non-nuclear forces. A broader array of alternatives to the use of nuclear weapons is likely to be the result. Pentagon officials who think about conventional-nuclear integration are not considering how to increase U.S. reliance on nuclear weapons. They are not looking for new nuclear missions — they are responding to U.S. adversaries who are increasing their reliance on nuclear weapons to overcome conventional force deficiencies. The Trump-Pence administration undertook modest steps, such as downsizing the yield on some warheads carried by ballistic missile submarines, in order to show adversaries that the U.S. military had credible responses to any limited nuclear use they might attempt. This has not resulted in new U.S. nuclear weapons or missions, and American allies have accepted this posture as a necessary adjustment to ensure the credibility of extended deterrence.

It's Integral to Rebuilding Alliances: American allies, particularly in Eastern Europe and Northeast Asia, are increasingly concerned about nuclear-backed coercion or aggression by Russia, China, and North Korea. The Biden administration's forthcoming strategic review will likely feature close collaboration with allies to elicit their views and offer reassurances in this regard. Reaffirming, if not elevating, the U.S. commitment to counter such coercion by improving the military's ability to stand up to threats of limited nuclear use will go far in reassuring allies. Indeed, engaging allies on conventional-nuclear integration — thereby making combined forces more resilient to limited nuclear threats — is a tangible and sensible expression of American security guarantees.

It's Not a 'Big-Ticket Item':

Conventional-nuclear integration is not a weapon system to be purchased. That is welcome news for a defense budget already under stress. The military will attain the necessary integration incrementally. To be sure, there are costs associated with increasing the resiliency of the joint force against limited nuclear use in a regional conflict, but they are manageable. For instance, the military estimates that making mission-critical hardware resistant to the effects of nuclear weapons, collectively referred to as hardening, adds 1 to 3 percent to its cost — if such hardening is designed into the system from the get-go. Retrofitting after the fact costs significantly more, so the services can realize savings if they prioritize nuclear survivability. During the Obama administration, the Defense Science Board strongly recommended that, "All major acquisitions be born with a nuclear survivability requirement derived from projected threat scenarios relevant to the range of missions expected for the system." It is up to the Biden administration to see this through.

The military's normal operating costs already cover the principal means of achieving the education, training, planning, and exercising needed for conventional-nuclear integration. Conventional

forces have to re-learn what it's like to operate under threat of nuclear attack, and the services are already moving in that direction. That comes with a new emphasis on integrating non-nuclear and nuclear forces, not necessarily additional costs.

Toward a Successful Nuclear Posture Review:

The success of the Biden administration's strategic review will depend, in part, on the degree to which myths are dispelled, threats are addressed, and goals are aligned. Conventional-nuclear integration has much to contribute in those regards — it offers the administration an affordable and responsible path to reducing U.S. reliance on nuclear weapons, deterring nuclear use in regional conflicts, and bolstering U.S. alliances. It's time for a more-informed and better-balanced debate about U.S. nuclear strategy and the contribution of conventional-nuclear integration to it.

Source: <https://warontherocks.com/2021/08/conventional-nuclear-integration-avoiding-misconceptions-and-mistakes/>, 10 August 2021.

NUCLEAR STRATEGY

CHINA

China's Alleged Nuclear Arsenal Construction is becoming Difficult to Hide: US Think Tank

The United States on 9 August urged Beijing to engage in nuclear nonproliferation discussions. The US proposed this suggestion by highlighting China's fast-expanding nuclear arsenal. During a news conference, the State Department spokesman Ned Price stated the fact that the US thinks it is essential for nuclear countries to engage directly in nonproliferation discussions to address lowering nuclear hazards and preventing misinterpretation.

At the press conference, Ned stated that the US

wants Beijing to work with them on real steps to decrease the dangers of destabilising arms races and conflicts.

He further added that the US's Deputy Secretary Wendy Sherman has recently visited the Russian Federation officials and had a discussion on the Strategic Stability Dialogue. Ned even claimed that it is essential for nuclear countries, especially China, to be a part of the open professional communication and discussion in order to

decrease the risk of these weapons.

While question China's nuclear policy, the US spokesperson refused to remark, yet he said that Beijing is constructing a bigger and more varied nuclear arsenal. He even said that this is becoming more and more evident. Adding more to this, Ned said that even if China is attempting to disguise it, this fast rate of the increasing nuclear arsenal is becoming more difficult to conceal. He even said that this does imply that China is departing from a decades-long nuclear strategy focused on minimal deterrence. Talking about the same fact, last week, US Secretary of State Antony J Blinken expressed grave worries about China's rapidly expanding nuclear arsenal. He had emphasised how Beijing had strayed significantly from its generations-old nuclear deterrent posture.

Previously, Commercial satellite pictures from the Gansu and Xinjiang deserts have recently shown the existence of what is thought to be China's huge new array of missile silos. The nuclear missile silo field 380 kilometres northwest of the Yumen field, particularly is raising concerns in the US. China's caseload reaches seven-month high as Delta variant wrecks havoc in country. As per ANI, The Washington Post stated that China appears to be aiming for a

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US thinks it is essential for nuclear countries to engage directly in nonproliferation discussions to address lowering nuclear hazards and preventing misinterpretation.

tenfold increase in intercontinental ballistic missiles, based on other missile silos it is building.

More about nuclear arsenal: Previously, the American Federation of Scientists published a study last month claiming that Beijing was constructing more than 100 missile silos in its Xinjiang province....

Source: <https://www.republicworld.com/world-news/us-news/chinas-alleged-nuclear-arsenal-construction-is-becoming-difficult-to-hide-us-think-tank.html>, 11 August 2021.

NUCLEAR STRATEGY

INDIA

Indigenous Aircraft Carrier (IAC(P71)) 'Vikrant' Returns after Successful Maiden Sea Voyage

IAC 'Vikrant' successfully accomplished its maiden sea voyage today for which she had sailed on 04 Aug 21 from Kochi. Trials progressed as planned and system parameters proved satisfactory. The carrier would continue to undergo series of sea trials to prove all equipment and systems prior handing over the vessel to the Indian Navy.

Indigenous Aircraft Carrier (IAC) 'Vikrant' designed by Indian Navy's Directorate of Naval Design (DND) is being built at Cochin Shipyard Limited (CSL), a Public Sector Shipyard under Ministry of Shipping(MoS). IAC is a leading example of the nation's quest for "Atma Nirbhar Bharat" and Indian Navy's "Make in India" initiative, with more than 76% indigenous content.

The Indigenous Aircraft Carrier is 262 m long, 62 m at the widest part and height of 59 m including the superstructure. There are 14 decks in all,

IAC is a leading example of the nation's quest for "Atma Nirbhar Bharat" and Indian Navy's "Make in India" initiative, with more than 76% indigenous content. The Indigenous Aircraft Carrier is 262 m long, 62 m at the widest part and height of 59 m including the superstructure. There are 14 decks in all, including five in the superstructure. The ship has over 2,300 compartments, designed for a crew of around 1700 people.

including five in the superstructure. The ship has over 2,300 compartments, designed for a crew of around 1700 people, having gender-sensitive accommodation spaces for women officers. The ship with high degree of automation for machinery operation, ship navigation and survivability, has been designed to accommodate an assortment of fixed wing and rotary aircraft. During the maiden sailing, ship's performance, including hull, main propulsion, Power Generation and Distribution (PGD) and auxiliary equipment were tested.

Trials, which were reviewed by Vice Admiral AK Chawla, Flag Officer Commanding-in-Chief Southern Naval Command on the last day; have progressed as planned and system parameters have been proved satisfactory. The successful completion of maiden trials sorties, despite challenges faced due to COVID-19 pandemic and COVID protocols in place, is testimony to the dedicated efforts of large number of stakeholders for over a decade. This is a major milestone activity and historical event. The carrier would undergo a series of Sea Trials to prove all equipment and systems prior to its delivery in 2022.

This is a major milestone activity and historical event. The carrier would undergo a series of Sea Trials to prove all equipment and systems prior to its delivery in 2022. Delivery of Vikrant is being targeted to coincide with celebrations to commemorate 75th anniversary of India's independence 'Azadi Ka Amrit Mahotsav'. With the delivery of IAC, India would join a select group of nations with the capability to indigenously design and build an Aircraft Carrier and provides thrust to Government's 'Make in India' initiative.

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Source: https://pib.gov.in/Press_Release_IframePage.aspx?PRID=1743815, 08 August 2021.

