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**OPINION – Ramesh Thakur**

**A 'P5+4' Summit could Break the Nuclear Deadlock**

In April, US President Donald Trump directed White House officials to identify pathways to new arms control agreements with Russia and China. If he's looking for a big and bold new idea, here's one: a 'P5+4' nuclear summit of the leaders of the nine countries that have the bomb. The five permanent members of the UNSC are the only countries recognised by the NPT as lawful possessors of nuclear weapons: China, France, Russia, the UK and the US. The '+4' are the non-NPT nuclear-armed countries—India, Israel and Pakistan—and North Korea, the world's only NPT defector state.

The existing architecture of nuclear arms control has served us well but is now crumbling. It was weakened first by the US exit from the ABM Treaty in 2002 and then the indefinite delay of the entry into force of the CTBT. More recently, the deterioration has accelerated with the Trump administration's abandonment of the nuclear deal with Iran, the US and Russian suspensions of the INF Treaty, and the failure thus far to discuss extending New START beyond its expiry date of 2021. There is a related problem. The NPT-centric architecture cannot accommodate the reality of four non-NPT

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possessor states. The architecture deficit is exacerbated by the fact that the agenda of nuclear arms control, non-proliferation and disarmament has stalled. The Korean denuclearisation-cum-peace-process has run out of steam. In May, meeting of the preparatory committee for the 2020 NPT review conference could not reach agreement on a common statement.

In 2017, two-thirds of the international community adopted the UN Treaty on the Prohibition of Nuclear Weapons. All nine bomb-possessing countries, and about 30 nuclear-dependent allies including Australia, mock this as empty virtue-signalling by those who don't

have the bomb. Yet nuclear powers themselves invite ridicule by insisting that the only proper forum for engaging in arms control negotiations is the Conference on Disarmament in Geneva. This farcical body has not managed to agree on its own work agenda for over 20 years. The primary motivations behind the Nuclear Ban Treaty were heightened consciousness of elevated levels of nuclear risks and threats, exasperation at the refusal of the nuclear-armed states to engage in credible disarmament negotiations, and frustration with the fraying arms control architecture. The primary impact of the treaty won't be operational but normative: it attaches a moral stigma to continued possession and to doctrines of deterrence. So the existing international machinery is no longer fit for purpose even for individual items on the nuclear agenda, let alone all of them. Summit diplomacy could be a mechanism for cutting through the Gordian knot of global gridlock.

Not all summits are successful and not all topics lend themselves well to summit diplomacy. Summits make the most difference in tackling those global problems where leadership commitment is the critical missing variable, where the chief obstacle to identifying policy convergence and reaching consensus on next

steps is the lack of an appropriate forum, and where speedy resolution is essential. The nuclear security summits convened during Barack Obama's time as president, for example, consolidated and strengthened the disparate national, multilateral and cooperative institutions and instruments to ensure nuclear security and prevent nuclear smuggling. They were important for having clear

US presidential leadership on this critical area of the nuclear challenge and elevated the issue to the level of a global leaders' summit.

Nuclear arms control satisfies all the key criteria for a summit. Like pandemics, climate change and biodiversity, nuclear threats spill across national boundaries and defy unilateral solutions. A summit

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of the nine political leaders, but only them, that is appropriately structured and has been adequately prepared can focus them to do what they alone can do—make tough choices from among competing interests and priorities. Cabinet ministers have single portfolio responsibilities. Heads of state and government have

to oversee the entire agenda. With broad, overarching responsibilities, leaders can weigh priorities and balance interests across competing goals, sectors, and national and international objectives. Before a summit, leaders' engagement catalyses officials to focus on and resolve interagency differences, jurisdictional turf battles and veto points. At the summit, leaders' involvement makes it possible for states to bargain across issues in order to cut deals; that is, to trade apples for oranges. After the summit, their commitment to the agenda

**The first thing a nuclear summit should do is reaffirm the famous 1987 declaration by US President Ronald Reagan and Soviet leader Mikhail Gorbachev: 'a nuclear war cannot be won and must never be fought'. If all nine leaders sign such a statement, it can be adopted as a resolution also by the UNSC and General Assembly. That would reverse the recent trend to normalise the discourse of possible nuclear-weapon use and, by hardening the normative boundary between nuclear and other weapons.**

invests it with legitimacy and prioritises its implementation and can help to redirect resources even amid constrained budgetary environments.

The first thing a nuclear summit should do is reaffirm the famous 1987 declaration by US President Ronald Reagan and Soviet leader Mikhail Gorbachev: 'a nuclear war cannot be won and must

never be fought'. If all nine leaders sign such a statement, it can be adopted as a resolution also by the UNSC and General Assembly. That would reverse the recent trend to normalise the discourse of possible nuclear-weapon use and, by hardening the normative boundary between nuclear and other weapons, perhaps also help to stop mission creep with respect to the roles and functions of nuclear weapons. Other items on the agenda could include drafting a declaration, to be duly converted into a global convention, on no first use of nuclear weapons by any country; taking nuclear weapons off high-alert launch status as a crisis stability measure (around 2,000 nuclear warheads are currently on high alert); securing verified reductions in warhead numbers by Russia and the US, which account for over 90% of global stockpiles; and determining how best to transition from US–Russian agreements to those involving all nuclear powers.

At the same time, regional rivals could explore bilateral risk-reduction arrangements on the sidelines of the global summit. A summit-level agreement on a few important items would be a powerful stimulus to restarting stalled talks on other outstanding items like bringing the CTBT into force and commencing negotiations on a FMCT. Even a modestly successful summit would tell the world that the nine powers take seriously their responsibility for preserving nuclear peace. If Trump takes the initiative and assumes ownership of the summit, he would be more deserving of the Nobel Peace Prize than Obama in 2009.

Source: <https://www.aspistrategist.org.au>, 07 June 2019.

**OPINION – Lyle J. Goldstein**

**Chinese Nuclear Armed Submarines in Russian Arctic Ports? It could Happen**

Many have speculated on the possibility of a Russia-China alliance. At a forum in China not long ago... a senior Chinese specialist

commented: “The U.S. has many allies. China can also have allies.” Yet the prevailing conventional wisdom among specialists is that this is unlikely to occur. While keeping my mind open to various possibilities, I myself have been quite skeptical. After all, how could they really help one another? Russia is not going to count on the Chinese PLA Navy in the midst of a contest for the Baltic any more than the Chinese are going to count on the Russian Navy turning the tide in the South China Sea. Conceivably, an upgraded security partnership joining the Asian giants could lead to military-industrial efficiencies. They are already jointly developing a heavy-lift helicopter, but what if they genuinely cooperated in the fabrication of bombers and destroyers too? Or even submarines and aircraft carriers? Few have seriously entertained this possibility and it still seems far-fetched.

However, a recent article in the *Independent Military Review* by Russian military specialist Alexander Shirokorad seems to blow through the generally pervasive skepticism. Not only does this author embrace the notion of joint Russia-China air and missile defense for the Arctic, but he also unexpectedly floats the entirely new concept of allowing Chinese submarines, nuclear-armed “boomers” or SSBNs at that, to gain critical support from Russian Arctic ports. To be sure, the idea seems quite preposterous at first glance. Both countries are extremely touchy regarding sovereignty issues. Russians, so it would seem, would not be eager for China to gain a military foothold in this ultra-sensitive area along Russia’s northern flank.

Meanwhile, China has only one military base overseas in Djibouti and has almost no experience with the hazardous maritime (let alone undersea) environment on the roof of the world. And yet, there could actually be a basis for investigating this admittedly eccentric proposition. Chinese strategists have

previously discussed the Arctic as a Russia-China cooperative zone of strategic “resistance space” to U.S. pressure, and I have previously noted China’s evident interest in studying submarine manoeuvres through the ice. Let us explore the Russian military analyst Shirokorad’s logic. He begins with a mystery, noting the slightly bizarre comments of Secretary of State Mike Pompeo in Finland during early May. According to the Russian analyst, Pompeo “broke out into an angry tirade aimed at the Celestial Kingdom” explaining that he accused Beijing of trying to turn the Arctic into the South China Sea. Noting the peculiarity of the chief American diplomat’s apparent fixation with the Northern Sea Route (NSR), Shirokorad observes caustically: “Taking into account the geography of American trade routes, ship owners from the United States are no more concerned about the Northern Sea Route than flying to Mars.”

Shirokorad, who has significant knowledge of both submarine operations and also the Arctic region, then throws Pompeo a “life-line,” suggesting that the secretary of state was merely reflecting the notion articulated in the most recent Department of Defense report on Chinese military power: “[Beijing’s military plans for the Arctic] could include deploying submarines to the region as a deterrent against nuclear attacks.” Notably, the very next sentence of that U.S. government report hints at possible Russia-China frictions along the NSR, for example, with respect to the deployment of non-Russian ice-breakers along that route. Somewhat surprisingly, this Russian military analyst asserts that American concerns are actually logical from the standpoint of nuclear and naval strategy. Offering a short course on Cold War SSBN strategy, he explains that Soviet admirals were duly embarrassed in 1962 when “all the Russian rocket submarines turned out to be useless due to the American ASW system.” While Soviet submarines could

**Soviet admirals were duly embarrassed in 1962 when “all the Russian rocket submarines turned out to be useless due to the American ASW system.” While Soviet submarines could effectively threaten European cities, Kremlin strategists were perturbed by U.S. deployments of American SSBNs to bases at Holy Loch (UK), Rota (Spain) and also Pearl Harbor. From these advanced bases, they could easily access their patrol areas and range all Soviet homeland targets.**

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By contrast, “in order to fire their weapons and hit U.S. territory, Soviet submarines had to travel 7,000 to 8,000 kilometres to reach patrol areas and then make the return journey.” Of course, increasing missile ranges allowed the Soviets to favourably alter those patrol areas, so that eventually they could even hit U.S. targets from “essentially pier side.” This trend enabled the Soviet Navy to utilize natural geography and climate. By the 1980s, the Soviet Navy regularly sent SSBN patrols under the ice of the Arctic. Searching out Russian ‘boomers’ in the “ice jungle” of the Arctic proved more than a little challenging, even for the U.S. Navy that pioneered such operations with the famous *Nautilus*. Shirokorod explains that Russian SSBNs were capable of breaking through ice up to two meters thick in order to unleash their salvo

nuclear-armed missiles. Turning back to China’s undersea deterrent and potential parallels to earlier Soviet naval dilemmas, this Russian military expert observes that, geographically, the Chinese coast is a “huge distance” from targets in the American heartland.

