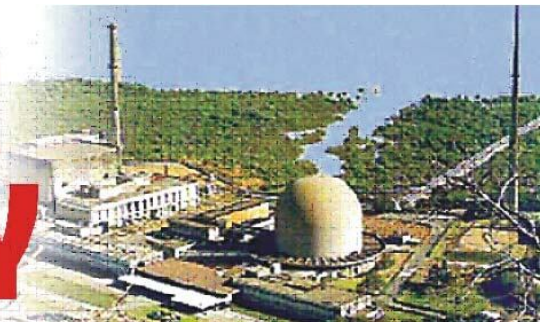
NUCLEAR SECURITY



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OPINION – Michael Peck

Meet "Dead Hand": This might be Russia's Most Terrifying Nuclear Weapons Idea Yet

If Russia is now discussing Perimeter publicly, that's reason for the rest of us to worry. Russia has a knack for developing weapons that—at least on paper—are terrifying: nuclear-powered cruise missiles, robot subs with 100-megaton warheads. Perhaps the most terrifying was a Cold War doomsday system that would automatically launch missiles—without the need for a human to push the button—during a nuclear attack. But the system, known as "Perimeter" or "Dead Hand," may be back and deadlier than ever.

This comes after the Trump administration announced that the United States is withdrawing from the 1987 INF Treaty, which eliminated the once-massive American and Russian stockpiles of short- and medium-range missiles. Donald Trump alleges that Russia has violated the treaty by developing and deploying new, prohibited cruise missiles.

This has left Moscow furious and fearful that America will once again, as it did during the Cold War, deploy nuclear missiles in Europe. Because of geographic fate, Russia needs ICBMs launched from Russian soil, or launched from submarines, to strike the continental United States. But shorter-range U.S. missiles based in, say, Germany or Poland could reach the Russian heartland.

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Viktor Yesin, who commanded Russia's Strategic Rocket Forces in the 1990s, spoke of Perimeter/ Dead Hand during an interview last month in the Russian newspaper Zvezda. Yesin said that if the United States starts deploying intermediate-range missiles in Europe, Russia will consider adopting a doctrine of a preemptive nuclear strike. But he also added this:

Zvezda: "Will we have time to answer if the flight time is reduced to two to three minutes when deploying medium-range missiles near our borders? In this version, all hope is only on Perimeter. And for a retaliatory strike. Or was Perimeter also disassembled for parts?

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Yesin: "The Perimeter system is functioning, it has even been improved. But when it works, we will have little left - we can only launch those missiles that will survive after the first attack of the aggressor."

It is not clear what Yesin meant when he said the system has been "improved," or even exactly what he meant by "functioning." Perimeter works by launching specially modified SS-17 ICBMs, which transmit a launch signal to regular nuclear-tipped ICBMs in their silos. David Hoffman, author of "The Dead Hand," the definitive book on Perimeter, describes Perimeter in this way:

What is unmistakable is that Perimeter is a fear-based solution. Fear of a U.S. first-strike that would decapitate the Russian leadership before it could give the order to retaliate. Fear that a Russian leader might lose his nerve and not give the order. And if Russia is now discussing Perimeter publicly, that's reason for the rest of us to worry.

"Higher authority" would flip the switch if they feared they were under nuclear attack. This was to give the "permission sanction." Duty officers would rush to their deep underground bunkers, the hardened concrete globes, the shariki. If the permission sanction were given ahead of time, if there were seismic evidence of nuclear strikes hitting the ground, and if all communications were lost, then the duty officers in the bunker could launch the command rockets. If so ordered, the command rockets would zoom across the country, broadcasting the signal "launch" to the intercontinental ballistic missiles. The big missiles would then fly and carry out their retaliatory mission.

There have been cryptic clues over the years that Perimeter still exists. Which illustrates one of the curiosities of this system, which is that the Soviet Union kept its existence secret from the American enemy whom it was supposed to deter."

What is unmistakable is that Perimeter is a fear-based solution. Fear of a U.S. first-strike that would decapitate the Russian leadership before it could give the order to retaliate. Fear that a Russian leader might lose his nerve and not give the order. And if Russia is now discussing Perimeter publicly, that's reason for the rest of us to worry.