NORTH KOREA

North Korea Seeks Cooperation with Russia to Counter US

North Korea plans to boost cooperation with Russia to counter the United States, Pyongyang's ambassador to Russia said, adding that peace on the Korean peninsula can only be achieved once American troops withdraw. Ambassador Sin Hong-chol's comments come after senior North Korean leaders warned that South Korea and the U.S. would face repercussions for their decision to go ahead with annual joint military drills. The drills are a "rehearsal for war" and prove the U.S. is responsible for destabilizing the situation, he told Russian news agency TASS in an interview. "We will also boost cooperation between North Korea and Russia with the view to counter the U.S., a common threat" Sin said.

Around 28,500 American troops are stationed in South Korea as a legacy of the 1950-1953 Korean War, which left the peninsula in a technical state of war when fighting ended with an armistice rather than a peace agreement. Washington and Seoul say the joint drills are defensive in nature. In a statement released by state media on 11 August, senior North Korean official Kim Yong Chol condemned South Korea for continuing the allied drills and warned of unspecified counteractions that would make Seoul "realize by the minute" that it had walked into a security crisis.

On 10 August, Kim Yo Jong, the powerful sister of

North Korea's leader, said the drills were the "most vivid expression of the U.S. hostile policy" toward North Korea and said the North will work faster to strengthen its preemptive strike

capabilities. The South Korean government in a statement called for North Korea to respond to its offers for dialogue and said "raising military tensions on the Korean peninsula wouldn't help anyone."

North Korea has a history of dialing up pressure on the South when it doesn't get what it wants from the U.S.

Analysts say the North has been trying to exploit South Korea's desperation for inter-Korean engagement, pressuring Seoul to drop the allied military drills and extract concessions from Washington on its behalf while the larger nuclear

diplomacy remains stalemated. North Korea ended a yearlong pause in ballistic tests in March by firing two short-range missiles into the sea, continuing a tradition of testing new U.S. administrations with weapons demonstrations.

But there haven't been any known test launches since then as leader Kim Jong Un

focused national efforts on fending off the coronavirus and salvaging a broken economy damaged further by pandemic border closures. North Korea's threat that it may respond to the U.S.-South Korean drills with counteractions and advances of its preemptive strike capability may signal a resumption of its weapons testing activities. The North also could carry out a previous threat to abandon a 2018 agreement with Seoul on reducing military tensions, retire a ruling party unit devoted to inter-Korean affairs or abolish an office that had handled South Korean tourism at a North Korean resort, said Kim Dong-

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yub, a professor from Seoul's University of North Korean Studies.

The Diamond Mountain tours were a major symbol of engagement between the rivals and an important source of income for the cash-strapped North before Seoul suspended them in 2008 after a North Korean guard fatally shot a South Korean tourist. North Korea has suspended its nuclear and long-range missile tests since 2018, when leader Kim Jong Un initiated diplomacy with South Korea and then-U.S. President Donald Trump while attempting to leverage his nuclear weapons for badly needed sanctions relief. After the talks fell through in 2019 over disagreements in exchanging the release of sanctions and North Korea's denuclearization steps, the North ramped up tests of new short-range, solid-fuel weapons to improve its ability to deliver nuclear strikes and overwhelm missile defense systems in South Korea and Japan.

Source: <https://www.dailysabah.com/world/asia-pacific/north-korea-seeks-cooperation-with-russia-to-counter-us>, 12 August 2021.

BALLISTIC MISSILE DEFENCE

JAPAN

Japan's 1st Line of Defense: Tokyo to Deploy High-End Drones to Check Chinese Hypersonic Missiles

Japan has come up with a new strategy to thwart China's hypersonic missile threats. China and Japan have contested claims over a group of uninhabited islands that fall in the East China Sea. In a press conference held in June, Japanese Prime Minister Yoshihide Suga firmly said, "The Senkaku Islands are under our control and are unquestionably our territory, historically and under international law". "We think it is extremely serious [matter] that these activities continue...We will

respond firmly and calmly to the Chinese side," he added. Both Japan and China lay claim to Senkaku Islands (Diaoyu in Chinese), which include five uninhabited islands and three barren rocks, making a total area of not more than 5 sq. km.

China's Foreign Ministry said, "The Diaoyu Island and its affiliated islands are an inherent part of China's territory, and it is our inherent right to carry out patrols and law enforcement activities in these waters". In July, Japan hit China where it hurt the most after it raised the Taiwan issue.

In July, Japan hit China where it hurt the most after it raised the Taiwan issue. Japanese Deputy Prime Minister Aso Taro said that his country "may take action if China invades Taiwan". China termed this statement as "dangerous" and reiterated that it will not permit any country to interfere in any matter related to Taiwan.

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Japan's Drone Defense

System: Keeping this tense relation in mind, Japan is considering using unmanned aerial vehicles or drones to detect Chinese hypersonic missiles. According to reports, these drones, which will be equipped with infrared sensors, will be able to send an early warning of potential attacks by hypersonic missiles. This drone-based detection system has been proposed as the country's first line of defense against hypersonic missile threats from China and Russia as well as to counter a new class of ballistic missiles, which are known to carry hypersonic vehicles.

The Japanese Ministry of Defence announced this plan on August 7, which is described as Tokyo's "rush to develop capabilities to counter the development of hypersonic weapons", according to Sankei Shinbun, a Japanese newspaper. According to reports, the unmanned aerial vehicle will be equipped with an infrared detection system, which will operate in the airspace close to the enemy and can detect any hypersonic missiles flying at Mach 5 and above. The technological verification of this system was completed in 2019.

Flying at extremely high speeds, hypersonic weapons are known to evade the conventional anti-aircraft radar. This delays their detection and as a result, the interception is also difficult. To overcome this situation, unmanned aerial vehicles are being considered to provide early detection as the existing missile defense systems are not competent enough to counter these hypersonic weapons. "The maneuverability and low flight altitude of hypersonic weapons could challenge existing detection and defense systems", a US Congressional Research Service report on hypersonic missile defense stated in June this year. "For example, most terrestrial-based radars cannot detect hypersonic weapons until late in the weapon's flight due to line-of-sight limitations of radar detection. This leaves minimal time for a defender to launch interceptors that could neutralize an inbound weapon". The Japanese drone-based detection system will have multiple UAVs, which will continuously monitor the airspace and transmit the data gathered by them to the ground stations.

Unmanned aircraft is a field in which the Japanese military has been increasingly investing in although it is not yet clear what type of drone will be used in this mission.... In addition, the Japanese government is aiming to build a "satellite constellation" that puts a large number of small artificial satellites into low earth orbit in space as a countermeasure against hypersonic weapons and wants to lay a multi-layered surveillance network.

China has stepped up the development of hypersonic weapons as it made huge investments in test facilities and engineering expertise. The

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country had claimed to have successfully tested the DF-17, a road-mobile MRBM designed to launch a hypersonic glide vehicle (HGV). It has a reported range of 1,800-2,500 km. Other HGVs include the DF-ZF, with a range of 1,600-2,400 km and a speed of Mach 5 – Mach 10. China is also reportedly deploying these vehicles on its DF-21 and DF-26 theater-range ballistic missiles.

Source: <https://eurasianimes.com/japans-1st-line-of-defense-tokyo-to-deploy-advance-drones-to-check-chinese-hypersonic-missiles/>, 11 August 2021.

RUSSIA

Russia Decides to Retire Topol Ballistic Missiles

Topol ICBMs with a range of 11,000 km coming out of service will be used for civilian purposes as Start-1 light-class solid-propellant carrier rockets. According to open sources, RT-2PM Topol entered development in 1977, with flight tests occurring between 1983-87. As of 2013, there were approximately 150 missiles in operational status.

The Armed Forces of the Russian Federation, commonly known as the Russian Armed Forces, is considering officially retiring a Topol ICBM in 2024. According to local media reports, the Armed Forces has decided to retire the RT-2PM Topol ICBMs, known to NATO as the SS-

25 Sickle. "It is planned to remove the latest Topol intercontinental ballistic missile from service in the strategic missile forces in 2024. Topol missiles out of working service are being replaced by Yars intercontinental ballistic missile with MIRV warheads....

Also added that it is planned that some of Topol ICBMs with a range of 11,000 km coming out of service will be used for civilian purposes as Start-1 light-class solid-propellant carrier rockets. According to open sources, RT-2PM Topol entered development in 1977, with flight tests occurring between 1983-87. As of 2013, there were approximately 150 missiles in operational status.

Source: https://defence-blog.com/russia-decides-to-retire-topol-ballistic-missiles/?__cf_chl_captcha_tk__=pmd_98fe32cf368896a7bc7a06bba487_2e839ce_85bbb-1628755007-0-gqNtZGzNAyKjcnBszQii, 08 August 2021.