Moreover, he assesses Chinese SSBNs as highly vulnerable to adversary forces in the open ocean areas of the Asia-Pacific. Here is where he drops the bombshell, or perhaps more accurately, the depth bomb. He asserts, “In venturing to the Arctic, the Chinese ‘immediately kill two birds with one stone’: significantly decreasing vulnerability and simultaneously reducing the distance to potential targets.” He estimates that Arctic deployments of the Chinese SSBN force

would reduce missile flight distances by 3.5 times. If it's not disturbing enough to see such an idea discussed openly in a major Russian newspaper, then Shirokorod actually goes a couple of steps further down the path of the New Cold War. "In the future, the Russian Federation and the PRC may also begin to create a joint anti-aircraft system and anti-missile defense system in the Arctic..." he writes. After all, he reasons, the US has been "planning to undertake strikes" via the Arctic against both China and Russia since the 1950s.

That cooperation in air and missile defense could also support the submarine component of Russia-China strategic cooperation in the Arctic is reasonably clear, but the analyst then makes the most extraordinary statement in this regard: "on our Arctic islands, the Chinese can deploy supply and communications systems for their strategic missile submarines." In the final paragraph of the essay, Shirokorod asks if such steps could endanger Russia and answers his own question emphatically: "Definitely not."

In closing, it must be emphasized that this article's importance should not be exaggerated. The musings of a single Russian strategist do not equal a new approach to Russia-China strategic cooperation, let alone a concrete bilateral military cooperation agreement on the deployment of the most prized, nuclear assets. Neither Moscow nor Beijing has given anything close to an official imprimatur to such eccentric ideas. And yet there is a small possibility that this one vision of the future could reach fruition

in coming decades if current trends toward cold war are not reversed. Moscow would have its fully built out Arctic infrastructure (both military

and commercial) with ample Chinese capital and engineering assistance. In return, Beijing would gain a reliable way to strike America and thus enhance its nuclear deterrent.

Source: <https://nationalinterest.org>, 01 June 2019.

**OPINION – Marshall Rogers-Martinez**

**What Geology Reveals about North Korea's Nuclear Weapons – and What it Obscures**

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**These tests are reminders that North Korea's military forces, particularly its nuclear arsenal, pose a serious threat to the US and its Asian allies. This reclusive nation is a high-priority U.S. intelligence target, but there are still large uncertainties about the power of its nuclear weapons. North Korean scientists work in isolation from the rest of the world, and defectors are far and few between.**

Since 2006 North Korea has conducted five more nuclear tests, each one larger than the last. Scientists are still working to measure their yield accurately. This question is important, because it reveals how advanced the North Korean nuclear program is, which has implications for global security.

North Korea's leader, Chairman Kim Jong Un, clearly is in no hurry to demilitarize his country. In the wake of two historic yet unproductive summits with President Trump, Kim made a state visit in April to Moscow, where he made clear that his country will not give up its nuclear weapons without international security guarantees. North Korea also tested what appeared to be short-range missiles on April 18 and May 4. These tests are reminders that North Korea's military forces, particularly its nuclear arsenal, pose a serious threat to the US and its Asian allies. This reclusive nation is a high-priority U.S. intelligence target, but

there are still large uncertainties about the power of its nuclear weapons. North Korean scientists work in isolation from the rest of the

world, and defectors are far and few between.

My research focuses on improving techniques for estimating the yield, or size, of underground nuclear explosions by using physics-based simulations. Science and technology give us a lot of tools for assessing the nuclear capabilities of countries like North Korea, but it's still difficult to track and accurately measure the size and power of their nuclear arsenals. Here's a look at some of the challenges.

**A Nation in the Dark:** For an isolated nation like North Korea, developing a functional nuclear weapons program is a historic feat. Just eight other sovereign states have accomplished this goal – the five declared nuclear weapons states plus Israel, India and Pakistan. North Korea has been developing nuclear weapons since the mid-1980s. Paradoxically, in 1985 it also joined the NPT, under which it pledged not to develop or acquire nuclear weapons. But by 2002, US intelligence discovered evidence that North Korea was producing enriched uranium – a technological milestone that can yield explosive material to power nuclear weapons. In response the U.S. suspended fuel oil shipments to North Korea, which prompted the North to leave the NPT in 2003. Then the North resumed a previously shuttered program to extract plutonium from spent uranium fuel. Plutonium-based nuclear weapons are more energy-dense than uranium-based designs, so they can be smaller and more mobile without sacrificing yield. North Korea conducted its first nuclear test on Oct. 6, 2006. Many experts considered the test to be unsuccessful because the size of the explosion, as determined from seismograms, was relatively small. However, that conclusion was based on incomplete information. And the test still served as a powerful domestic propaganda

tool and international display of might.

**More Tests, More Uncertainty:** Since 2006 North Korea has conducted five more nuclear tests, each one larger than the last. Scientists are still working to measure their yield accurately. This question is important, because it reveals how advanced the North Korean nuclear program is, which has implications for global security. Estimates of the size of North Korea's most recent test in September 2017 place it between 70 and 280 kilotons of TNT equivalent. For reference, that's five to 20 times stronger than the bomb that was dropped on Hiroshima. In fact, the explosion was so strong that it caused the mountain under which it was detonated to collapse by several meters. We have a variety of tools for gaining knowledge about these events, ranging from satellite imagery to radar and seismograms. These methods give us an idea of North Korea's capabilities,

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but they all have drawbacks. One difficulty common to all of them is uncertainty about geological conditions at the test site. Without a good understanding of the geology, it's difficult to accurately model the explosions and replicate observations. It is even harder to constrain the error associated with those estimates.

Another, less understood phenomenon is the effect of fracture damage at the test site. North Korea has conducted all of its nuclear tests at the same location. Field experiments have shown that such repeat tests dampen the outgoing seismic and infrasound waves, making the explosion appear weaker than it actually is. This happens because the rock that was fractured by the first explosion is more loosely held together and acts like a giant muffler. These processes are poorly understood and contribute to even more uncertainty. Additionally, the author's research and work

by other scientists have shown that many types of rock enhance the production of earthquake-like seismic waves by underground explosions. The more energy from an explosion that gets converted into these earthquake-like waves, the more difficult it becomes to estimate the size of the explosion.

**What Do We Know?** What US officials do know is that North Korea has an active nuclear weapons program, and any such program poses an existential threat to the US and the world at large. Intelligence experts in South Korea and nuclear scientists in the US estimate that North Korea has between 30 and 60 nuclear weapons in reserve, with the ability to produce more in the future. It's still unclear how far North Korea can deliver nuclear weapons. However, their ability to produce plutonium enables them to make small, easily transportable nuclear bombs, which increase the threat.

In the face of such developments, one course of action available to the U.S. that would serve our country's national security interests is to negotiate with North Korea in good faith, but accept nothing less than complete nuclear disarmament on the Korean peninsula. And any such agreement will have to be verified through disclosures and inspections to ensure that North Korea doesn't cheat. That's impossible if US experts don't have an accurate accounting of what the North has achieved so far. The more that Americans negotiator know about Pyongyang's nuclear activities to date, the better prepared they will be to set realistic terms if and when North Korea decides – as other nations have – that its future is brighter without nuclear weapons.

Source: <https://nationalinterest.org>, 04 June 2019.

**OPINION – Miles A. Pomper, Joy Nasr**

### **Why is the Trump Administration So Eager to See a Nuclear Saudi Arabia?**

The Trump administration twice approved the transfer of nuclear technical expertise to

Saudi Arabia after last year's murder of Saudi journalist Jamal Khashoggi, according to new revelations. The disclosures have fueled frustrations in Congress over the administration's apparent eagerness to aid Riyadh and its nuclear ambitions, including repeatedly ignoring and blindsiding lawmakers. The new details only add to questions about the White House's motivations and the implications of a nuclear Saudi Arabia for the Middle East and U.S. national security. In a statement released on 4<sup>th</sup> June, Democratic Sen.

Tim Kaine of Virginia disclosed the timing of the two "Part 810" authorizations, named after the relevant provision in the US Atomic Energy Act. They were among seven such authorizations that the Department of Energy under the Trump administration has granted US companies to discuss potential nuclear reactor designs and blueprints with Saudi Arabia, as they have sought to win a chunk of Riyadh's budding nuclear energy program. Under US law, companies are permitted to block the Department of Energy from publicly disclosing their provision of information to foreign customers in order to keep business secrets confidential. However, the same law states that Congress should be kept fully informed about any US nuclear cooperation with other countries, which lawmakers say the administration has failed to do in this case, raising concerns about potential backroom deals.

Moreover, the revelations come after Trump had ignored congressional objections to a multibillion-dollar arms sales package to Riyadh and to continuing U.S. support for Saudi Arabia's military intervention in Yemen. Amid the authorizations and despite high-level outreach by senior administration officials, including Energy Secretary Rick Perry and Jared Kushner, President Trump's son-in-law, efforts to seal a nuclear cooperation agreement with Riyadh have still fallen short. The impasse contributed to a recent Saudi decision to push back by another year a decision on which foreign supplier it wants to supply its first two nuclear power reactors. But fears of nuclear proliferation, and that Saudi Arabia's nuclear energy bid may aid a covert nuclear weapons program, have not subsided. U.S. law requires the

signing of a bilateral nuclear cooperation agreement with any country prior to the export of nuclear technology—such as reactors, key components and fuel—in order to make sure that the importing country will not use this technology to pursue nuclear weapons or otherwise undermine American security and interests. This provision is referred to as a “123 agreement,” per Section 123 of the U.S. Atomic Energy Act.

Saudi Arabia began pursuing the technology for a nuclear power program in 2011, under then-King Abdullah, initially planning to construct 16 or more reactors that would provide for the kingdom’s energy needs and free up oil supplies for export, as part of a broader economic reform agenda. In 2017, that plan was reduced to two reactors after the Saudis realized that it was too ambitious given the country’s lack of

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pre-existing nuclear expertise and infrastructure. Two developments have really shifted the strategic dimensions of Riyadh’s plans and raised concerns about what the Saudis ultimately want, though: the 2015 international nuclear agreement with Iran to curb its nuclear program, and the rise of Crown Prince Mohammed bin Salman. Saudi Arabia was openly opposed to the Iran deal, which it believed did not do enough to prevent its regional rival from acquiring the fissile material for a nuclear weapon or rein in its support for proxy groups in the Middle East, which poses a challenge to Saudi interests. Since assuming the power behind the throne in Riyadh, Prince Mohammed has led an aggressive Saudi response to Iranian influence in the region, including its ongoing intervention in the war in neighbouring Yemen to counter alleged Iranian proxies. The crown prince has also pledged to acquire a nuclear weapon should Iran do so.