Source:/nationalinterest.org, 08 January 2019.

OPINION – Kunal Singh

Why is India's No First Use Policy under So Much Strain?

In 2014, the election manifesto of the BJP included a promise to "revise and update" India's nuclear doctrine. It gave rise to speculations that the Narendra Modi government, upon being elected, would consider revoking India's pledge of NFU of nuclear weapons. In an interview to ANI, Modi quelled those speculations by asserting that NFU won't be revoked. "No first use is a reflection of our cultural inheritance," Modi added.

Not just a politician like Modi, but scholars too had once tried to explain India's nuclear posture using arguments of culture. Rajesh Basrur had argued that minimalism and restraint are part of India's "nuclear-strategic culture". Culture can certainly be one of the factors but nuclear postures are first and foremost decided on the basis of structural realities.

Not just a politician like Modi, but scholars too had once tried to explain India's nuclear posture using arguments of culture. Culture can certainly be one of the factors but nuclear postures are first and foremost decided on the basis of structural realities.

As another scholar, Kanti Bajpai, argued in a paper (2000), India's nuclear posture after the 1998 tests evolved through a debate between three different schools of nuclear thinking: rejectionism; pragmatism; and maximalism. The final posture corresponds to the school which is more aligned with structural realities at that point of time. That India chose NFU in its draft nuclear doctrine (1999) and official nuclear doctrine (2003) was a result of structural factors favouring pragmatists.

However, in recent times, we have seen a number of statements from sitting and retired senior members of the nuclear security establishment questioning the NFU policy. No less than the then defence minister, Manohar Parrikar, expressed doubts over the utility of NFU in November 2016. Most recently, Lt Gen (retd.), BS Nagal, former commander-in-chief of the SFC, has called the NFU policy a "formula for disaster" and argued for dropping it forthwith. It is true that India still officially sticks to a NFU policy but it is hard to deny that the consensus around NFU has weakened and that the maximalist position has grown stronger.

China's impressive infrastructure and massive military modernisation have effectively eroded the Himalayan buffer. Now, the conventional disparity between India and China is not just huge but also more palpable. This is putting immense pressure on India's NFU policy.

How have structural factors diluted the NFU consensus? In three ways.

First, NFU policy suits a power which wants to deter just nuclear wars. In other words, if a nuclear weapons state is comfortably placed on a conventional (or, more broadly, non-nuclear) front with respect to its adversaries, it does not need to threaten first use of its nuclear bombs. India was, and continues to remain, a stronger conventional power compared to Pakistan. While China was conventionally stronger, India felt somewhat protected due to difficult terrain on the Himalayan border. Now, China's impressive infrastructure and massive military modernisation have effectively eroded the Himalayan buffer. Now, the conventional disparity between India and China is not just huge but also more palpable. This is putting immense pressure on India's NFU policy.

New Delhi now has more missiles and more accurate ones. It has high quality surveillance platforms. It can access commercially available remote sensing technologies. It is developing MIRVs and investing in missile and air defence systems. While most of these developments may be relevant for China, they also make India more capable than ever before of executing CF strikes against Pakistan.

Second, India's conventional advantage has been blunted by Pakistan through a clever use of sub-conventional assets (read terrorists) and threat of using tactical nuclear weapons against any Indian conventional response to a 26/11 type of an attack. India's nuclear doctrine, that professes massive retaliation even against use of midget nukes, does not help. Pre-emptive counterforce (CF) strikes, if they can be executed, seem to be a way out of this problem. Nagal has openly advocated this strategy and Shivshankar Menon, the former national security advisor, has indicated openness to the idea.

Third, India today has access to much better technology than it had in 2003 when it released its nuclear doctrine. In their forthcoming paper, "India's Counterforce Temptations", two US-based scholars, Christopher Clary and Vipin Narang, list out the technologies that enable a CF posture for India. New Delhi now has more missiles and more accurate ones. It has high quality surveillance platforms. It can access commercially available remote sensing technologies. It is developing MIRVs and investing in missile and air defence systems. While most of these developments may be relevant for China, they also make India more capable than ever before of executing CF strikes against Pakistan. However, it should be noted at this point that India is still a long way away from possessing the capability of executing successful CF strikes. And it may never reach there because Pakistan is rapidly increasing its arsenal size and improving the survivability of its nuclear weapons.