EMERGING TECHNOLOGIES AND DETERRENCE

GENERAL

Nuclear First: 3D-Printed Safety-Related Components Installed at Browns Ferry

Marking a notable milestone for nuclear component additive manufacturing, four 3D printed fuel assembly channel fasteners have been installed and are now operational at Tennessee Valley Authority's (TVA's) Browns Ferry Nuclear Plant Unit 2 in Athens, Alabama. Channel fasteners are a type of bracket that attaches to the top of the nuclear fuel assembly to hold the channel that wraps around the assembly and guides coolant flow up through the bundle. They essentially secure the fuel channel to the reactor's BWR fuel assembly. The safety components are conventionally fabricated from expensive castings and typically require precision machining.

The four stainless-steel channel fasteners were 3D-printed last year at Oak Ridge National Laboratory (ORNL) under the Department of Energy-funded Transformational Challenge Reactor (TCR) program and installed on ATRIUM 10XM fuel assemblies at Framatome's nuclear fuel manufacturing facility in Richland, Washington. They were installed at Browns Ferry 2 during its planned spring outage, which ended on April 22. The brackets will now remain in the reactor for six years "with regular inspections during that

period," ORNL said.

The Browns Ferry components used direct metal laser sintering (DMLS) with a powder bed fusion process, an additive manufacturing technique in which a laser is used to melt and fuse the material powder together. "Deploying 3D-printed components in a reactor application is a great milestone," noted ORNL's Ben Betzler, TCR program director, on Aug. 9. "It shows that it is possible to deliver qualified components in a highly regulated environment."

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ORNL has said it chose to demonstrate 3D-printing of channel fasteners first in part because they have "a straightforward, though non-symmetric, geometry and is a relatively simple part—ideal for a first-of-a-kind demonstration of additive manufacturing, in which material is deposited in layers, following a computer-designed model, to form precise shapes without the need for later carving or machining."

Refined Nuclear Component Manufacturing:

The project is another key achievement for the TCR program, a flagship federal government R&D effort to enable technologies for advanced nuclear reactors through additive manufacturing and artificial intelligence. Among the program's objectives are to lower costs, speed up deployment, and modernize manufacturing, materials, and computational sciences for nuclear energy. Under another much-watched research project, work continues to demonstrate—by 2024—a TCR microreactor that will use a 3D-printed core, advanced materials, and integrated sensors and controls.

While the additively manufactured fuel assembly channel fasteners are the first-of-their-kind installed at an operating reactor, they are also the first physical parts that have "digital twins," or exact virtual models, created using TCR's advanced monitoring and artificial intelligence techniques while being manufactured, according to ORNL. ORNL has said it chose to demonstrate 3D-printing of channel fasteners first in part because they have "a straightforward, though non-symmetric, geometry and is a relatively simple part—ideal for a first-of-a-kind

demonstration of additive manufacturing, in which material is deposited in layers, following a computer-designed model, to form precise shapes without the need for later carving or machining.”

Last year, the lab also noted that although additive manufacturing may turn out to be a more cost-effective way to manufacture the part—which is typically cast and machined—the project will crucially serve as a “test case” for TCR’s digital platform. A key priority at TCR is to target a method to quickly certify the quality of components that will go into nuclear reactors, said ORNL’s Ryan Dehoff, section head for Secure and Digital Marketing.

‘The Foundation for Designing and Manufacturing a Variety of 3D-Printed Parts’ Nuclear component and fuel manufacturer Framatome hailed the milestone as a new frontier for nuclear technology. ... Framatome, which has been working to introduce additive manufacturing to nuclear fuel since 2015, has said its efforts are focused on stainless steel and nickel-based alloy fuel assembly components. During a December 2020 workshop hosted by the Nuclear Regulatory Commission (NRC), the French technology firm noted it gained experience, demonstrated competency, and accomplished the full scope of basic product development during the fuel assembly component implementation project.

The scope included design modification and control for the powder bed fusion DMLS advanced manufacturing technique—including product and material specifications, as well as inspection requirements. The project also established qualification and quality control criteria. Perhaps more crucially, it paved the way for licensing and commercial operation of a safety-related fuel assembly component in a reactor. The NRC told POWER that TVA was able to install the components at Browns Ferry “without prior approval” using the 10 CFR 50.59 change process. “Reliability of the component is assured via the

vendor’s quality assurance program,” it said. Broadly, however, the regulatory body said it has been working with industry to “identify those components that would require prior approval and to ensure that the important issues that could impact safety are fully understood and accounted for as part of any request for approval.” The agency also noted it has issued an action plan to guide these preparations.

The nuclear industry, however, is cognizant of potential benefits. Nuclear plant operators point mainly to potential supply chain cost savings. Advanced manufacturing, for example, could provide a long-sought solution to procuring parts whose suppliers are no longer in business or take too long to deliver, or whose quality is questionable.

Looking ahead, Framatome is working to introduce other fuel assembly components using additive manufacturing technologies and materials, including lower debris filters and upper grids and filters. For TVA, the giant federally owned corporation that has

indicated nuclear energy will play an increasingly significant role when it phases out coal generation by 2035, the “innovative manufacturing approach could pave the path for use across the existing nuclear fleet and also in advanced reactors and small modular reactors,” said Dan Stout, TVA’s director of Nuclear Technology Innovation. “TVA is actively engaged in developing new nuclear technology for tomorrow,” he noted on 9 August.

The Promise of Advanced Manufacturing: During the two-day NRC workshop that explored advanced manufacturing technologies for nuclear applications, several attendees noted that interest in advanced manufacturing has ramped up of late, owing to technical leaps that promise to modernize manufacturing of replacement components in existing reactors or streamline construction of small modular and advanced reactors. But partly because the nuclear industry is so highly regulated, it has been slower than other power sub-sectors to take on manufacturing advancements that have boosted technology efficiency and capabilities, such as for gas turbines and wind turbines.

The nuclear industry, however, is cognizant of potential benefits. Nuclear plant operators point mainly to potential supply chain cost savings. Advanced manufacturing, for example, could provide a long-sought solution to procuring parts whose suppliers are no longer in business or take

too long to deliver, or whose quality is questionable. Advanced manufacturing could also help correct issues related to existing component design—for example, material failures—or which fall outside of regulatory compliance. At the workshop, notably, the NRC highlighted five “primary” technologies that it is actively exploring with public participation. These include laser powder bed fusion; direct energy deposition; electron beam welding; powder metallurgy (focused on hot-isostatic pressing); and cold spray techniques.

Laser Powder Bed Fusion: Laser powder bed fusion, such as was used to make the Browns Ferry components, uses a laser to melt or fuse powder particles together within a bed of powder. According to the NRC, it is generally “most advantageous for more complex geometries,” and its applications potentially involve smaller components, fuel hardware, and small internals.

Direct Energy Deposition (DED): DED involves a nozzle mounted on a multi-axis arm that deposits melted material on a surface. It could be suited to larger components, owing to its faster production and greater build-chamber volumes, the NRC said.

Electron Beam Welding: Electron beam welding involves a fusion welding process using a beam of high-velocity electrons to join materials. It can produce single-pass welding without filler material, and could be suitable for welding medium and large components.

Powder Metallurgy/Hot-Isostatic Pressing: PM/HIP involves the densification of a metal powder in a mold using high temperatures and pressure. The Electric Power Research Institute (EPRI) and the DOE are exploring this technique, using electron beam welding to fabricate a NuScale reactor vessel.

Cold Spray: Finally, cold spray involves powder sprayed at supersonic velocities onto a metal surface to form a bond with the part. Its potential

nuclear applications include mitigation or repair of stress-corrosion cracking in reactor applications or potential chloride induced stress corrosion cracking in spent fuel canisters, the NRC said.

The Vast Landscape of Nuclear Advanced Manufacturing: Although the Browns Ferry milestone is significant for its delivery of a 3D-printed safety component in a commercial reactor, recent achievements by the nuclear industry worldwide illustrate the wide scope for advanced manufacturing applications in the nuclear sector. Like Framatome, nuclear fuel technology firm Westinghouse has explored producing components with powder bed fusion, binder jetting, and DED. Last year, Westinghouse marked another notable “first” when Exelon in the spring of 2020 installed a Westinghouse thimble plugging device at Byron 1. The device, which is

Although the Browns Ferry milestone is significant for its delivery of a 3D-printed safety component in a commercial reactor, recent achievements by the nuclear industry worldwide illustrate the wide scope for advanced manufacturing applications in the nuclear sector.

typically used to hold nuclear fuel as it is lowered into the reactor core, is made with laser powder bed fusion. Along with its development of “multiple complex designs” for fuel debris filtering, Westinghouse is involved in a three-year DOE-funded

project to additively manufacture spacer grids for nuclear reactors. Exelon, notably, also says it has used cold spray on primary moisture separators to mitigate flow accelerated corrosion in a pressurized water reactor steam drum. It notes cold spray “shows promise for in-plant repair applications.”