Prince Mohammed’s apparent role in ordering Khashoggi’s murder, among other actions, has heightened existing concerns in Congress and among nuclear experts about the proposed

nuclear cooperation agreement and the consequences of a nuclear Saudi Arabia. Some administration officials have said they would prefer—and some in Congress want them to insist—that Saudi Arabia follow the example of the neighbouring United Arab Emirates, which agreed in its 123 Agreement with the US in 2009 to renounce acquiring the technology for uranium enrichment and spent fuel reprocessing that can produce the fissile material needed for nuclear weapons. US negotiators are also still trying to push a reluctant Riyadh to sign a voluntary additional safeguards agreement with the IAEA, which

provides the agency with greater authority and abilities to detect clandestine nuclear programs. Riyadh’s efforts to acquire American nuclear technology without American non-proliferation restrictions could stoke more tensions in the U.S.-Saudi relationship.

The already faltering negotiations received another serious blow...with allegations by congressional Democrats that some Trump associates—including Michael Flynn, the former national security adviser, and his aides—were seeking to sidestep U.S. non-proliferation restrictions and take advantage of their positions to help a business effort aimed at supplying nuclear reactors and enrichment technology to Saudi Arabia and other Middle Eastern states.

The allegations put forward in February by the House Committee on Oversight and Reform involve a consortium tied to IP3 International, a company founded by retired U.S. government staffers and military generals under the pretext of reviving America’s dying nuclear industry. Flynn worked as an adviser to a subsidiary of IP3, Iron Bridge Group Inc., between June 2016 and December 2016, when he was advising the Trump campaign and then involved in the presidential transition. During Flynn’s time in the transition, followed by his short-lived tenure as national security adviser, his colleagues at IP3 appeared to be using his influence and that of his aides to advance memos and documents



authorizing American investments in the Saudi nuclear project. They called for Jared Kushner to present the proposals “to the President for signature,” without first getting input from relevant U.S. government agencies such as the Departments of State and Energy.

The documents reference conversations with the Trump transition team describing a “Middle East Marshall Plan” to build dozens of nuclear reactors across the region, sidestepping US laws designed to limit nuclear proliferation. Trump had apparently placed Thomas Barrack, a billionaire financier and long-time personal friend, in charge of the plan; Barrack also chaired Trump’s inaugural committee. Barrack has close business ties to Saudi Arabia and has reportedly benefited handsomely from Trump’s presidential campaign and election. Since Trump won the Republican nomination for president, nearly a quarter of the \$7 billion in investments in Barrack’s company has come from contacts in the UAE and Saudi Arabia.

The House Committee’s investigation revealed that during the transition, IP3 had been pressing Barrack and a Flynn aide, Derek Harvey, to get the White House to allow U.S. firms to transfer highly sensitive nuclear technology to Saudi Arabia, while not seeking to block Riyadh from pursuing enrichment technology, either on its own or elsewhere. It also revealed ties between Saudi nuclear power organizations, IP3, Kushner and Brookfield, a Canadian company that in January 2018 bought the bankrupt U.S. nuclear reactor manufacturer Westinghouse, after Barrack had suggested it do so. Then, in August 2018, Brookfield bought out and became the de-facto owner of 666 Fifth Avenue, a heavily indebted building owned by Kushner’s family company, paying for the 99-year lease up front, just in time before the Kushners’ massive debts on the building were due in February 2019.

Also in February, reports emerged of a meeting between Trump and nuclear industry executives,

initiated by IP3, to discuss bids on Saudi Arabia’s nuclear program.

Saudi Arabia has shortlisted the US as one of the five finalists for its two nuclear reactors. But experts believe that U.S companies are unlikely to win the lion’s share of any deal given the conditions that Washington may continue to insist on in any nuclear cooperation agreement, as well as commercial considerations. A more likely partner is South Korea, which is building the UAE’s four reactors and already has a partnership with Saudi Arabia to develop a new generation of smaller reactors. South Korea’s state-run nuclear company has adopted and improved an earlier Westinghouse design to the point where it now claims it is no longer U.S. intellectual property, thus allowing Seoul to export it to a country that does not have a 123 Agreement with Washington. Should Riyadh accept this argument, it may then have a means of acquiring U.S.

technology without U.S. non-proliferation restrictions. But such an approach would not just provoke a commercial challenge from Westinghouse. It would likely further stoke tensions in the already estranged U.S.-Saudi relationship, and between Congress and the White House over the Trump administration’s own cozy ties with Riyadh.

*Source: <https://www.worldpoliticsreview.com>, 05 June 2019.*

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**OPINION – Thomas Karako**

**Distributed Deterrence: The Continuing Utility of ICBMs**

Like its three predecessors, the 2018 Nuclear Posture Review reaffirmed the need for the nuclear triad of bombers, submarine-launched ballistic missiles and intercontinental ballistic missiles. Now comes the hard part. With the authorization and appropriation cycle for fiscal 2020 now underway, the US is moving closer to the coming bow wave of modernization efforts

necessary to recapitalize it. During the post-Cold War period, when the U.S. faced few real challenges to its military superiority, it was easy to be lax on conventional and nuclear modernization alike, first while taking the peace dividend and then later while focused on counterterrorism.

Geopolitical rivalry is back, and with it a renewed need to steward nuclear deterrence — what former Secretary of Defense Ash Carter called the bedrock of American national security. One underappreciated attribute of the triad is the distributed quality provided by land-based ICBMs. The program to replace and modernize the ICBM leg is known as the Ground Based Strategic Deterrent. But GBSD is not just about the missile. The program includes silo refurbishment, ground systems and infrastructure, and nuclear command-and-control improvements that will ensure its viability into the late 21st century. The GBSD modernization program will enhance penetration of enemy missile defenses, improve cyber protection, ease the sustainment and guidance package update process, improve surveillance of the missile fields, permit rapid re-targeting, and perhaps increase the missiles' payloads to accommodate advanced delivery systems in the future. The program is challenged, however, by a daunting bow wave of increased modernization costs, competing Air Force priorities and the production of solid-rocket motors. This suite of improvements is long overdue. Originally designed to last for about 10 years, today's nearly 50-year-old ICBMs are rapidly nearing the end of their service lives, primarily due to aging of their solid-rocket motors.

In the 1950s, the Air Force got into the ICBM business in short order, pulling together a national team to develop and field liquid-fuelled Atlas and Titan missiles in the span of a few years. The development of solid-fuel missiles produced the more reliable and prompt Minuteman family, with two variants in the 1960s and the Minuteman III deployed in 1970. In 1990, there were a total of 1,000 deployed ICBMs, of several types. Today, some 400

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Minuteman III missiles remain, which were first deployed a half century ago but have had their avionics and motors replaced. Since then, a combination of regular testing and aging will result in a shortfall of available ICBMs by the early 2030s. The GBSD program must remain on schedule to prevent that shortfall. The distributed and hardened characteristics of ICBMs creates their quality as a so-called warhead sink. Under

**In 1990, there were a total of 1,000 deployed ICBMs, of several types. Today, some 400 Minuteman III missiles remain, which were first deployed a half century ago but have had their avionics and motors replaced. Since then, a combination of regular testing and aging will result in a shortfall of available ICBMs by the early 2030s. The GBSD program must remain on schedule to prevent that shortfall.**

current assumptions, each of at least 400 silos would require two warheads each. Any adversary would have to expend a considerable portion of their strategic nuclear force to disable them all. Raising the threshold for nuclear attack strengthens deterrence. The ICBM leg served its purpose in the Cold War, but the distributive principle will remain important for the

foreseeable future. A nuclear force without ICBMs would have a very small number of aim points: two bomber bases and a small number of submarines operationally deployed. Nuclear bombers have long been off alert, so on any given day could be concentrated rather than dispersed. America's stealthy nuclear submarines remain the most survivable leg, but the removal of ICBMs would permit adversaries to redirect efforts on

anti-submarine warfare.

Broad technological and strategic developments are making the principle of distribution more salient for nuclear and conventional military operations alike. As the National Defense Strategy notes, US military superiority can no longer be taken for granted. The onetime American monopoly on precision guidance and exquisite intelligence, surveillance and reconnaissance is now over, and the military services have begun to adapt accordingly. Both the Navy's new concept

of Distributed Maritime Operations and the Army's Multi-Domain Operations grapple with the spectre of suppression and overmatch from near peers. Both employ manoeuvre, mobility and distribution to increase the number of aim points and complicate an enemy's surveillance and targeting. Competing both with its service culture and

large bills coming due on other platforms, the Air Force's attention to ICBMs has waxed and waned. Other priorities have included the B-21 bomber, the new tanker, and the F-35. This squeeze may intensify in the coming years as the annual cost of nuclear modernization begins to rise. But there is no time to lose. Although the defense budget process is far from over, a recent markup by House appropriators cut \$118 million from GBSD funding for 2020 — a 20 percent reduction from the budget request. Although the cost for GBSD is substantial, it is lower than the procurement and operational cost for either the nuclear submarines or the bomber.

Another potential obstacle is limitations of the domestic industrial base to build a lot of solid-rocket motors. Assuming things go as planned, the Air Force could next year move onto engineering, manufacturing and development for what is expected to be about 640 multistage missiles. In the defense bill drafts released, the House Armed Services Committee report language once again expressed congressional concerns that

rocket motor production could slow the GBSD program. In its next report to Congress on the matter, the Air Force may wish to consider using a team of suppliers or some kind of a national team in order to meet capacity, rather than a single source.

These challenges can and must be overcome. The stabilizing quality of distributed ICBMs remains critical to nuclear deterrence. Four nuclear posture reviews over 25 years have affirmed and reaffirmed the need for the triad. Although

operated by the Air Force, the contribution of ICBMs to deterrence is a national asset. Congress has been right to question the program's cost and the precarious state of domestic solid-rocket motor production, and other ways to mitigate risk. Given the coming cliff in the early 2030s, it is incumbent upon the Air Force and

congressional representatives to mitigate further delays with the future of ICBMs and the triad as a whole.

Source: <https://www.defensenews.com>, 08 June 2019.

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#### OPINION – Steven Pifer

### Stop the Low-yield Trident Nuclear Warhead

The House Subcommittee on Strategic Forces debated the draft Fiscal Year 2020 National Defense Authorization Act. It voted out, on party lines, language that prohibits deployment of a low-yield warhead on the Trident D5 submarine-launched ballistic missile. That makes sense: The rationale for the warhead is dubious, and the weapon likely would never be selected for use.

The Trump administration's 2018 Nuclear Posture Review called for a low-yield warhead on some Trident D5 SLBMs. The plan modifies a W76-1 warhead, which has an explosive yield of 100 kilotons — seven times the size of the weapon used against Hiroshima — to produce the W76-2,

reportedly with a yield of “just” five-seven kilotons.

Adding this weapon to the arsenal would risk lowering the nuclear threshold. To be sure, Pentagon officials assert that new low-yield weapons would not lower the threshold. Yet the Nuclear Posture Review argued for low-yield weapons out of concern that Russia might feel it could use its “small” nuclear weapons free of concern about U.S. retaliation because the United States arsenal consists mainly of large-yield weapons.