India's solid fuel missiles have enabled it to move towards canisterised systems for storing its land-based ballistic missiles. Such systems can reduce turnaround times — earlier India used to rely on physical separation of components to prevent unauthorised use — and hence are suitable even for pre-emptive strikes in case the rival is shown

to be readying its nuclear assets for use. Canisterisation has further enabled India's nuclear deterrent to move to the seas. With INS Arihant, a nuclear propelled SSBN, India has a credible sea-based deterrent. With a couple of more SSBNs, it can boast of a genuine nuclear triad. But SSBNs involve pre-mating of warheads with ballistic missiles, and hence increase the strain on command and control, especially with the NFU policy intact. Both canisterisation and sea-based deterrence thus increase the strain on NFU policy.

These three changes have created a more propitious ground for nuclear maximalists. There is no single strategic culture that is immune to changes in structural realities.

Source: https://www.hindustantimes.com, 10 January 2019.

OPINION – Mark Episkopos

The One Thing that could 'Sink' Russia's Deadly Borei-Class Nuclear Missile Submarine

Russia's fourth-generation Borei-class was conceived in the early 1980's as a great leap forward in Russian submarine technology; a new, modern design over its aging Delta and Typhoon predecessors. Armed with nuclear-capable Bulava missiles, the Borei line was meant to guarantee the submarine component of Russia's nuclear triad for decades to come. Approximately four decades after its inception, what has the Borei project accomplished? What are its prospects?

Whereas many other Russian modernization efforts involve iterative updates to Soviet-era weapons, the Borei class—or Project 955—represents an entirely new design concept. In fact, the Russian Navy entertained but eventually cancelled its Typhoon modernization project due to cost concerns. In envisioning the next generation of Russian submarines, Russian engineers set out to make the Borei line significantly smaller and lighter than the Typhoon while carrying a more destructive payload. This, they accomplished in spades: Borei is twice as light as Typhoon at 24,000 against 48,000 tons, has a significantly smaller beam (ship width), and travels at a marginally faster speed.

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Borei submarines offer these advancements in handling and maneuverability even as they accommodate a much more powerful payload. As previously reported by The National Interest, the RSM-56 "Bulava" is a 550 kT nuclear-capable warhead guided by a GLONASS-powered inertial navigation system. Specially designed for the Borei line, Bulava dwarfs Typhoon's 100 kT R-39 Rif ballistic missiles. With three Borei submarines in active service by 2006, the Russian Navy announced in 2008 that the rest of the seven Borei vessels planned through 2024 will be part of a new Borei II (also known as Project 955A) revision, featuring lower noise levels, additional communication featured, and revised crew living quarters. While it was previously speculated that Borei II submarines starting from Knyaz Vladimir will feature twenty Bulava tube-launchers, current reports point to the same sixteen-tube launching mechanism being used across the whole Borei line. On paper, The Borei project is a marked improvement on its predecessor and appears more than capable of satisfying Russia's submarine nuclear deterrence needs. But there remains a growing problem that

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threatens to cripple Borei development if not kept in check: costs.

On the surface, Borei vessels appear remarkably cost-effective. After all, the older but similarly-performing U.S. Ohio-class submarines cost two billion dollars per unit as opposed to 890 million dollars per Borei vessel. But the challenge is that even these vastly reduced costs are hard to sustain because Russia is working on several large, concurrent projects within a much smaller defense budget. These estimates do not factor in the submarines' increased cost after the Borei II improvements, nor do they include the massive research and development outlays involved in designing a new submarine and its weapons systems. Bulava appears complete, but only on the heels of a tortured development process that included multiple malfunctions, navigation deviations, and even an engine explosion.

Casting yet further doubt on Borei's future are reports that the Russian Navy will not be moving ahead with its last two Borei submarine orders, scheduled for the mid 2020's. Further complicating the cost/benefit analysis, Russia must balance Borei spending against its other major ongoing submarine project, the Yasen class.