Cold spray applications, meanwhile, have been used in a variety of accident-tolerant fuels technologies that are currently being tested at various nuclear reactors across the country. EPRI, which is weighing three advanced manufacturing roadmaps (for Class 1 primary pressure boundary components, reactor internals, and other class components), also says big gains have already been demonstrated for advanced manufacturing technologies. It suggests demonstration pieces of light water reactor components using PM/HIP have already been produced.

Outside the US, ENGIE in 2019 installed its first additively manufactured valve body (a non-safety classified component) in a nuclear power plant. ENGIE is now working with the European Union's Sustainable Nuclear Energy Technology Platform—under its Nuclear Components Based on Additive Manufacturing (NUCOBAM) program—to establish a qualification methodology for additively manufactured components in a nuclear installation. NUCOBAM expects its efforts will benefit nuclear industry profitability and improve safety through optimized component design....

Source: <https://www.powermag.com/nuclear-first-3d-printed-safety-related-components-installed-at-browns-ferry/>, 10 August 2021.

NEW ZEALAND

New Zealanders Concerned about 'Killer Robots' as Government Pushes against New Arms Race

A majority of New Zealanders say they oppose "killer robots", or autonomous weapons, being used in conflict, making the country among the most concerned in the world. As the Government considers its policy on autonomous weapons and pushes for international rules around their use, a survey commissioned by the Ministry of Foreign Affairs and Trade (Mfat) shows there little knowledge of, but some concern about, so-called "killer robots" among the public.

New Zealand has long been an advocate for disarmament in international forums, after a protest movement in the 1980s led to the country declaring itself a nuclear-free zone. Autonomous weapons systems, which use artificial intelligence to target and kill people without any human decision-making, are seen as a new frontier in the arms race between major military powers. Disarmament Minister Phil Twyford said that, compared to a similar Human Rights Watch survey of 28 countries, New Zealand placed third among countries for opposing the weapons.

"Partly because of our anti-nuclear history, New Zealanders are quite plugged into this kind of thinking. They get it. It actually makes sense to regulate and agree rules on weapons of war to protect civilians and make the world safer," he said.

The survey, run by polling company Colmar Brunton, posed a series of questions about autonomous weapons to 2000 New Zealanders. The majority, 79 per cent, said they had not heard about autonomous weapons until they were surveyed.

New Zealand could play a "leading role" in pushing against autonomous weapons, and there was an "intensive" policy process happening between government agencies, including Mfat and the Ministry of Defence.

Some 51 per cent said they "strongly" opposed the use of such weapons, 21 per cent they somewhat opposed, and 13 per cent said they somewhat supported use of the weapons. A majority, 60 per cent, were concerned the weapons could technically fail, 53 per cent worried the weapons would "cross a moral line", and 52 per cent said "they'd be unaccountable". "It is a relatively new issue on the public agenda. I thought it was interesting that so many people did actually know and had a moral position on it," Twyford said.

He said more people would become aware that "swarms of drones using facial recognition software, completely cut off from human decision-making, could be let loose in the battlefield, or by terrorists against civilians – that is a pretty terrifying prospect".

Twyford said he hoped New Zealand could play a "leading role" in pushing against autonomous weapons, and there was an "intensive" policy process happening between government agencies, including Mfat and the Ministry of Defence. The Government should have a policy to take to a United Nations conference on the subject in November, he said. "The ethical and moral position on killer robots is absolutely clear. And we have an abhorrence of the application of AI to weapons of war, that takes humans out of the decision-making chain. That is our position. "We want to see legally binding rules And that should absolutely include a ban on fully

autonomous, sometimes referred to as unpredictable autonomous, weapons.”

Source: <https://www.stuff.co.nz/national/politics/126024267/new-zealanders-concerned-about-killer-robots-as-government-pushes-against-new-arms-race>, 12 August 2021.

NUCLEAR ENERGY

GENERAL

Global Climate Objectives Fall Short without Nuclear Power in the Mix: UNECE

The urgent need to reduce emissions and slow global heating, should involve the roll-out of more nuclear power stations.... Only weeks before world leaders gather in Glasgow to hammer out plans to slow climate change, the United Nations Economic Commission for Europe (UNECE) has released a document arguing that nuclear power can help deliver on the Paris Agreement and the 2030 Agenda for Sustainable Development. “Nuclear power is an important source of low-carbon electricity and heat that can contribute to attaining carbon neutrality and hence help to mitigate climate change,” UNECE Executive Secretary Olga Algayerova said.

In the new technology brief published on 6 August, the agency warned that “time is running out to rapidly transform the global energy system,” as fossil fuels still account for over half of electricity generation in the UNECE region, which include the countries of Europe, but also countries in North America, Central Asia and Western Asia. The report highlights how only hydropower has played a greater role in avoiding carbon emissions over the past 50 years.

The Intergovernmental Panel on Climate Change (IPCC) released its landmark report on 9 August, warning that some climate change trends are currently now irreversible, but there is still time to limit it with strong and sustained reductions in emissions of CO2 and other greenhouse gases.

In the UNECE region, nuclear power is providing over 30% of electric generation in eleven countries (Belgium, Bulgaria, Czech Republic, Finland, France, Hungary, Slovakia, Slovenia, Sweden, Switzerland, Ukraine). Twenty countries currently operate nuclear power plants, and fifteen countries have new reactors under construction or under development.

Nuclear power is a low-carbon energy source that has avoided about 74Gt of CO2 emissions over this period, nearly two years’ worth of total global energy-related emissions, it noted. Yet nuclear power currently provides 20 per cent of electricity generated in the UNECE region and 43 per cent of low-carbon generation.

Still time to Limit Climate Change: The publication comes as the Intergovernmental Panel on Climate Change (IPCC) released its landmark report on 9 August, warning that some climate change trends are currently now irreversible, but there is still

time to limit it with strong and sustained reductions in emissions of CO2 and other greenhouse gases. The UNECE document also highlighted a 2018 report by the IPCC which sees demand for nuclear generation increase six times by 2050 with the technology providing 25%

of global electricity. Nuclear power, it stated, has the potential to increase its integration with other low-carbon energy sources in a future decarbonised energy mix.

Powering the Region: According to the document, in the UNECE region, nuclear power is providing over 30% of electric generation in eleven countries (Belgium, Bulgaria, Czech Republic, Finland, France, Hungary, Slovakia, Slovenia, Sweden, Switzerland, Ukraine). Twenty countries currently operate nuclear power plants, and fifteen countries have new reactors under construction or under development.

Seven UNECE member States are in the process of developing nuclear power programmes for the first time. A number of countries - such as Canada, Czech Republic, Finland, France, Hungary, Poland, Romania, Slovakia, Slovenia, Russia, Ukraine, the

United Kingdom and the United States - have explicitly stated that nuclear power will play an important role in reducing their national emissions in the future.

Climate Mitigation: In contrast, Belgium and Germany have announced phasing out nuclear power, in 2025 and 2023 respectively. Over 70 reactors have been shut down since 2000, for political, economic or technical reasons. In most cases, these have been replaced at least partly by fossil-fuel power generation. The report argues that this represents a setback for climate mitigation efforts. Preventing the premature closure of further nuclear power plants is seen by the International Energy Agency and the IAEA as an urgent priority for addressing climate change, it states.

Nuclear Options: As nuclear power plants produce both low-carbon electricity and heat, they also offer opportunities to decarbonise energy intensive industries, the UNECE report argues, such as scaling up low or zero-carbon steel, hydrogen, and chemical production to decarbonise hard-to-abate sectors. Nuclear power is cost-competitive in many parts of the world, it states. But the UN agency warns that to prevent radiological accidents and manage radioactive waste, risks must be properly anticipated and handled.

Some countries choose not to pursue nuclear power because they consider the risks to be unacceptable. The technology brief highlights the need for nations that use nuclear power to work together on these issues to help mitigate climate change and accelerate deployment of low-carbon technologies.

Source: <https://news.un.org/en/story/2021/08/1097572>, 11 August 2021.

IAEA to Host Nuclear Energy Events in the Run Up to the Pre-COP26 Climate Meeting

The IAEA will host three virtual events in connection with the Pre-COP26 climate meeting

in Italy this autumn, the final ministerial gathering before the United Nations Climate Change Conference (COP26) in Glasgow in November. The IAEA webinars will highlight nuclear power's vital role in decarbonizing energy production as well as the importance of engaging and empowering young people in the transition to net-zero energy systems.