So, at a minimum, the goal of new U.S. low-yield nuclear weapons would appear to be to persuade Moscow that the United States is more likely to go nuclear. It is in the U.S. interest to maintain the highest possible threshold against the use of any nuclear arms. We should avoid steps that might signal, even inadvertently, that the use of “small” nukes is somehow acceptable.

Moreover, the United States already has low-yield weapons and is modernizing them. Next year, serial production of the B61-12 nuclear gravity bomb will begin. That bomb, the result of a program costing \$8-10 billion, supposedly has a variable yield range of 0.3 kilotons to 50 kilotons.

Advocates of placing the W76-2 atop Trident SLBMs argue that the W76-2 could penetrate sophisticated air and missile defenses and reach its targets in minutes rather than hours. That’s true, but the U.S. military already is investing many tens of billions of dollars in the F-35 Joint Strike Fighter and B-21 bomber. Those aircraft are advertised as having stealth and advanced electronic warfare capabilities specifically designed to penetrate and defeat sophisticated air defenses.

As for flight times, there may not be that much difference between minutes and hours for most

non-strategic nuclear missions. That is especially the case in missions for which the primary purpose of delivering a low-yield warhead is to demonstrate U.S. resolve and try to arrest escalation rather than destroy a particular target.

Even if the W76-2 is deployed, would it ever be launched, even in a situation in which nuclear weapons had been used or were on the brink of use? SLBMs on submarines at sea constitute the most important and most survivable leg of the U.S.

strategic triad, because the submarines can hide underwater and have lots of ocean in which to roam. Each submarine at sea carries a significant portion of the survivable U.S. nuclear deterrent.

The problem with launching an SLBM with a W76-2 is that it would reveal the submarine’s location. The submarine could maneuver away from the launch point,

but it still would have compromised its general position, putting at risk the boat and the other 80-90 warheads it carried. Would the U.S. military run that risk, particularly given the availability of other low-yield options?

A bigger problem is discrimination. The Russians could not tell whether a launched SLBM carried a W76-2 or a W76-1 (100 kilotons) or, for that matter, a W88 (450 kilotons) until the weapon (or weapons) detonated. The circumstances in which Washington might consider using a low-yield nuclear weapon against Russia or Russian military forces almost certainly would result from escalation of a conventional conflict. By far the most likely location for U.S.-Russia conventional conflict is the Baltic region in Europe.

Assume a conventional NATO-Russia conflict in the Baltics, and Russia escalates by using a few “small” nuclear weapons. A decision to respond with a W76-2 would mean launching an SLBM from the Atlantic Ocean. The problem is that a launch from many parts of the Atlantic toward the Baltics

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would also appear, at least initially, to be a launch against Moscow. Would the U.S. leadership launch a W76-2 — and run the risk that the Russians misread it as larger warhead intended to flatten Moscow in a decapitation strike — when F-35s and B61-12 bombs are available in Europe (as they will be in the early 2020s)?

The W76-2 makes little strategic sense, could inadvertently lower the nuclear threshold and likely would never be used, even in the most dire circumstances. The Trump administration made a mistake by deciding to produce it. Congress should use the 2020 National Defense Authorization Act to correct that mistake and prohibit its deployment.

Source: <https://thehill.com>, 08 June 2019.

**OPINION – Chris Bryant**

**Germany is Wrong about Nuclear Power**

Herbert Diess is no stranger to controversy, some of it inexcusable. With a strongly-worded critique of German climate policy, the Volkswagen AG boss has provoked yet another row. This time, though, he is spot on.

“If we’re really serious about climate protection, the nuclear power plants should run for longer,” Diess told Tagesspiegel when asked about chancellor Angela Merkel’s decision after the Fukushima disaster to shut down her country’s nuclear fleet by 2022. Closing Germany’s last coal-fired power plant in 2038 – as decided in January by a government-appointed commission – is “far too late,” Diess said. We “should have quit coal first and then nuclear.”

It takes some nerve for VW to lecture the German government about environmental policy. The carmaker’s cheating on diesel emissions exposed millions of city dwellers to toxic fumes. By

promoting gas-guzzling sports utility vehicles instead of smaller models, VW has also made the carbon pollution problem worse. Its cars and trucks are responsible for a staggering 2% of the world’s total carbon dioxide emissions, the company concedes. Still, Diess’s frustration over nuclear

power is understandable; by privileging coal, Germany has picked the wrong poison.

A belated convert to electric vehicles, VW now plans to launch 70 of these models in the next 10 ten years so that e-cars comprise at least 40 percent of its sales. These huge investments won’t benefit the climate much if drivers in Germany or elsewhere recharge their

vehicles using electricity generated by coal power.

Yet that seems likely to happen. With only seven nuclear reactors still operating in Germany, down from 17 in 2011, atomic power there seems to be in terminal decline. While renewable energy (helped by vast state subsidies) has taken up the carbon-containing slack, solar and wind installations have slowed lately because of regulatory changes and local opposition. Coal and lignite still make up a frightening 35% of Germany’s electricity mix. Hence the country is a long way from reaching its climate goals, something that’s been noted by France’s president Emmanuel Macron as he ponders how quickly to mothball his own country’s reactors.

Germany’s nuclear shutdowns might please the electorate but they’re boneheaded from a climate perspective. If advanced economies continue to turn their backs on atomic power and partly fill the gap with fossil fuels, they risk billions of tonnes of additional carbon dioxide emissions, the International Energy Agency warned. Nuclear provides about 10 percent of global electricity generation, but the IEA worries that two-thirds of that could be lost by 2040 as reactors age and wholesale electricity prices fall.

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The agency wants instead to keep existing nuclear plants operating for as long as possible and it says the capital investments required to achieve that can be competitive when compared to other new clean energy sources. Electricity markets would, however, need to be redesigned to recognize nuclear's contribution to environmental and energy security. The UN Intergovernmental Panel on Climate Change also seems to be coming around to the idea of a role for nuclear.

Echoing Diess, Wolfgang Reitzle, the chairman of car parts supplier Continental AG, has spoken out in favor of extending the lifespan of Germany's nuclear plants. But their views aren't widely shared at home.

Fastening products billionaire Reinhold Wuerth told Bild that the speed of the nuclear exit was "a mistake" and a comeback of nuclear should be "an option."

Germany's anti-nuclear movement dates back decades and public opposition increased after the Chernobyl disaster, the horrors of which HBO has recently revisited. Car bumper stickers that declare "Nuclear power, no thanks!" are still a common sight in Berlin's otherwise climate-friendly hipster neighborhoods. When a YouTube rant criticizing Merkel's Christian Democrats went viral recently, the party tried to push back by highlighting its role in closing the country's atomic plants.

In theory, it's not too late for Germany to change its mind on nuclear power, but Diess must know the chances are slim. The coalition government is fragile and the political desire to revisit such an emotionally charged topic must be verging on zero. His decision to speak out anyway is admirable.

Source: <https://www.bloomberg.com>, 04 June 2019.

NUCLEAR STRATEGY

RUSSIA

**Russia is Testing Nuclear Weapons at Remote Arctic Bases Despite Global Ban, US Claims**

A senior U.S. intelligence official has warned that Russia is likely conducting secret nuclear weapon tests at remote Arctic sites as it works to modernize its atomic arsenal, despite an international treaty prohibiting such activities. Lieutenant General Robert Ashley, the director of the U.S. Defense Intelligence Agency, made the claim in a speech given at the Hudson Institute think tank in Washington, D.C., *The Wall Street Journal* reported. He said the U.S. believes that Russia is carrying out low-yield testing at Novaya Zemlya—a secluded archipelago above the Arctic Circle where the USSR often tested nuclear weapons. Ashley's comments mark the first time the U.S. has publicly accused Russia of violating the CTBT ratified by Russia

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in 2000, which prohibits any tests that create a nuclear yield.

"The United States believes that Russia probably is not adhering to its nuclear-testing moratorium in a manner consistent with the 'zero-yield' standard," Ashley told the audience. He added, "Our understanding of nuclear weapon development leads us to believe Russia's testing activities would help it to improve its nuclear weapons capabilities. The United States, by contrast, has forgone such benefits by upholding a 'zero-yield' standard." Ashley did not specify how large the suspected tests have been, simply stating, "We believe they have the capability to do it, the way that they're set up." Low-yield testing may only involve a very small amount of explosive power, though the production of any nuclear yield at all would contravene the treaty.

... There has not yet been an official response from the Russian government in Moscow. The country's Permanent Representative to International

Organizations in Vienna, Mikhail Ulyanov, said Russia "voluntarily and unilaterally established a moratorium on nuclear tests since the end of the 1980s. We are observing it," state news agency Tass reported. Noting that Ashley presented no evidence to support his claim, Ulyanov pointed out that Washington never ratified the treaty. ...Vladimir Shamanov, who is the head of the Russian State Duma Defence Committee, told the Interfax news agency that Ashley "could not have made a more irresponsible statement," according to ABC. "Nuclear tests cannot be carried out secretly," Shamanov added, suggesting claims to the contrary "reveal that the professionalism of the military is systemically falling in America."

*Source: David Brennan, Newsweek, 30 May 2019.*

## **USA**

### **US Air Force B-2 Stealth Bomber to Get New Nuclear Weapon this Year**

New weapons and technologies arming the Air Force's stealthy B-2 bombers are expected to bring "massive firepower to even the most heavily-defended targets," according to an official service acquisition report. Specific adjustments, as outlined by the report, include the expected delivery of a new "earth-penetrating" upgraded B-61 mod 12 nuclear bomb for the aircraft - to arrive as soon as this year. Secondly, the stealth bomber is now being integrated with a new suite of on-board technologies to include improved sensors, avionics, intelligence and targeting, according to the Air Force 2018 Annual Acquisition Report.

The new avionics and targeting suite, called the Defense Management System (DMS), brings the aircraft an entirely new generation of technologies enabling the aircraft to elude enemy attacks and air-defense. The DMS detects signals or "signatures" emitting from ground-based anti-aircraft weapons, Air Force officials have said. Current improvements to the technology are

described by Air Force developers as "the most extensive modification effort that the B-2 has attempted."

The first eight modified B-2s are slated to arrive in June, 2022, the service report states. The modernized system, called a B-2 "DMS-M" unit, consists of a replacement of legacy DMS subsystems so that the aircraft can be effective against the newest and most lethal enemy air defenses.

Upgrades consist of improved antennas with advanced digital electronic support measures, or ESMs along with software components designed to integrate new technologies with existing B-2 avionics, according to an Operational Test & Evaluation report from the Office of the Secretary of Defense. The Air Force acquisition report aligns closely with these assessments, stating that

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the DMS "upgrades the threat warning systems on board by replacing aging antennas, electronics, display system and an autorouter."