Meanwhile, military insider sources tell Russian state media that Borei's next iteration, Project 955B, has already been cancelled for failing to meet "the cost/efficiency criterion." Casting yet further doubt on Borei's future are reports that the Russian Navy will not be moving ahead with its last two Borei submarine orders, scheduled for the mid 2020's. Further complicating the cost/benefit analysis, Russia must balance Borei spending against its other major ongoing submarine project, the Yasen class. Production costs for the first Yasen vessel, Severodvinsk, ran up to 1.5 billion dollars, with the second entry into the series projected to cost twice that. At its core, the Borei line successfully performs a vital role in the Russian nuclear triad. But it remains to be seen how, or if, the Russian Ministry of Defense plans to consolidate the Borei project to make it financially solvent over the long term.

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Source: https://nationalinterest.org,09 January 2019.

OPINION – Richard D. Fisher Jr., Thor E. Ronay

The Next China Military Threat: The World's Biggest Mobile ICBM?

Russia's RS-28 "Sarmat" ten-ton payload liquid-fueled intercontinental ballistic missile (ICBM) will be the world's largest nuclear strike missile when it enters production, as early as 2021. Reportedly it may carry up to fifteen 350 kiloton warheads, or up to twenty-four of the new "Avangard" nuclear-armed Hypersonic Glide Vehicle (HGV) warheads. But since mid–2017, Chinese sources have revealed details of an even larger twenty-ton payload solid-fuel space-launch vehicle (SLV) that could form the basis for what might become the world's largest "mobile" ICBM.

In May 2017, the now closed Chinese website ChinaSpaceFlight.com offered the first depiction of the family of solid-fuel SLVs to be offered by the China Aerospace Science and Industry Corporation (CASIC). Seen in this image for the first time was the twenty-ton payload Kuaizhou-21, or KZ-21, and the KZ-21A, which adds two side boosters. Likely since the middle of the last decade, CASIC had been given the go-ahead by the Chinese government and the PLA to develop a line of solid-fuel SLVs. These would compete for domestic and international launch services with the China Aerospace Science and Technology Corporation (CASC), which builds China's family of Long March liquid-fueled SLVs and ICBMs, and

its latest DF-31, DF-31A, and DF-41 mobile solid-fuel ICBMs.

So far, CASIC's 1.2-meter diameter road-mobile Kauizhou-1/IA SLV, based on its DF-21 medium range ballistic missile, has made four successful launch missions through September 29, 2018. In 2019, CASIC may launch its first 2.2-meter diameter road-mobile and solid-fueled KZ-11 SLV, which has the same diameter as CASC's DF-41 ICBM. The latter also forms the basis for CASC's Long March-11 solid-fuel SLV, which has been launched five times as of December 21, 2018.

The KZ-21, however, features an unprecedented 4-meter diameter solid-fuel rocket motor, larger than the 3.7-meter diameter Solid Rocket Booster (SRB) developed by the former Thiokol Company to help launch the U.S. Space Shuttle. A ChinaDaily report from 25 December 2017 noted that CASIC would begin testing the engine for the KZ-21 in February 2018. That month, an image appeared on Chinese web pages of CASIC engineers standing beside elements of the 4-meter solid rocket motor. There have been no subsequent reports or images to confirm successful testing of this engine, but Chinese sources indicate the KZ-21 SLV could be in service by 2025. As in the United States and Russia, China has shown ample precedent for SLVs assisting the development of ICBMs, and vice-versa. CASC's liquid-fueled DF-5 ICBM served as the basis for the Long March-1 SLV, and the multiple satellite-launching Long March-2C aided the follow-on development of the latest ten-warhead capable DF-5C.

To date, there has been no public Chinese suggestion that the KZ-21 will become the basis for the world's largest solid-fuel ICBM, but it would be foolish to assume China's strategic planners have decided to forego such an option. China may now be deploying its three-thousand-plus-kilometers range DF-17, armed with a small maneuverable HGV warhead. If sized similarly to Russia's Avangard, a twenty-ton payload KZ-21 might carry close to fifty HGVs.