The events are part of the All4Climate initiative launched by COP26 co-host Italy in collaboration with the World Bank and the participation of the city of Milan and the Lombardy Region.

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All4Climate seeks to foster dialogue on the challenges presented by the climate crisis and to help deliver on the goals of the Paris Agreement, to limit global warming this century to well below 2 degrees Celsius. "Given that it provides almost a third of the world's low-carbon electricity, nuclear power needs to be at the table

where energy solutions to the climate crisis are discussed," said Mikhail Chudakov, IAEA Deputy Director General and Head of the Department of Nuclear Energy. "We are very pleased that our events have been included in the official All4Climate calendar. It reflects the continuous work by the IAEA on this important topic, and the events themselves will provide timely input to global discussions about energy and climate change ahead of COP26 in November."

The Pre-COP preparatory meeting customarily precedes COP meetings. Held in Milan from 30 September to 2 October, this year's Pre-COP is expected to host ministers and delegations from more than 40 countries, representatives of the UN Framework Convention on Climate Change Secretariat and other stakeholders in the fight against climate change and the transition to sustainable development. They will discuss potential political roadblocks to living up to the world's climate ambition as expressed in the Paris Agreement and devise strategies for overcoming such challenges at the COP26 summit.

Timely engagement of young scientists, engineers

and policy makers is crucial for a future where nuclear power, as a clean and sustainable energy source, plays an important role in the move away from coal, the most carbon-intensive fossil fuel and therefore the most important target for replacement. The IAEA's first virtual event on the All4Climate calendar, on 2 September, will be Youth Engagement on the Road to Decarbonization, in which young professionals will exchange perspectives on the role of nuclear power and other clean energy sources in the fight against climate change.

The next event, on 20 September, will feature the five finalists of the IAEA Net Zero Challenge, a competition of policy recommendations by young professionals for an accelerated transition to net zero emissions. The finalists will present their recommendations and a committee will select the winner of the Challenge, who will be offered an opportunity to attend COP26 in Glasgow.

Youth themes will again be front and centre on 28 September at the Empowering Youth: Attracting the Next Generation of Nuclear Professionals webinar. Students, young professionals and senior leaders will use this event to inspire young people to pursue careers in nuclear science and technology, underscoring the unique role that young generations have in mitigating climate change and achieving sustainable development.

The IAEA is also gearing up for COP26, with plans to organize several events on nuclear technology's role in fighting and adapting to climate change. "There, I will personally reiterate the message that, without the substantial contribution of nuclear power to the global energy mix, we will not achieve our climate goals," IAEA Director

General Rafael Mariano Grossi said in his introductory statement to the IAEA Board of Governors in June. "Nuclear must have a seat at the table when the world's future energy and climate policies are being discussed."

Source: <https://www.iaea.org/newscenter/news/iaea-to-host-nuclear-energy-events-in-the-run-up-to-the-pre-cop26-climate-meeting>, 09 August 2021.

Timely engagement of young scientists, engineers and policy makers is crucial for a future where nuclear power, as a clean and sustainable energy source, plays an important role in the move away from coal, the most carbon-intensive fossil fuel and therefore the most important target for replacement.

Zero-Carbon Bitcoin? The Owner of a Pennsylvania Nuclear Plant Thinks it could Strike Gold

Could bitcoin mining be the salvation of the embattled nuclear energy industry in America? The owners of several nuclear

power plants, including two in Pennsylvania, have formed ventures with cryptocurrency companies to provide the electricity needed to run computer centers that mine bitcoin. Since nuclear energy does not emit greenhouse gases, the project's investors say, the zero-carbon bitcoin would

address climate concerns that have tarnished the energy-intensive cryptocurrency industry. Talen Energy, the owner of the Susquehanna Steam Electric Station near Berwick, Pa., announced that it has signed a deal with TeraWulf Inc., an Easton, Md. cryptocurrency mining firm, to build a giant bitcoin factory next to its twin reactors in northern Pennsylvania. The first phase of the venture,

dubbed Nautilus Cryptomine, could cost up to \$400 million.

Talen's project could eventually use up to 300 megawatts — or 12% of Susquehanna's 2,500 MW capacity. It's the second bitcoin-mining venture in the last month that involves owners of Pennsylvania nuclear facilities. In July, Energy Harbor Corp., the former power-generation subsidiary of First Energy Corp., announced it

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signed a five-year agreement to provide zero-carbon electricity to a new bitcoin mining center operated by Standard Power in Coshocton, Ohio. Energy Harbor owns two nuclear units in Ohio and the twin-unit Beaver Valley Power Station in Western Pennsylvania.

A nuclear fission start-up, Oklo, also announced last month it signed a 20-year deal with a bitcoin miner to supply it with power, though the company has not yet built a power plant.

In recent years, commercial nuclear operators have struggled to compete in competitive electricity markets against natural gas plants and renewable sources such as wind and solar. Unfavorable market conditions have hastened the retirements of several single-unit reactors, such as Three Mile Island Unit 1 in Pennsylvania. Lawmakers in New Jersey, New York and Illinois have enacted nuclear bailouts, paid by electricity customers, to stave off early retirement for other plants.

The cryptocurrency deals would provide nuclear generators with reliable outlets for their power, and bitcoin miners with predictable sources of power at cheap prices, along with a zero-carbon cachet. "Nuclear energy is uniquely positioned to provide power to crypto mining companies and other major energy users who have committed to a carbon-free future". The nuclear industry views the crypto craze as a launching pad for expansion. "U.S. nuclear power plants are ready and able to supply miners with abundant, reliable carbon-free power while also providing new business pathways for the nuclear developers and utilities, increasing their operating profits, and potentially accelerating the deployment of the next generation of reactors". . .

Nuclear producers aren't the only power generators getting in on the trend. Stronghold Digital Mining, a bitcoin miner that registered last month for a \$100 million initial stock offering,

plans to build its bitcoin mining operation in north western Pennsylvania, powered from Venango County waste coal. While its bitcoin would not be zero-carbon, it would reduce environmentally harmful piles of waste coal. Energy and cryptocurrency experts say several trends are

shifting the market in favor of U.S. nuclear power producers. In May, Chinese regulators announced measures to limit bitcoin mining in several regions that failed to meet Beijing's energy-use targets. Bitcoin

production levels have fallen since then, forcing bitcoin producers to relocate to places with low operating costs and cool climates to reduce the costs of cooling the bitcoin data centers. The state of Washington, which has lots of inexpensive hydroelectric power, has undergone a huge boom in bitcoin mining.

How Mining is Done: Bitcoin is a peer-to-peer virtual currency which can be exchanged for traditional currency such as the U.S. dollar. It is the most successful of hundreds of attempts to

create virtual money through the use of cryptography, the science of making and breaking codes — hence, they are called cryptocurrency. Bitcoin mining is built around blockchain technology, and it involves generating a string of code that decrypts a collection

of previously executed bitcoin transactions. Successful decryption is rewarded with a new bitcoin. The supply of bitcoins is limited to 21 million — nearly 90% have already been mined. So the remaining bitcoins become increasingly scarce and more difficult to extract.

Data centers operated by bitcoin miners randomly generate code strings, called "hashes," to solve the puzzle and earn new coins. Worldwide, miners on the bitcoin network generate more than 100 quintillion hashes per second — that's 100,000,000,000,000,000,000 guesses per second, according to Blockchain.com. The first phase of the Nautilus project in Pennsylvania

Nuclear energy is uniquely positioned to provide power to crypto mining companies and other major energy users who have committed to a carbon-free future".

U.S. nuclear power plants are ready and able to supply miners with abundant, reliable carbon-free power while also providing new business pathways for the nuclear developers and utilities, increasing their operating profits, and potentially accelerating the deployment of the next generation of reactors".

would generate five quintillion hashes per second. Such guesswork requires muscular computing power, robust internet connections, and lots of electricity. "Mining cryptocurrency is an international, profitable, and energy-intensive business," Scott Madden a management consulting firm, said in a paper it published last year. Bitcoin mining consumes an estimated 0.5% of the electricity produced worldwide — about as much as the country of Greece.

Some lawmakers have called for greater regulation of cryptocurrency, citing the enormous amount of resources required to produce it. "There are computers all over the world right now spitting out random numbers around the clock, in a competition to try to solve a useless puzzle and win the bitcoin reward," Sen. Elizabeth Warren, D-Mass., said in June, calling for a crackdown on "environmentally wasteful cryptocurrencies."