The autorouter introduces what could easily be referred to as a transformative technology for several key reasons; the report describes the autoloader as something which "which automates the re-planning of aircraft missions in flight." This brings several key implications.... Increased automation lessens what's often referred to as the "cognitive burden" for pilots. This frees up pilots to focus on pressing combat variables because computer automation is performing certain key procedural functions. Secondly, by allowing for "re-planning of aircraft missions in flight," the autorouter brings a sizeable intelligence advantage. Instead of relying upon pre-determined target information, on-board intelligence can help pilots adjust attack missions as targets change and/or relocate while in flight. Much of these improvements can be attributed to an ongoing effort to implement a new computer processor into the B-2, a system reported by Air Force

developers to be 1,000 times faster than the existing system. Also, given the pace of emerging electronic warfare threats, it is indeed quite significant that the new DMS technical adjustments will increase the aircraft's ability to "avoid electronic threats."

Overall, it would not be an exaggeration to describe this technological upgrade as transformative, something that will propel the B-2's ability to attack in high-threat environments for decades. This is extremely important for several reasons. The B-2 is expected to remain operational for many years as the new B-21 bombers progressively arrive. Secondly, these kinds of upgrades will give the B-2 a much greater ability to fight against and/or elude the most modern air defenses. Much is being made of new, long-range, networked Russian-built air defenses reportedly able to operate on a larger scope of frequencies, leverage digital networking and draw upon improved computer processing speeds — supposedly bringing the technology sufficient to hold even stealth bombers at risk.

Now it is not yet proven, of course, that these systems could actually "hit" a stealth aircraft, they definitely change the threat calculus. For instance, even if a stealth aircraft is detected in some way, that does not mean advanced air defenses can complete the "kill chain" and succeed in destroying the aircraft. ...

The Air Force report says the B-2 will be armed with a new B61-12 nuclear weapon by as soon as August of this year. The B61-12 adds substantial new levels of precision targeting and consolidates several different kinds of attack options into a single weapon. Instead of needing separate variants of the weapon for different functions, the B61-12 by itself allows for earth-penetrating attacks, low-yield strikes, high-yield attacks, above

surface detonation and bunker-buster options. Air Force officials described the B61-12 as having an "All Up Round."

The latest version of the B61 thermonuclear gravity bomb, which has origins as far back as the 1960s, is engineered as a low-to-medium yield strategic and tactical nuclear weapon, according to nuclearweaponsarchive.org, which also states the weapon has a "two-stage" radiation implosion design. The joint program completed developmental testing on June 20, 2018, and successfully conducted all 31 developmental flight test events. The B61-12 transitioned from the engineering and manufacturing development phase to the production phase October 26, 2018.

The evidence that the B61-12 can penetrate below the surface has significant implications for the types of targets that can be held at risk with the bomb. By bringing an "earth-penetrating" component, the B61-12 vastly increases the target scope or envelope of attack. It can enable more narrowly targeted or pinpointed strikes at high-value targets underground — without causing anywhere near the same level of devastation above ground or across a wider area.

Source: Kris Osborn, <https://nationalinterest.org>, 09 June 2019.

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## **BALLISTIC MISSILE DEFENCE**

### **INDIA-USA**

#### **US ... Offers Missile Defence Systems; India Yet to Respond to Offer**

The Trump administration has approved the sale of armed drones to India and has offered integrated air and missile defence systems aimed at helping the country boost its military capabilities and protect shared security interests



in the strategically important Indo-Pacific region. The approval-cum-offer from the US came in the aftermath of the February 14 Pulwama terrorist attack in which 40 Indian soldiers were killed and the increasing militarisation and assertiveness of China in the Indo-Pacific ocean. According to the officials, the Trump administration is ready to offer its best defence technologies to India. ...

While the deal is yet to see the light of the day, mainly because of the delay in decision-making process by India in view of the general elections, the US in recent months informed New Delhi about its decision to sell armed version of the Guardian drones. The ball is now in India's court, a defence industry source told PTI. The deal, if it happens, could be in the range of over \$2.5 billion, the industry source said. Close on the heels of armed drones, which will have its implications in South Asia and Indo-Pacific region, the US has also offered its integrated defence missile capabilities to India. While officials are tight-lipped about it, the offer is said to be about two of its latest systems: THAAD, which is highly effective when used against long-range ballistic missiles and Patriot Missile defense system. India, which has already signed an agreement with Russia to purchase S-400 missile defence system, is yet to respond to the American offer. The American offer, which came of its own, is currently being studied in New Delhi...

In a fact sheet on "US Security Cooperation with India" issued, the State Department joined the White House in trying to help strengthen its defence capabilities mainly due to the Indo-Pacific

region. ... Some of the recent top defence sales to India include: MH-60R Seahawk helicopters (USD 2.6 billion), Apache helicopters (USD 2.3 billion), P-8I maritime patrol aircraft (USD 3 billion), and M777 howitzers (USD 737 million). The State Department is also pushing for Lockheed Martin F-21 and Boeing F-18/A, two state-of-the-art fighter aircraft that India is currently evaluating.

"These platforms provide critical opportunities to enhance India's military capabilities and protect shared security interests in the Indo-Pacific region," the State Department fact sheet said. ...

Source: <https://www.news18.com>, 08 June 2019.

#### **SAUDI ARABIA**

#### **Saudi Arabia Secretly Purchased Ballistic Missile**

#### **Technology from China: Report**

Saudi Arabia has "significantly" expanded its ballistic missile programme through recent purchases from China, CNN reported on 5<sup>th</sup> June. The purchases expanded both its missile infrastructure and technology, the news agency said, citing three unidentified sources with direct knowledge of the matter. Key Congressional Democrats discovered the weapons expansion programme outside of "regular US government channels"....

The legislators told the news agency they concluded the Trump administration had knowledge of the weapons deal and deliberately left Congress out of a series of meetings where they would have been briefed on the purchases. While Saudi Arabia is the US's top

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**Congress out of a series of meetings where they would have been briefed on the purchases. While Saudi Arabia is the US's top arms buyer, it is barred from purchasing ballistic missiles from Washington under a 1987 regulation that prevents the sale of rockets capable of carrying weapons of mass destruction. The purchases are particularly worrying to a Congress that has been attempting to limit Saudi Arabia's weapons capabilities for months, amid growing concerns over the devastating Saudi-led war in Yemen.**

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On 5<sup>th</sup> June, key US senators from both major parties introduced 22 separate resolutions in an attempt to block arms sales to Saudi Arabia and the United Arab Emirates. The resolutions aim to stop the \$8bn sale of weapons to Saudi Arabia, pushed through by the Trump administration without congressional oversight in May 2019. The sale was pushed through by US Secretary of State Mike Pompeo, who declared a state of emergency on 24 May, citing tensions with Iran as a means to strip Congress of its authority to halt the sales. Since the murder of journalist Jamal Khashoggi at the hands of Saudi government agents last year, Congress has passed a series of measures to denounce Crown Prince Mohammed bin Salman in defiance of US President Trump. Congress also passed a resolution that aimed to end Washington's support for Saudi-led coalition forces in Yemen, but Trump vetoed that measure.

Source: <https://www.middleeasteye.net>, 05 June 2019.

### NUCLEAR ENERGY

#### GENERAL

#### **Nuclear Newcomers: Getting Organized for Success**

Coordination among stakeholders is key for any complex undertaking. Introducing nuclear power is no different. The IAEA has recently issued a publication that can help nuclear newcomer countries set up and maintain an effective coordination mechanism, referred to as a nuclear energy programme implementing organization (NEPIO). A NEPIO is an important element of the IAEA Milestones Approach, an internationally accepted, comprehensive framework for nuclear power programme development. *Responsibilities*

*and Functions of a Nuclear Energy Programme Implementing Organization*, published in the IAEA Nuclear Energy Series (No. NG-T-3.6 (Rev. 1)), describes a set of practical and detailed responsibilities, functions and activities that national authorities can use as guidance. This publication, which represents a significant revision of a document first issued in 2009, takes into account nearly 10 years of experience and good practices of countries that are introducing or have recently introduced nuclear power, as well as lessons learned during Integrated Nuclear Infrastructure Review (INIR) missions and IAEA technical assistance activities to newcomer countries.

"There are many ways to structure a NEPIO and several could result in the successful execution of all functions and activities," explained Sean Dunlop of the Nuclear Infrastructure Development Section, who was responsible for this publication. "The 2009 publication focused on a single approach: it assumed that a NEPIO would be a new organization established specifically to manage the nuclear power programme, and we see this working well in some cases. In other embarking countries the government's responsibilities and functions are discharged effectively by interagency policy committees and working groups rather than a single, stand-alone organization." In addition to describing a NEPIO's responsibilities and functions, this revision defines the specific activities NEPIOs may carry out in relation to each of 19 infrastructure issues, ranging from a government's national position on nuclear power to the procurement of items and services for the first nuclear power plant, during each phase of development. The new publication recognizes that the NEPIO plays an important and evolving role in each of the three phases of nuclear power infrastructure development.

**Case Studies:** Several countries in various phases of their nuclear power programme development contributed case studies, sharing their experiences, good practices and lessons learned in the establishment and organization of their national NEPIOs. For example, the Kenya Nuclear Electricity Board (KNEB) serves as Kenya's NEPIO.

It is responsible for coordinating all aspects of Kenya's nuclear power programme. Progressively, other institutions will be established, or existing institutions appointed to take up specific roles in the programme as it advances. Most importantly, these include the nuclear regulatory body and the future owner/operator of the nuclear power plant.

**First issued in 2007 and revised in 2015, the IAEA Milestones Approach supports countries in creating an enabling environment for a successful nuclear power project and to understand, and prepare for, the associated commitments and obligations. This result-oriented approach comprises three phases (consider, prepare, construct), three milestones (decide, contract, commission) and 19 infrastructure issues to be addressed in each phase.**

development and stakeholder involvement. Over the past decade, the Milestones Approach has become a reference for Member States starting or expanding their nuclear power programmes. The Milestones Approach and supporting documents are widely used, and its framework and terminology have been broadly accepted.

Belarus is currently completing the construction and preparing for the operation of its first nuclear power plant. As is the case in several embarking countries, Belarus' NEPIO is organized on two levels. A high-level Inter-departmental Commission for Nuclear Power Plant Construction, headed by the Deputy Prime Minister, meets monthly to discuss major issues and monitor programme implementation. The Nuclear Energy Department of the Ministry of Energy coordinates day-to-day issues and also focuses on the development and implementation of programmes related to the long term sustainability of the nuclear power programme.

Source: <https://www.iaea.org>, 04 June 2019.