According to some Asian military sources, a PLA Rocket Force ICBM unit has about six missiles, which for the KZ-21 could approach three hundred warheads. Thus, potentially, five KZ-21-based ICBM units could nearly match the 1,550 warheads deployed each by the United States and Russia, pursuant to the 2010 New Start Treaty which expires in 2021. It is very likely that China could build transporter-erector-launchers (TELs) large enough to move KZ-21-based ICBMs a short distance from various nodes of the PLA Rocket Force's (PLARF) "Underground Great Wall" of tunnel ICBM bases for quick staging. Add to this the potential for CASIC's KZ-1 and KZ-11 SLV production lines to also be turned to producing new mobile ICBMs. In that case, starting in the early 2020s, the PLA will have plenty of capacity to build ICBMs which could "sprint" to match or exceed the deployed nuclear warhead arsenals of Russia and the United States.

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China does not reveal its current ICBM and warhead numbers. Despite decades of U.S. government attempts to engage PLA and political officials in preliminary dialogues on strategic weapons, China likely will continue rejecting suggestions that it begin to exercise strategic nuclear transparency. Instead, China has spent decades trying to convince the world that it has no ambitions for strategic nuclear superiority, will not engage in a nuclear arms race, adheres to a "No First Use" of nuclear weapons pledge, does not proliferate, and seeks merely to have an "assured" means of nuclear retaliation to deter nuclear attack.

Russia for decades ran a similar deception gambit, whilst at least it pretended to engage in normative arms control. It thusly co-opted generations of U.S. arms control devotees into believing that U.S. defense and verification actions—rather than Soviet ideology, strategic goals, capacities, and serial violations—were the main threat. U.S. arms controllers obsessively insisted the latter should be ignored or downplayed in order to "keep the Soviets at the table." Unsurprisingly, Moscow regularly ran the table until Reagan called the game.

Russia and China may calculate that such a nuclear "tilt" against the United States could be used to dissuade and deter U.S. military support for Taiwan, South Korea, Japan, or multiple Russian targets in Europe. However, with missile platforms like the KZ-21 China would have the means to seek nuclear superiority over Russia in the 2030s and beyond.

Given that such deception stratagems are even more central in China's millennia of statecraft, U.S. policymakers must now be more vigilant and realistic, and apply the expensive lessons from decades of Soviet/Russian deception/diversiya. The U.S. focus must be on Chinese goals, capabilities, and actions, and not on bringing them to the wormy table of arms control. China likely will continue to eschew the "arms control process," unless it determines it must be exploited to better gain time, concessions, and U.S. self-constraint, per the Soviet/Russian example.

A successful disarmament treaty would have to be preceded by an effective arms control mechanism; that in turn demands an acceptable level of trust between all of the NWS, inside or outside of the NPT. To instill such confidence and to facilitate any purposeful negotiations on disarmament, it is essential that the NPT is amended to include NWS outside of the NPT into the treaty.

Until very recently, the United States largely has willfully deceived itself about converging Chinese threats, thus obviating the need for China to deign to engage in the arms control gambit. The dominant non-status quo power, China views arms control as another meddlesome aspect of the global state system whose architecture, legitimacy, and norms it rejects.

For decades, top Chinese leaders ritually have denied any ambitions for global "Hegemony." Now, in 2019 it is increasingly clear that China seeks to reshape global economics and politics to serve the goals of the Chinese Communist Party (CCP) leadership, and that it is building a PLA which could soon have the means to impose the CCP's will regionally, globally, and in Space. Given such ambitions it seems highly likely that CCP leaders long ago decided they must attain nuclear superiority.

But even before such a nuclear buildup, it is imperative to consider the possibility of offensive nuclear cooperation between Russia and China, inasmuch as they have held two publicly announced "strategic defense" exercises in 2016 and 2017. Russia and China may calculate that such a nuclear "tilt" against the United States could be used to dissuade and deter U.S. military support for Taiwan, South Korea, Japan, or multiple Russian targets in Europe. However, with missile platforms like the KZ-21 China would have the means to seek nuclear superiority over Russia in the 2030s and beyond.

Source: https://nationalinterest. org, 08 January 2019.