Why Possible Numbers Look Good: But as a business proposition, bitcoin has appeal. Scott Madden, the consulting firm, suggested last year that nuclear operators in some states were in a unique position to profit from cryptocurrency ventures. Diverting 1 megawatt of power to an efficient mining operation could conservatively generate top-line revenue of \$900,000 a year and profits of \$650,000, not accounting for cooling, repairs, or technicians, according to Scott Madden. Its analysis predicts that a project could break even in about 15 months. The consulting firm's conceptual project was based upon a bitcoin price of \$9,275. The price of a bitcoin varied between \$38,000 and \$42,000. Such numbers no doubt got the attention of Talen Energy, which plans to divert about 180 MW to the first phase of the Nautilus Cryptomine, which would be producing bitcoin at the Susquehanna plant in Luzerne County.

...Unlike other crypto projects in which the power generator is an arms-length electricity supplier, the Nautilus Cryptomine is a 50-50 venture between Talen and TeraWulf. The project would be directly connected to the Susquehanna plant

— "behind the meter," in industry parlance — and would avoid any transmission costs from the grid. The direct connection also guarantees that the operation is sourced exclusively with carbon-free energy, Mr. Wertheimer said.

The cryptomine would be located inside a 200,000-square-foot building — about four football fields.

The mining operation would be built on a data center campus that Talen is developing next to the Susquehanna plant. The data center would generate about 1,000 construction jobs, Mr. Wertheimer said. The cryptomine would employ about 50 people to operate. The first phase of

the project would cost about \$350 million to \$400 million. "As you look across the United States, and you look at kind of the challenges that are facing nuclear plants, I think this is a great opportunity to prolong the life of a lot of plants," he said.

Source: <https://www.post-gazette.com/business/powersource/2021/08/07/Zero-carbon-bitcoin-The-owner-of-a-Pennsylvania-nuclear-plant-thinks-it-could-strike-gold/stories/202108070012>, 07 August 2021.

URANIUM PRODUCTION

JORDAN

Jordanian Uranium Mining Company has Processed 70 Tonnes of Ore

The Chairman of the Jordan Atomic Energy Commission (JAEC), Khaled Touqan said on 14 July that the Jordanian Uranium Mining Company (JUMCO) has operated its pioneering plant to extract yellowcake from uranium ores since the start of 2021. In addition to exploring for uranium in the center of the Kingdom, the Jordanian nuclear programme also comprises of the Jordan Research and Training Reactor which became operational in 2016, and the Nuclear Power Plant Project to produce electricity and desalinate seawater, which is currently ongoing.

Touqan said that the Synchrotron-light for

Experimental Science and Applications in the Middle East (SESAME) had begun receiving international researchers in 2018 to conduct research using synchrotron light. JUMCO General Manager Mohammad Shunnaq said that, over the past year, the company has undertaken the design and installation of a factory for the production of yellow cake. He highlighted the company's successful operation of a crude agglomeration line despite the exceptional circumstances due to the coronavirus pandemic. He said operation of the pilot plant has processed 70 tonnes of ore.

JUMCO, established in 2013, is the commercial arm of JAEC tasked to develop the Central Jordan Uranium Project. Exploratory studies by the Natural Resources Authority in the early 1980s indicated significant deposits of uranium ore in several parts of Jordan. JUMCO's main tasks include: Conducting detailed exploratory studies for the Central Jordan area, conducting research and specialised studies on uranium ores, designing industrial processes for the production of yellow cake, completing the project's economic feasibility study in line with international standards, setting up a production factory to produce yellow cake, producing the nuclear fuel needed to operate Jordanian nuclear reactors and exporting the surplus to boost the national economy, positioning Jordan as regional centre for nuclear fuel.

JUMCO produced yellow cake from an extraction unit set up for this purpose and is operating in a semi-continuous industrial system. It is also working to establish a pilot plant at the company's

Sewaqa field camp. Uranium exploration continues in accordance with international guidelines as well as the classification of uranium ores in Central Jordan based on international standards. JAEC said the uranium mining project allows for the development of technical expertise across scientific and engineering fields at the national level. This expertise will filter into the local industrial sector, leaving a positive socio-economic impact on the community at large. The company recruits qualified Jordanian geologists and engineers who utilise and implement international standards throughout the project.

Source: <https://www.neimagazine.com/news/newsjordanian-uranium-mining-company-has-produced-70-tonnes-of-ore-8931139>, 27 July 2021.

KAZAKHSTAN

Top Uranium Miner Kazatomprom Ups Production 9% in Second Quarter

Kazatomprom noted that its uranium sales of 4,915 tonnes in Q2 2021 increased significantly 99% over Q2 2020 due to seasonality and differences in the timing of deliveries for 2020 and 2021. According to a press-release, the higher uranium spot price in 2021 had a positive impact on Kazatomprom's average realized price, which rose 3% to \$29.6/lb U3O8 in Q2 2021 compared to \$28.75/lb in Q2 2020.

Kazakhstan's Kazatomprom the world's largest uranium producer, announced today that the company produced 3,073 tonnes of uranium (as U3O8) in Q2 2021 on an attributable basis, which is 9% more than in Q2 2020 (2,809 tonnes). Overall, uranium production in Kazakhstan (100% of KAP and its partners production) was 5,527 tonnes in Q2 2021, a 6% increase over Q2 2020 (5,213 tonnes). The company said that production on both a 100% and attributable basis was slightly higher in the second quarter of 2021 compared to the same period in 2020, due to the impact of COVID-19 in 2020 resulting in lower production.

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4,915 tonnes in Q2 2021 increased significantly 99% over Q2 2020 due to seasonality and differences in the timing of deliveries for 2020 and 2021. According to a press-release, the higher uranium spot price in 2021 had a positive impact on Kazatomprom's average realized price, which rose 3% to \$29.6/lb U3O8 in Q2 2021 compared to \$28.75/lb in Q2 2020.

If spot prices remain higher than 2020 through to year-end, KAP said that the trend of increasing average realized price is expected to continue, with the company's delivery schedule weighted to the second half of 2021.

Additionally, the company reiterated that its 2021 production guidance of 22,500 – 22,800 tonnes (12,550 – 12,800 tonnes on an attributable basis) remains unchanged at this time.

Kazatomprom is the world's largest producer of uranium, with the company's attributable production representing approximately 23% of global primary uranium production in 2020. The group benefits from the largest reserve base in the industry and operates, through its subsidiaries, JVs and Associates, 26 deposits grouped into 14 mining assets. All of the company's mining operations are located in Kazakhstan and extract uranium using ISR technology with a focus on maintaining industry-leading health, safety and environment standards.

Source: <https://www.kitco.com/news/2021-08-02/Top-uranium-miner-Kazatomprom-ups-production-9-in-second-quarter.html>, 02 August 2021.

NUCLEAR COOPERATION

ROMANIA-CANADA

Romania Strengthens Nuclear Cooperation with Canada

Romania and Canada have signed a MoU in Bucharest to strengthen cooperation in the field

of nuclear energy, enabling the completion, refurbishment and possible expansion of Romania's Cernavoda nuclear power plant.... Romania signed similar agreements with the US and France last year. Cernavoda is the first and only nuclear power generating facility in Romania,

operating since 1996. The facility, with two 706 MW operating units, currently fulfills 18% of Romania's electricity demand. The facility is owned and operated by the state-owned Societatea Nationala Nuclearelectrica (SNN).

The Cernavoda NPP uses Canadian Deuterium

Uranium 6 (CANDU-6) pressurized heavy-water reactor technology. Romania has long wanted to complete two additional CANDU units at Cernavoda and is also making plans to refurbish the two operational units there for longer service lives. In October 2020, Romania signed an intergovernmental agreement with the United States for the construction of units 3 and 4 and the refurbishment of unit 1. American company AECOM will coordinate the USD 8 billion project, which includes a consortium of companies from the US, Romania, Canada and France.

Source: <https://bbj.hu/economy/energy/energy-trade/romania-strengthens-nuclear-cooperation-with-canada>, 11 August 2021.

NUCLEAR PROLIFERATION

IRAN

US Urges Iran's New President Ebrahim Raisi to Resume Nuclear Talks

The US has called on Iran's new president to return to talks on reviving a historic nuclear deal. The window for diplomacy would not remain open forever, a spokesman for the US state department warned. Tensions between the US and Iran have soared since 2018, when then-President Donald Trump pulled out of the nuclear deal and restored sanctions. Ebrahim Raisi was sworn in on 5 August

saying he would support “any diplomatic plans” to end sanctions on Iran. “All illegal US sanctions against the Iranian nation must be lifted,” he said. Western countries accuse Iran of trying to build nuclear weapons - a charge Tehran denies.