## GERMANY

### Germany Faces Growing Calls to Delay Phase-out of Nuclear Energy

Angela Merkel's government is facing growing calls from business leaders to postpone plans to phase out nuclear power in Germany in order to protect the environment. The chief executive of Volkswagen and the chairman Continental AG, a leading car parts manufacturer, are among those to speak out in recent weeks. They have seized on the climate movement of 2019 as an

opportunity to argue in favour of nuclear energy, and warn shutting down Germany's last reactors could leave the country reliant on highly pollutant brown coal. Mrs Merkel pledged to shut down all of Germany's nuclear reactors by 2022 in the wake of a public outcry following the 2011 Fukushima disaster in Japan. But critics say it was too ambitious to switch to renewable energy and phase out nuclear power at the same time. With

renewables unable to make up the shortfall, Germany has been forced to turn to coal.

Germany is among world leaders in developing renewable energy, and currently generates 47 per

### **IAEA Milestones Approach:**

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**Germany is among world leaders in developing renewable energy, and currently generates 47 per cent of its energy from renewable sources. But it also generates 30 per cent from coal, and experts warn renewable sources are not yet ready to replace the 13 per cent currently generated by nuclear power. To make matters worse, much of the country's coal production is of brown coal, or lignite, which is cheaper to mine than traditional hard coal but more pollutant.**

cent of its energy from renewable sources. But it also generates 30 per cent from coal, and experts warn renewable sources are not yet ready to replace the 13 per cent currently generated by nuclear power. To make matters worse, much of the country's coal production is of brown coal, or lignite, which is cheaper to mine than traditional hard coal but more pollutant. ...

"Anyone who is in favour of low-carbon energy generation and guaranteed energy supply security cannot avoid nuclear energy," Klaus-Peter Willsch, an MP from Mrs Merkel's Christian Democrat party (CDU), told Bild newspaper. "In terms of climate protection, nuclear energy is the cleanest way of generating energy." But the German Green Party, which made sweeping gains in the European elections and recently overtook Mrs Merkel's party to take first place in the German opinion polls, remains implacably opposed. ...

Source: <https://www.telegraph.co.uk>, 06 June 2019.

## **INDIA**

### **BHEL Secures Kudankulam Contract**

The Russian-designed AES-92 VVER reactors are being built with Russian technical assistance as the first stage of phase 2 at the site in Tamil Nadu, which is already home to two operating AES-92 units. BHEL performed a similar role at Kudankulam 1 and 2, which the company says "showcased" its capability in installing equipment designed and supplied by other manufacturers. The turbines for the first two Kudankulam units were made by Silmash in St Petersburg.

Twelve out of India's 18 operating pressurised heavy water reactors have steam turbine generator sets supplied by BHEL, the company said. It is also currently executing turbine generator packages for four 700 MWe Indian-designed PHWR units that are currently under construction, two each at Kakrapar and Rawatbhata (Rajasthan). "BHEL has dedicated

infrastructure and skilled manpower to address the special design, manufacturing and testing requirements complying with international codes and standards for various components/equipment of nuclear power plants," BHEL said.

Construction of Kudankulam 3 formally began in June 2017 with unit 4 following in October that year. The units are scheduled to enter commercial operation in 2025 and 2026, respectively. Kudankulam 1 and 2, also AES-92 units supplied by Rosatom subsidiary Atomstroyexport, were built by NPCIL and commissioned and operated by

NPCIL under International Atomic Energy Agency safeguards. Kudankulam 1 entered commercial operation in December 2014 and unit 2 in April 2017.

Source: *World Nuclear News*, 11 June 2019.

### **Fuelling Change at Kudankulam Nuclear Plant**

**The two 1,000 MW units, which are currently operational, are being readied to take in next-generation nuclear fuel, which offers higher uranium capacity, fuel burn-up and enhanced operational safety, besides reducing the quantum of spent fuel or nuclear waste. If things pan out as planned, the units will be operating on the advanced fuel variant from 2021.**

The KKNPP will be undergoing a significant shift. The two 1,000 MW units, which are currently operational, are being readied to take in next-generation nuclear fuel, which offers higher uranium capacity, fuel burn-up and enhanced operational safety, besides reducing the quantum of spent fuel or nuclear waste. If things pan out as planned, the units will be operating on the advanced fuel variant from 2021, reliable sources in DAE told Express. The new nuclear fuel is called TVS-2M, developed by Russia's TVEL Fuel Company, a subsidiary of Rosatom State Atomic Energy Corporation, which happens to be the technical consultant and main equipment supplier for the KKNPP.

In fact, during the 11th International Forum ATOMEXPO-2019 held in Moscow, Russia, in April this year, Rosatom officials had openly aired the requirement for change in fuel variant for Kudankulam reactors, to improve the technical and economic performance of the plant. The expo was attended by DAE Secretary Kamlesh Nilkanth Vyas.

Oleg Grigoriev, Senior Vice President for Commerce and International Business of TVEL (Rosatom), had said, "We are currently working

with Indian colleagues on finalising the agreement for supplying nuclear fuel for units 3 and 4 of KKNPP. Our main work focuses on introducing new nuclear fuel TVS-2M for Kudankulam units that are operational. We are working very closely and productively on that. All works are on schedule. Simultaneously, we are working to make Kudankulam NPP-ready for the new nuclear fuel by 2021," he had said.

... DAE officials confirmed that introducing the new variant is on the cards. "Compared to UTVS fuel assemblies, TVS-2M, specifically designed for Kudankulam VVER-1000 type reactors, has a proven history of improving power plant operation, as well as the ability to reduce the amount of spent nuclear fuel. The TVS-2M also allows the option of shifting the operations from 12-month to an 18-month fuel cycle" sources said.

To a query, DAE sources said there was no need for any major structural changes in the plant's design components for having new nuclear fuel, which would have mandated fresh approvals from AERB. Shift to advanced fuel assemblies will also reduce the amount of spent nuclear fuel, the storage of which is becoming a major cause of concern. The unit-1 of KKNPP has been operational from 2014 and unit-2 from 2016. The spent fuel or nuclear waste is currently kept within the power plant in what is called Spent Fuel Pool (SFP). Only now, NPCIL has shown the intent to construct 'Away from Reactor' (AFR) spent fuel storage facility in Kudankulam and public hearing will be conducted by Tamil Nadu Pollution Board (TNPCB) on July 10.

However, there is still a long way to go before India's first AFR becomes operational. Though

Supreme Court has extended the deadline till April 30, 2022, NPCIL may miss the deadline once again, considering the fact there are several clearances that are yet to be obtained, including environment clearance from Union Environment Ministry, sitting clearance from AERB etc. NPCIL is already lagging behind, even going by the revised schedule, a copy of which is available with Express, submitted before the Supreme Court.

**Compared to UTVS fuel assemblies, TVS-2M, specifically designed for Kudankulam VVER-1000 type reactors, has a proven history of improving power plant operation, as well as the ability to reduce the amount of spent nuclear fuel. The TVS-2M also allows the option of shifting the operations from 12-month to an 18-month fuel cycle.**

**Concerns over Storage Space:** The concern is there is no information on how much of storage space is available in the Spent Fuel Pool. As per official records, Refuelling cycle of KKNPP reactors is usually 12 months, with 300 Effective Full Power Days of power operation and around 60 days for Refuelling Shut Down (RSD) needed. Reactor core consists of 163 Fuel Assemblies (FA), out of which 48 or 49 FAs are discharged from core to Fuel Pool (FP) during RSD and are replaced by similar number of new FAs.

**There is still a long way to go before India's first AFR becomes operational. Though Supreme Court has extended the deadline till April 30, 2022, NPCIL may miss the deadline once again, considering the fact there are several clearances that are yet to be obtained, including environment clearance from Union Environment Ministry, sitting clearance from AERB etc.**

Spent Fuel Assemblies at KKNPP are stored in a fuel pool located inside the primary containment of the reactor building. The fuel pool is divided into two compartments for spent fuel storage and also has a separate compartment for loading of a cask for spent

fuel and new fuel. The total capacity of fuel pool is 565 cells for spent fuel assemblies and 64 cells for sealed cans for storing defective fuel assemblies. This storage capacity of spent fuel pool is sufficient to store spent nuclear fuel generated up to 7 years of reactor operation and one complete core unloading. After 8 years of reactor operation, spent fuel from fuel pool will have to be removed and stored at AFR.

Source: SV Krishna Chaitanya, <http://www.newindianexpress.com>, 09 June 2019.

**JAPAN**

**Japan Plans Carbon Emission Cuts, More Nuclear Energy**

Japan is calling for further efforts to cut its carbon emissions by promoting renewable energy while also pushing nuclear power despite its 2011 Fukushima nuclear plant disaster. An energy policy paper, adopted by the cabinet, said Japan faces the urgent task of reducing carbon emissions by utilities that rely heavily on fossil fuel plants to make up for shortages of cleaner nuclear energy. The call comes as nuclear reactors around Japan are slowly being restarted — despite lingering anti-nuclear sentiment since the Fukushima crisis — after being shut down to meet tougher safety standards.

Japan wants renewable energy's share in 2030 to grow to 22-24% of the country's power supply from 16%, while pushing nuclear energy to 20-22% from just 3% in 2017. The report said the cost of renewables also needs to be reduced.

Japanese utilities rely more heavily on fossil fuel plants than those in the U.S. and Europe, the paper said. Coal and natural gas accounted for 74% of Japan's energy supply. Nuclear energy made up about one-third of Japan's energy supply before 2011, when a massive earthquake and tsunami destroyed the Fukushima Daiichi nuclear plant's cooling systems, sending three of its reactors into meltdowns.

Despite the government's renewed ambitions for nuclear power, reactor restarts are proceeding slowly as nuclear regulators spend more time on inspections under the stricter post-Fukushima

standards, while utility companies have opted to scrap aged reactors instead of investing in additional safety measures. Nearly half of the 54 reactors in Japan have been designated for decommissioning, and only nine have resumed

operation since the accident. The slow reactor restarts have added to Japan's large plutonium stockpile from spent fuel. Japan has resorted to reducing the 47-ton stockpile by burning plutonium in conventional reactors after the country's fuel recycling program stalled. The plutonium is currently enough to produce about 6,000 atomic bombs. But the amount is not decreasing, and experts are now calling for more drastic steps to reduce the stockpile amid criticism that it makes Tokyo's calls for nuclear non-proliferation less credible. About 37 tons of spent Japanese fuel is being stored in France and Britain where it has been reprocessed since Japan lacks the capability to do it at home. Japan's main reprocessing plant at Rokkasho, where plutonium and spent fuel are stored but reprocessing has not started, says the 10 tons stored in Japan is under close monitoring by the IAEA and there is no risk of proliferation. ...

**An energy policy paper, adopted by the cabinet, said Japan faces the urgent task of reducing carbon emissions by utilities that rely heavily on fossil fuel plants to make up for shortages of cleaner nuclear energy. The call comes as nuclear reactors around Japan are slowly being restarted — despite lingering anti-nuclear sentiment since the Fukushima crisis — after being shut down to meet tougher safety standards.**

**Three projects in three states will receive a total of approximately \$11 million in funding under cost-sharing arrangements. This is the latest round of funding through the Office of Nuclear Energy's (NE) funding opportunity announcement (FOA), US Industry Opportunities for Advanced Nuclear Technology Development. Previous rounds were announced in April, July and November 2018 and in March 2019. The total of the five rounds of awards is approximately \$128 million.**

Source: Mari Yamaguchi, <https://japantoday.com>, 08 June 2019.

**USA**

**More US Funding for Advanced Nuclear Technology**

The US Department of Energy (DOE) on 24 May announced further funding for advanced nuclear technology projects. Three projects in three states will receive a total of approximately \$11 million in funding under cost-sharing arrangements. This is the latest round of funding through the Office of

Nuclear Energy's (NE) funding opportunity announcement (FOA), US Industry Opportunities for Advanced Nuclear Technology Development. Previous rounds were announced in April, July and November 2018 and in March 2019. The total of the five rounds of awards is approximately \$128 million.

Subsequent quarterly application review and selection processes will be conducted over the next four years. The funding follows three pathways: First-of-a-Kind (FOAK) Nuclear Demonstration Readiness Project pathway, addressing major advanced reactor design development projects or complex technology advancements for existing plants which have significant technical and licensing risk and have the potential to be deployed by the mid-to-late 2020s; Advanced Reactor Development Projects pathway, for proposed concepts and ideas that are best suited to improving the capabilities and commercialisation potential of advanced reactor designs and technologies; Regulatory Assistance Grants pathway, providing direct support for resolving design regulatory issues for advanced reactor designs and capabilities. The two projects selected under the Advanced Reactor Development Projects pathway include:

- Advanced Remote Monitoring (DOE Funding: \$9,183,255; Non-DOE: \$4,081,445). Utilities Service Alliance will research, develop, and deploy automation and advanced remote monitoring technology into the US nuclear fleet to achieve economic viability while maintaining or improving safety and reliability.
- STPNOC FIRE PRA 2019 (DOE Funding: \$942,477; Non-DOE: \$235,619). STP Nuclear Operating Company is to develop and implement advanced Fire PRA modelling techniques that will remove existing conservatism and lead to realistic models to be used in the nuclear industry.

One project was selected under the Regulatory Assistance Grant pathway:

- Software Verification and Validation Guidelines for Nonlinear Soil-Structure Interaction Analysis to Enable Cost-Effective Advanced Reactor Design (DOE Funding: \$470,483; Non-DOE: \$117,621). SC Solutions will develop a

nonlinear soil-structure interaction analysis software verification and validation guidance document as a critical tool to facilitate cost reductions in nuclear plant licensing and construction.

*Source: <https://www.neimagazine.com>, 28 May 2019.*

## **NUCLEAR COOPERATION**

### **CHINA-RUSSIA**

#### **Russia, China ink Deal for Chinese Nuclear Plant**

Russia's Rosatom and China National Nuclear Corporation (CNNC) have signed a contract to build power units 3 and 4 at the Chinese nuclear power plant of Godabu. The agreement states that Rosatom will supply them with the latest Russian-designed VVER-1200 reactors. The contract was signed by representatives of the Engineering Department at Rosatom and the CNNC.

"We are starting the practical implementation of a new Russian nuclear power plant project with a Russian design in a new location, taking into consideration the contract signed in advance for China's Tianwan nuclear plant, as the company will be building four energy units of the third developed generation until 2028," said Alexei Lekachev, CEO of Rosatom.

The general contract for the construction of Russian-designed power units No. 7 and No. 8 based on VVER-1200 reactor technology at Tianwan NPP was signed earlier in March 2019. Xudapu NPP units No. 3 and No. 4 power start-ups are scheduled for 2027 and 2028, respectively.

As for the Tianwan NPP, the power start-up of unit No. 7 is scheduled for 2026 while unit No. 8 power start-up is planned for 2027. Noncontracts formulation was held in line with a strategic package of agreements defining key areas for development of cooperation between Russia and China in nuclear energy sector for the coming decades. The strategic package of agreements was signed on June 8, 2018, during Russian President Vladimir Putin's state visit to China.

*Source: <https://www.esi-africa.com>, 12 June 2019.*

URANIUM PRODUCTION

MAURITANIA

Mauritania to Join List of Uranium

Mauritania will enter the limited list of uranium producing countries in 2020 following the promising findings of the Australian mining company Aura Energy in the Tiris Zemmour mine. "The production of yellowcake is a true milestone for Aura Energy's push to achieve producer status. To achieve yellowcake production from our site in the Sahara Desert has required commitment and stamina from our dedicated technical team." Yellowcake (also called urania) is a type of uranium concentrate powder obtained from leach solutions, in an intermediate step in the processing of uranium ores. The company said the mine offers promising prospects for commerciable uranium, which will enhance the finances of the sparsely populated and poor West African country.

Aura Energy was granted an exploitation license for its Tiris uranium project in Mauritania in 2018. It's extensive mineral resources include iron ore, gold, copper, gypsum, and phosphate rock. In addition to uranium, exploration is ongoing for tantalum crude oil, and natural gas. Mauritania's economy is dominated by extractive industries (oil and mines), fisheries, livestock, agriculture, and services. Half the population still depends on farming and raising livestock. Extractive commodities make up about three-quarters of Mauritania's total exports, subjecting the economy to price swings in world commodity markets.

Source: <http://northafricapost.com>, 03 June 2019.

NUCLEAR NON-PROLIFERATION

GENERAL

NPT Signatories Must Return Nuclear Weapons to their Land – Russian, Chinese Leaders

Russia and China have called on all member states

of the NPT to return all nuclear weapons kept abroad to their territory, reads a joint statement by Russian President Putin and Chinese President Jinping on the outcomes of their talks in Moscow. "The sides find the irresponsible approach of some states to fulfilling their obligations under the NPT unacceptable," the statement says. "These states must abandon the practice of 'joint nuclear missions' and return all nuclear weapons placed outside the borders of nuclear states back to their national territory."

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Moscow and Beijing also expressed support for the CTBT, stressing its importance to global security. "Russia and China think that the US' statements on refusing to ratify the CTBT and preparing the test site for holding nuclear tests deal a serious blow to the CTBT. The sides continue to apply all possible efforts in order

for the CTBT to come into force as soon as possible," the document informs. According to the Russian and Chinese leaders, arms control is a key element of ensuring international security and stability. "The central role in the process of arms control belongs to the UN and its multilateral disarmament mechanism," the statement stresses. "The sides support the expansion of collective efforts in favour of multilateralism, finding it necessary to renew the profound multilateral efforts on current issues on the agenda in the sphere of arms control and depoliticize such efforts."

Source: <http://tass.com>, 06 June 2019.

BRAZIL

USA Pressures Brazil on Iran and Nuclear Politics

Although the Jair Bolsonaro government (PSL) has declared itself pro-American, the USA has not been successful in pressuring Brazil to change its nuclear politics and adopt a posture more aggressive toward Iran. At the seventh edition of the Bilateral Dialogue of Non-Proliferation and Disarmament, Brazilian authorities and the American assistant secretary of State, Christopher



Ford, discussed these issues. In an interview with Folha de São Paulo, the American appeared optimistic and did not use the term pressure, which was heard on the Brazilian side. "We talked about everything. We are two of the largest democracies in the hemisphere," he said.

Members of the Brazilian government confirmed the good nature of the meeting, but the agreement stopped there. Ford admitted that Brazil and the USA "certainly have differences," on Brazil's adherence to the 1997 Additional Protocol to the NPT. The Treaty says that the International Agency

of Atomic Energy can visit not only declared facilities to ensure that nuclear programs are peaceful but also undeclared sites. In the meeting, Brazilian officials said that the constitution forbids nuclear bombs and there is a bilateral arms agreement framework with former rival Argentina in place since 1994. The American

officials have requested a bilateral arms agreement with Brazil for years. Additionally, Brazil has a fuel production cycle and is developing the nuclear propulsion system for its future submarine. Signing this agreement would place industry technology secrets in the open. Therefore, Brazil did not join the 132 adherents (out of 189) in the NPT who signed the protocol. Brazil established, in its 2009 National Defense Strategy that the country could only participate if nuclear-powered countries gave up its nuclear weapons. This is really utopian.

Source: <https://www1.folha.uol.com.br>, 05 June, 2019

## **NUCLEAR PROLIFERATION**

### **NORTH KOREA**

#### **Japan, US, Australia Urge North Korea to Return to Nuclear Talks**

The Japanese, U.S. and Australian defense chiefs... agreed to cooperate on denuclearizing the Korean Peninsula and urge North Korea to return to disarmament negotiations that have remained at

a standstill since the collapse of a second summit between Washington and Pyongyang in late February. Acting U.S. Defense Secretary Patrick Shanahan reached the agreement with Japanese and Australian defense ministers Takeshi Iwaya and Linda Reynolds at their meeting on the sidelines of the Asia Security Summit, known as the Shangri-La Dialogue, in Singapore.

In the wake of the collapse of the Feb. 27 to 28 summit in the Vietnamese capital, where U.S. President Donald Trump and North Korean leader

Kim Jong Un failed to reach a deal, Pyongyang has resumed provocative actions such as recent short-range missile tests. Prior to the trilateral gathering, Japanese and Australian defense ministers held bilateral talks and agreed to work together to crack down on ship-to-ship smuggling involving North Korean

vessels, while confirming the importance of bilateral security cooperation. At the outset of his meeting, Iwaya told Reynolds, who took up the post late in May, 2019 after the general election in May, that Japan is willing to expand joint drills with Australia to bolster their joint defensive capabilities. North Korea is believed to use illegal ship-to-ship transfers of goods as a way to evade U.N. Security Council sanctions aimed at preventing Pyongyang from developing nuclear weapons and ballistic missiles.

Source: <https://www.japantimes.co.jp>, 02 June 2019.

#### **North Korea's Nuclear Bomb is Much Bigger than Previously Thought**

Scientists looking anew at a 2017 North Korean nuclear test discovered that the explosion was likely about two-thirds more powerful than U.S. officials previously thought. Earlier data put the yield somewhere between 30 and 300 kilotons; the U.S. intelligence community said 140 kilotons. That was already the most powerful device tested

by North Korea, topping a 2016 test by about an order of magnitude. But a new look at seismological data suggests that the blast was between 148 and 328 kilotons, and probably around 250 kilotons.

That's the conclusion from a group of researchers from the University of California, Santa Cruz; the Seismological Observatory of Costa Rica; and elsewhere, as published in the *Journal of Geophysical*

*Research: Solid Earth*. The team combined sound-wave data recorded during the blast with information about North Korean nuclear tests since 2006 and plugged it all into models showing how sound would travel through various types of rock at an estimated depth of 430 to 710 meters.