The 2015 deal between Iran and six other countries - the US, UK, France, China, Russia and Germany - saw it stop some nuclear work in return for an end to sanctions hurting its economy. But Iran restarted banned nuclear work after Mr Trump pulled out of the deal. Thorny negotiations have been taking place in the Austrian capital, Vienna, between Iran and other countries which are still part of the agreement to try to revive the frayed deal and lift sanctions. However the talks have been on hold for several weeks.

In comments following Mr Raisi’s inauguration, US state department spokesman Ned Price told reporters: “We urge Iran to return to the negotiations soon so that we can seek to conclude our work.” “Our message to President Raisi is the same as our message to his predecessors... the US will defend and advance our national security interests and those of our partners. We hope that Iran seizes the opportunity now to advance diplomatic solutions,” he said.

But he added: “This process cannot go on indefinitely. The 60-year-old is close to Iran’s Supreme Leader, Ayatollah Ali Khamenei, and has been touted as a possible successor. Among the major challenges he faces is a battered economy, which has led to growing discontent among ordinary Iranians, who have seen a sharp rise in the cost of living. Iran has also blamed US sanctions for an acute shortage of medicines. Alongside the economic crisis, Iran is battling the coronavirus pandemic. It is the worst-hit country in the region and has recorded its highest number of cases for the past three days running...

Source: <https://www.bbc.com/news/world-middle-east-57421235>, 06 August 2021.

NUCLEAR DISARMAMENT

GENERAL

UN Pledges Full Support to Nagasaki Voices Fuelling ‘Powerful Global Movement’ Against Nuclear Arms

António Guterres has reaffirmed the full support of the United Nations to amplifying the powerful testimony of the survivors of the atomic bomb that was dropped on the Japanese city of Nagasaki, 76 years ago, which has helped build a “powerful global movement against nuclear arms”.

In his message to the Nagasaki Peace Memorial on the 9 August anniversary, the UN Secretary-General said he continued to be humbled by the “selfless acts of the hibakusha, the name given to those who survived and continue to bear witness. “Your courage in the face of immense

In his message to the Nagasaki Peace Memorial on the 9 August anniversary, the UN Secretary-General said he continued to be humbled by the “selfless acts of the hibakusha, the name given to those who survived and continue to bear witness. “Your courage in the face of immense human tragedy, is a beacon of hope for humanity”.

human tragedy, is a beacon of hope for humanity”, he said in his address, delivered on his behalf at the ceremony by the UN High Representative for Disarmament Affairs, Izumi Nakamitsu. “I reaffirm the full support of the United Nations to ensuring that your voices are heard by

the world’s people, and especially by younger generations.”

Out of the Ashes: The UN chief told the people of the city that was devastated in 1945, just days after the first bomb was dropped by the United States on Hiroshima during the final days of World War Two, that they had built a “cultural metropolis” out of the ashes. “Your dynamic city exemplifies modernity and progress, while you work diligently to prevent devastation from ever befalling another city”, he said, warning however that the prospect of another nuclear weapon being used, were as dangerous now, as any time since the height of the Cold War between the US and former USSR.

“States are racing to create more powerful weapons, and broadening the potential scenarios

for their use. Warlike rhetoric is turned up to maximum volume, while dialogue is on mute”, said the Secretary-General.

Grounds for Hope: But two developments this year provide grounds for hope, in the form of the reaffirmation from the US and Russia, “that a nuclear war cannot be won and must never be fought”, together with a commitment to engage in arms control talks. Secondly, said Mr. Guterres in his message, the Treaty on the Prohibition of Nuclear Weapons has now come into force, representing “the legitimate fears of many States, about the existential danger posed by nuclear weapons.”

And for the parties to the Nuclear Non-Proliferation Treaty, the UN chief said they all parties now need to reinforce “the norm against nuclear weapons” at the upcoming Tenth Review Conference, and take real steps towards elimination. It is incumbent on all Member States of the UN, “to seek the abolition of the most deadly weapons ever made”, said Mr. Guterres, and together, we must prevent the tragedy of Nagasaki’s nuclear destruction, “from ever occurring again.”

JAPAN

PM Suga Clearly States Japan won’t Join Nuclear Weapons Ban Treaty

Prime Minister Yoshihide Suga has stated clearly that Japan will not join the Treaty on the Prohibition of Nuclear Weapons in remarks during an Aug. 6 press conference after the peace memorial ceremony marking the 76th anniversary

of the U.S. atomic bombing of Hiroshima. Suga referred to “the increasingly severe security environment” surrounding Japan, and said the country will not ratify the nuclear weapons ban treaty. The prime minister’s comments defied Hiroshima Mayor Kazumi Matsui’s statements in the Peace Declaration he delivered earlier the same day at the peace memorial ceremony, in which he urged Japan to ratify the landmark treaty that went into effect in January. In his address, Matsui also asked nuclear powers to join discussions to help maximize the treaty’s effectiveness.

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In a bid to elicit a policy shift among nuclear-weapon states’ leaders, their allies and other parties yet to participate in the treaty, Matsui called for civil society to reach a consensus that nuclear weapons are unnecessary. He also urged the Japanese government to sign the treaty and attend the first Meeting of States Parties. But Prime Minister Suga’s speech at the peace memorial ceremony in Peace Memorial Park in Hiroshima’s Naka Ward did not mention the nuclear weapons ban treaty, and instead reiterated the conventional government position of Japan as a bridge between nuclear and non-nuclear nations. It was Suga’s first time attending the ceremony since taking office.

After the ceremony, Suga met representatives of A-bomb survivors’ groups in Hiroshima, who requested to the prime minister himself that Japan join the nuclear weapons ban treaty. Due to surging coronavirus infections, 751 people attended the ceremony — less than 10% of a normal year’s attendance. Twenty-four of them

Representatives from the United States and 82 other countries and European Union member states also joined the ceremony, and observed a one-minute silence at the stroke of 8:15 a.m. on Aug. 6. According to the Ministry of Health, Labor and Welfare, 127,755 people with an average age of 83.94 held A-bomb survivors’ certificates as of the end of March.

were representatives of A-bomb victims' bereaved families invited from prefectures across Japan.

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Source: <https://mainichi.jp/english/articles/20210807/p2a/00m/0na/024000c>, 07 August 2021.

UK

Nuclear Disarmament Campaign Sparks Pro-Trident Response from Barrow MP and Ministry of Defence

BARROW'S MP and the Ministry of Defence defend the UK's nuclear deterrent following calls for the immediate decommissioning of the Trident nuclear weapons system. On the 76th anniversary of the dropping of the first atomic bomb (August 6) anti-nuclear campaigners met in Abbot Hall Park, Kendal to remember the horrors of the bombing of Hiroshima in 1945. Members and supporters of South Lakeland and Lancaster District Campaign for Nuclear Disarmament kept a minute's silence for the 340,000 children, women and men who died as a result of the atomic bombs dropped in 1945 and shared readings calling for a world free from nuclear weapons.

Philip Gilligan, on behalf of the group, said: "The seed sent to us by our friends in Hiroshima is

descended directly from camellia bushes which survived the blast, fireball and radioactivity which killed so many people in 1945. We aim to cherish it as a symbol of worldwide resistance to nuclear weapons".

"In 2021, campaigning for a future free from the threat of nuclear warfare is more urgent than it has ever been. In our own country, instead of meeting commitments under Article

VI of the Treaty on the Non-Proliferation of Nuclear Weapons to "pursue negotiations in good faith on effective measures relating...to nuclear disarmament", the Government is replacing and upgrading the Trident nuclear weapons system, widening the circumstances in which the UK's nuclear weapons could be used and increasing the size of this lethal arsenal by a staggering 40 per cent. Policies like these increase the risk of another Hiroshima and must be resisted by us all."

Simon Fell, MP for Barrow, said: "We would all do well to consider the lessons of Hiroshima and the terrible cost of war. But it is entirely possible to do so and recognise the strategic importance of the nuclear deterrent to our own, and our NATO-partners' safety. "The deterrent keeps us safe every single day and is the life blood of Barrow, with over 10,000 people involved in the submarine programme locally." The shipyard in Barrow is the

main site supplying submarines for the Dreadnought and Astute programmes which play a key role in the nuclear deterrent.

A spokesman for the Ministry of Defence said: "The UK's independent nuclear deterrent exists to deter the most extreme threats to the UK and our NATO allies. It will remain essential for as

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The UK's independent nuclear deterrent exists to deter the most extreme threats to the UK and our NATO allies. It will remain essential for as long as the global security situation demands. The UK remains fully committed to the long-term goal of a world without nuclear weapons, negotiated within the framework of the Non-Proliferation Treaty.

long as the global security situation demands. The UK remains fully committed to the long-term goal of a world without nuclear weapons, negotiated within the framework of the Non-Proliferation Treaty, and will keep working with international partners towards an environment where further progress on nuclear disarmament is possible."