A 250-kiloton weapon would be about 16 times more powerful than the one that leveled Hiroshima. Detonated over Washington, D.C., it would have knocked down virtually every residential structure in the downtown area and inflicted third-degree burns on everyone within a three-mile radius.

Estimating the size of the bombs that North Korea tests underground is no easy matter outside of the country. The regime doesn't release information such as the depth of the testing sites, the density of the surrounding rock and soil, etc. Outsiders are left to look at seismological sound waves of the sort that governments use to measure the size of earthquakes. (Underground nuclear bomb tests produce direct and compressed waveforms, not the wavy ones of natural earthquakes.) Scientists use data from teleseismic stations around the world that measure P, or primary, waves. These are the initial waves that occur in earthquakes when two big tectonic plates slip past each other.

The P waves indicate the size of the S, or secondary, waves that knock down buildings.

**Earlier data put the yield somewhere between 30 and 300 kilotons; the U.S. intelligence community said 140 kilotons. That was already the most powerful device tested by North Korea, topping a 2016 test by about an order of magnitude. But a new look at seismological data suggests that the blast was between 148 and 328 kilotons, and probably around 250 kilotons.**

The 2017 North Korean test produced an earthquake of 6.3 magnitude. But how you look at that data shapes the conclusion that you reach. The new research uses a statistical trick called a "relative waveform equalization procedure," essentially a bit of tuning, like removing static noise from an audio signal, to enable the researchers to

better compute "two very closely located explosions recorded at multiple stations," according to the paper.

Steven Gibbons, a geophysicist with the program for Array Seismology and Test-Ban-Treaty Verification at the Norwegian Seismic Array, or NORSAR, who was not affiliated with the study, told the American Geophysical Union, "They've

**They've modeled what the reflection would look like for different yields and depths and solved for what the signal would look like if you didn't have to account for this returning wave. The most impressive thing in the paper for me is how similar these waveforms are. This is what gives me confidence that they've done a good job.**

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what gives me confidence that they've done a good job."

Source: <https://www.defenseone.com>, 04 June 2019.

## **NUCLEAR SAFETY**

### **INDIA**

#### **Ahead of public hearing, report shows AFR will be close to Kudankulam reactors**

The Tamil Nadu Pollution Control Board has called for a public hearing for the establishment of India's

first Away from Reactor (AFR) spent fuel storage facility for KKNPP, on July 10. The hearing is to be held at the school ground of Nithyalakyanasundari Vellaiyan Chettiyar government higher secondary school in Radhapuram taluk of Tirunelveli. The contentious issue is NPCIL plan to set up the AFR within the existing plant premises of KKNPP unit 1 and 2. The Environment Impact Assessment (EIA) report for the project, made public, shows the AFR is coming up in an area of 0.35 hectare, close to the reactors.

The total project cost is estimated to be Rs 538 crore, which was sanctioned by the Department of Atomic Energy in September 2015, and the design life will be for 75 years. While the public have been invited to give views and objections, anti-nuclear activists are against the project, claiming that NPCIL is playing with danger.

“AFR means Away from Reactor. Here the facility is being planned within the plant premises. We will meet the Chief Minister and other political parties to draw political consensus in opposing the project, besides exploring legal options,” said anti-Kudankulam nuclear

activist G Sundarrajan, who filed a petition in the Supreme Court seeking shutting down of the power plant until the AFR is built.

However, NPCIL and its environmental consultant, Mecon Limited, defended the location, saying, “AFR would be a component of operating KKNPP 1 and 2 and will be integrated with it as one of the engineered features.... The AFR facility is an operational requirement for KKNPP 1 and 2 to store the spent fuel generated during its lifetime. At Reactor - spent fuel pool (inside the reactor building) has the storage capacity to accommodate spent fuel generated up to about seven years (full power year) of reactor

operations. The proposed AFR facility is planned to be constructed to meet the above operation requirement of KKNPP 1 and 2.”

According to the EIA report, “The AFR facility will have systems for water cooling, purification, ventilation, etc. Besides, it will have a control room from where all the important system parameters can be controlled/monitored. In addition, the safety-related and important indications/alarms of the AFR facility will be provided in the Main Control Room of KKNPP 1 and 2.”

**Radiation Dose Due to AFR:** NPCIL officials claim the radiation dosage on the general public due to

construction of AFR would be a fraction of the limit set by AERB and the global average. For instance, due to operation of KKNPP 1 and 2, for the year 2017, the dose received by a hypothetical person at the fence post through all routes is 0.0118 microsievert ( $\mu\text{Sv}/\text{y}$ ), which is only 0.001 per cent of AERB dose limit of 1,000  $\mu\text{Sv}/\text{y}$  prescribed for the members of public and much less when compared to the annual global average dose of 2400 $\mu\text{Sv}$

**AFR would be a component of operating KKNPP 1 and 2 and will be integrated with it as one of the engineered features.... The AFR facility is an operational requirement for KKNPP 1 and 2 to store the spent fuel generated during its lifetime. At Reactor - spent fuel pool (inside the reactor building) has the storage capacity to accommodate spent fuel generated up to about seven years (full power year) of reactor operations. The proposed AFR facility is planned to be constructed to meet the above operation requirement of KKNPP 1 and 2.**

from natural background.

“At farther distances from Kudankulam site, the doses are insignificant, demonstrating compliance with regulatory limit. The dose contribution due to AFR is negligible. The combined waste from KKNPP 1 and 2 and AFR will be treated and disposed in line with AERB authorised limits. Hence, there will be no additional radiological impact to the general public as well as to the environment due to addition of AFR facility at KKNPP,” NPCIL said.

**Missed Deadlines:** NPCIL has missed the 2018 deadline for building AFR facility — spent nuclear fuel is currently kept within the power plant in a

Spent Fuel Pool. The enterprise had approached the apex court, seeking more time. Simultaneously, Sundarrajan had filed his petition. However, the court extended the deadline to build AFR to April 30, 2022.

AERB had recommended an AFR facility for KKNPP, for prolonged storage of spent fuel while granting site clearance. The Advisory Committees for Safety Review of Various Projects, during its 126th meeting in 2011, also recommended that AFR should be finalised five years ahead of a power plant's operation. Sources told Express that NPCIL has to import certain components for the AFR like spent fuel storage racks and fuel handing machine, for which procurement has been initiated only last year.

In the affidavit submitted to the SC, NPCIL acknowledged "there has been underestimation in the assessment of time needed for setting-up AFR..... The AFR facility is a challenging task on account of no previous experience with long storage requirements of high burnup Russian type PWR fuel and thereby being the first-of-its-kind facility in India."

Source: *SV Krishna Chaitanya, <http://www.newindianexpress.com>, 05 June 2019.*

## **NUCLEAR TERRORISM**

### **GENERAL**

#### **Morocco Elected to Coordinate Global Initiative to Combat Nuclear Terrorism**

During the 11th GICNT plenary meeting held on June 5-7 in Buenos Aires, Argentina, 88 countries have endorsed Morocco to be the Implementation and Assessment Group Coordinator (IAG) of the GICNT from 2019-2021. According to the GICNT official website, "IAG...is charged with implementing priorities identified by the plenary and ensuring GICNT activities are coordinated and complementary to other international efforts. The IAG is currently focused on developing and

executing a flexible work program that produces practical results for the GICNT through three working groups."

**Global Spent Fuel & Nuclear Waste Management Market is expected to grow at a strong CAGR by 2026. Some of the key factors influencing the market growth include huge demand for waste management services, increasing dependence on fossil fuel and Ongoing and upcoming nuclear plant decommissioning activities. However, high initial cost and has high payback period is restricting market growth.**

The list of the group includes, the Nuclear Detection Working Group (NDWG) which focuses on "mapping, building, and enhancing National Detection Capabilities", and the Nuclear Forensics Working Group (NFWG) whose main goal "is to develop documents that raise awareness of nuclear forensics among policymakers." The list also includes the Response and

Mitigation Working Group (RMWG) which "coordinate activities designed to produce best practices and recommendations for the response to a radiological/nuclear terrorist incident." ...The election of Morocco as IAG came as a recognition of the country's efforts in fighting terrorism at the national and global scale. Morocco will hold its IAG mid-term plenary meeting in June 2020.

Source: <https://www.morocoworldnews.com>, 09 June 2019.

## **NUCLEAR WASTE MANAGEMENT**

### **GENERAL**

#### **Spent Fuel & Nuclear Waste Management - Global Market Outlook (2017-2026)**

According to this research, the Global Spent Fuel & Nuclear Waste Management Market is expected to grow at a strong CAGR by 2026. Some of the key factors influencing the market growth include huge demand for waste management services, increasing dependence on fossil fuel and Ongoing and upcoming nuclear plant decommissioning activities. However, high initial cost and has high payback period is restricting market growth.

Nuclear waste usually refers to materials or residues left after the burning of nuclear fuel in reactors. These residues mainly comprise radioactive materials that can cause acute radiation sickness.

Based on the application, boiling water reactors has significant growth in the forthcoming years. These reactors operate in lower fuel temperature and require lower pressure compared to pressurized water reactors. The boiling water reactors segment is thus poised to exhibit a greater CAGR than pressurized water reactors.

By Geography, Asia Pacific is expected to grow at a considerable market share during the forecast period. Asia-Pacific has the most significant number of power generation projects in the pipeline. Further, China is fast-tracking the development of third-generation nuclear power plants both in terms of domestic design as well as nuclear projects under construction.

Source: <https://finance.yahoo.com>, 11 June 2019.

### USA

#### Plan to Reclassify Radioactive Nuclear Waste Spurs Anger

A Department of Energy plan to reclassify some of the country's radioactive waste to lesser threat levels in order to save time and money is angering environmental groups and raising questions among experts. The Energy Department put into place its new interpretation for high-level radioactive waste, saying that the updated definition will allow the agency to more easily

move less hazardous waste from old nuclear weapons facilities where it has languished without a permanent disposal solution.

The agency's previous classification efforts managed hazardous waste based on how it was produced instead of its radioactivity. For example, the use of uranium fuel in a nuclear reactor produces high-level radioactive waste. Classifications for the waste determine disposal methods, which can vary in things like how deeply such material is buried in the ground or how thick the protective material in which it is encased.

The Energy Department said its past approach cost billions of dollars and led to decades of delays. "Recognizing this failure, this Administration is proposing a responsible, results-driven solution that will finally open potential avenues for the safe treatment and removal of the lower level waste currently housed in three states," the Energy Department's Undersecretary for Science Paul Dabbar said. By changing the process to allow for some high-level radioactive waste to be categorized as low-level, the agency said it will be able to start moving waste that has been trapped in Energy Department facilities in Washington state, South Carolina and Idaho. ...

Source: *Cecelia Smith-Schoenwalder*, <https://www.usnews.com>, 10 June 2019.



Centre for Air Power Studies

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

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