Source: <https://www.nwemail.co.uk/news/19501612.nuclear-disarmament-campaign-sparks-pro-trident-response-barrow-mp-ministry-defence/>, 10 August 2021.

NUCLEAR WASTE MANAGEMENT

AUSTRALIA

Australian Government Names Preferred Site for Waste Facility

Australia's Federal Minister for Resources and Water, Keith Pitt, on 11 August announced his intention to make a declaration under the National Radioactive Waste Act 2012 confirming part of the land at Napandee near Kimba in South Australia, as the preferred site for the National Radioactive Waste Management Facility (NRWMF). Public comment is invited until 22 October. Following the consultation period, the Minister will consider relevant comments and may then declare Napandee as the site for the facility after which the Government would take steps to acquire the site.

The Ministry notes that the project "is an emotive issue for many, including the Traditional Custodians of the Napandee site, the Barngarla people". It adds that the Australian Radioactive Waste Agency "will continue to work in a way that respects the views of those who have concerns" and that the announcement "is another step towards a \$31 million Community Development Package to support the local host community". A poll showed that more than half the population

of the Kimba support the proposal but the announcement now opens the door to a legal challenge by traditional owners, according to ABC.

The legislation for the project had been amended to list several other site options that had previously been discarded in a successful bid to gain Opposition support. However, the formal determination can now be challenged in the courts opening the way for a judicial review of the site selection process by the Barngarla people. ABC notes that consultation was only carried out with ratepayers, not with Barngarla traditional owners, some of whom have said they do not want the facility on their land. In a statement, representative body the Barngarla Aboriginal Corporation said it was denied the right to vote on the site. "If the Minister declares Napandee as the site, we will bring it to a judicial review"....

The Napandee facility would host primarily low-level waste and sometimes store intermediate-level waste temporarily. The waste is currently held at more than 100 locations across the country. More than 80% of radioactive waste in Australia is associated with the production of nuclear medicine. "We want to make sure we can continue to use the world's leading best health technology for all

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Australians," Pitt said. "To do that, it has to be stored and dealt with. Upon reviewing all the information, it is clear that radioactive waste can be safely and securely stored at Napandee."

Source: <https://www.neimagazine.com/news/newsaustralian-government-names-preferred-site-for-waste-facility-8991297>, 12 August 2021.

UK

Hartlepool could be Site for 'Nuclear Waste Dumping' Under New Plans

In a letter sent to numerous politicians in the region, including Ben Houchen, the Tees Valley

Mayor, and Hartlepool Council leader Shane Moore, Sacha Bedding, the chief executive of the Wharton Trust said he wanted to 'explore whether Hartlepool would be a suitable location for an offshore Geological Disposal Facility (GDF)'... Mr Bedding, said: "Hartlepool is a place which has benefitted hugely from the harnessing of nuclear energy.

"We see the opportunity which a GDF could bring. We have a chance to develop the town in a way in which is, quite frankly, unimaginable without it. We are able to exercise our moral responsibility by dealing with the nuclear by-products, we have an opportunity to reimagine our town, to grow our skills base, to secure hundreds of well-paying jobs for generations." In a statement, Sacha Bedding, said: "The people of Hartlepool, which is highly skilled with experience and heritage in mining, nuclear power and dealing with hazardous waste, have a right to decide, in an informed manner, whether this is an appropriate economic and environmental opportunity for the town.

Hartlepool is a place which has benefitted hugely from the harnessing of nuclear energy. "We see the opportunity which a GDF could bring. We have a chance to develop the town in a way in which is, quite frankly, unimaginable without it. We are able to exercise our moral responsibility by dealing with the nuclear by-products, we have an opportunity to reimagine our town, to grow our skills base, to secure hundreds of well-paying jobs for generations.

"The Wharton Trust, a charity which works to minimise the impact of the low socio-economic opportunities in the town, has been keeping a watching brief on this matter for a number of years and has recently been meeting with a variety of agencies and political parties, the latest being The Labour Group, to bring this conversation to the table, with a view to creating a working group to explore it further.... After climate change, the long-term strategy of how we deal with spent radioactive fuel – which includes waste from things like radiotherapy and X-rays – is the most pressing environmental issue of our time. This is not an issue which can be 'kicked into the long grass' to be dealt with by our grandchildren and great grandchildren. There is

a moral obligation to find a permanent solution for spent nuclear fuel and, since Hartlepool is already proven in this field and is about to have its nuclear power station decommissioned and with it, a third of our economic footprint, having a sensible, informed and factual conversation about the pros and cons of hosting a GDF makes complete sense.

The opportunity to bring in 750 jobs for over 100 years and billions of pounds of additional investment should be discussed. Politicising this opportunity is actually a great disservice to the people of Hartlepool, who have the right to hear the information and ultimately decide for themselves, whilst benefiting in the process." The

Leader of Hartlepool council, Shane Moore, said: "I want to be absolutely clear with residents that I do not support Radioactive Waste Management's (RWM) proposal to create a site for the disposal of nuclear waste here in Hartlepool. "Some people may argue there is nothing to lose from having an initial discussion with RWM, but I am inherently sceptical and unsupportive of this development.

Source: <https://www.thenorthernecho.co.uk/news/19497576.hartlepool-site-nuclear-waste-dumping-new-plans/>, 06 August 2021.

USA

Green Light for \$2.3B Spent Nuclear Fuel Storage Site in Texas

The U.S. Nuclear Regulatory Commission staff is recommending granting a proposed license for a planned spent nuclear fuel interim storage facility in west Texas. The Nuclear Regulatory Commission (NRC) issued its final environmental impact statement on the application by Interim

Storage Partners LLC, which is a joint venture of Waste Control Specialists LLC and Orano CIS.

If granted, the owners would construct a facility to store from 5,000 (in the beginning) to 44,000 short tons of spent commercial nuclear fuel and a small quantity of spent mixed oxide fuel for about 40 years. U.S. Department of Energy statistics indicate that the U.S. commercial nuclear power industry generates about 2,000 metric tons of used uranium fuel per year. Once spent and removed from the reactor, used fuel rods are currently stored at close to 75 sites in 34 states, according to the DOE. The proposed interim site would be in Andrews County, Texas less than a mile from the New Mexico border. The owners would build and operate the project within a 14,000-acre parcel of land accessible by rail and road.

Project costs could be about \$350 million during the construction phase and total expenses of close to \$2.3 billion by the end of the 40-year lifespan, according to the NRC report. Once built, the project operators could begin receiving and storing the spent nuclear fuel within three months. The original plan is to store 5,000 short tons with subsequent expansion eventually bringing the total to close to 44,000 tons, equal to about 20 years of operation by the entire U.S. nuclear power generation fleet....

When a geologic repository becomes available, the spent fuel stored at the proposed interim storage site would be removed and sent to the repository for disposal. Defueling would involve similar activities to those associated with shipping spent nuclear fuel from nuclear power plants and

Independent Spent Fuel Storage Facilities....

The NRC staff concluded that land, air and water impacts would be relatively small and transportation infrastructure and activities also would not be a major issue, according to the report. The environmental impact states exposure risk was low given the transportation safeguards and relatively short time in transport.

"The NRC staff also evaluated the potential occupational and public health impacts of the proposed SNF transportation under accident conditions," the

NRC release reads. "Based on an ISP analysis of cask response to transportation accident conditions, releases of SNF would not be expected from the xxiv proposed SNF shipments under accident conditions. Under accident conditions with no release, the highest estimated dose consequence to an emergency responder that spent 10 hours at 3 meters [3.3 yards] from the SNF cask was 1.6 mSv [160 mrem]. ISP also

evaluated maximally exposed individual dose risks and collective dose risks to the public from the transportation of SNF under accident conditions involving a release under a variety of accident configurations.

"The highest reported individual public dose risk was 2.62×10^{-11} Sv [2.62×10^{-9} rem] once an accident has occurred. Therefore, when the NRC staff scales the result by the probability of an accident occurring (1.1×10^{-7} rail accidents per km), the shipment distance for ISP's longest route {5,043 km [3,134 mi]} and the total number of proposed shipments over the duration of the project (3,400), the resulting maximum individual dose risk is low at 4.9×10^{-11} Sv [4.9×10^{-9} rem]."

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The nation's 94 operating nuclear power units generate about 20 percent of electricity capacity, according to federal statistics. Nuclear units also generate more than half of the nation's current carbon-free power. Once the licensing period is up, the project would be decommissioned.

Source: <https://www.powerengineeringint.com/nuclear/waste-management-decommissioning/green-light-for-2-3b-spent-nuclear-fuel-storage-site-in-texas/>, 03 August 2021.



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