OPINION – Saurabh Todi

Reforming the NPT for New Realities

The NPT came into force in 1970. It became the bedrock of the global nonproliferation and disarmament regime due to its near universal membership. The NPT was envisaged as a comprehensive treaty that addressed issues including nonproliferation, disarmament and peaceful uses of nuclear energy. However, the NPT has been largely unsuccessful in making any progress toward disarmament. A successful disarmament treaty would have to be preceded by an effective arms control mechanism; that in

turn demands an acceptable level of trust between all of the NWS, inside or outside of the NPT. To instill such confidence and to facilitate any purposeful negotiations on disarmament, it is essential that the NPT is amended to include NWS outside of the NPT into the treaty as recognized NWS.

Most of the nuclear weapon states are adversaries of each other and use nuclear weapons as a deterrent. Any technological advancement by one state is bound to elicit a response by their perceived adversary, albeit within the confines of their technological prowess. The dynamics between the United States and Russia, the United States and China, the United States and North Korea, India and China, and India and Pakistan exemplify such contentious relationships. The expected U.S. withdrawal from the 1987 U.S.-Soviet Union INF treaty, uncertain extension of the New START treaty, development of nuclear-capable hypersonic weapons and underwater drones by Russia, development of Pakistani tactical nuclear weapons, and rapid modernization of nuclear arsenals by every nuclear weapon state are some very recent developments that have the potential to further accentuate tensions between these nations.

Currently, there are four known NWS outside of the NPT: India, Israel, North Korea, and Pakistan. Considering that Israel practices a policy of nuclear opacity and North Korea is currently negotiating the status of its nuclear weapons program, either of these countries cannot be considered for inclusion into a reformed NPT unless they declare themselves as a NWS and express no intention of unilaterally disarming. That leaves India and Pakistan as the only non-NPT NWS that can be realistically included in the reformed NPT.

The world has come to terms with South Asian nuclear weapons and no one expects either India or Pakistan to disarm unilaterally anymore. Bringing them into the fold of the NPT would formalize the accepted reality and push both nations to become responsible stakeholders in global nuclear disarmament discussions.

India and Pakistan have often criticized the NPT as discriminatory, with an Indian diplomat once famously lamenting that the NPT had led to "nuclear apartheid." Both countries initiated their indigenous nuclear programs and tested nuclear weapons in 1998. It's been 20 years since, and both India and Pakistan have fast growing nuclear arsenals and have developed everything from tactical ballistic missiles to MIRVs to ICBMs. Furthermore, the world has come to terms with South Asian nuclear weapons and no one expects either India or Pakistan to disarm unilaterally anymore. Bringing them into the fold of the NPT would formalize the accepted reality and push both nations to become responsible stakeholders in global nuclear disarmament discussions. Additionally, frequent bilateral and multilateral communication between adversaries can help soothe concerns and misjudgments regarding their nuclear weapon capabilities and their command and control structures.

The inequity in their NWS status has prevented India and China from initiating a formal bilateral nuclear discussion. Similarly, given the historically tense India-Pakistan relationship, engaging at a multilateral forum can provide an alternative platform to discuss nuclear issues away from the shadow of their acrimonious bilateral relationship.

The NPT NWS have a formal mechanism to engage in multilateral discussions on disarmament issues at the NPT Review Conferences and can pursue bilateral discussions to determine relevant confidence-building measures. However, such an opportunity for multilateral participation is not afforded to the NWS outside of the NPT. Due to the risk of violating Article 1 of the NPT, experienced NWS are circumspect in sharing their best practices regarding nuclear command and control structures with their non-NPT counterparts.

As India and China develop and become more assertive in their shared region, it is crucial for them to engage in frequent dialogues and initiate confidence-building measures to minimize any scope for miscalculation. The inequity in their NWS status has prevented India and China from initiating

a formal bilateral nuclear discussion. Similarly, given the historically tense India-Pakistan relationship, engaging at a multilateral forum can provide an alternative platform to discuss nuclear issues away from the shadow of their acrimonious bilateral relationship.

By adopting the Treaty on the Prohibition of Nuclear Weapons in 2017, the UN General Assembly effectively repudiated the NPT for its inability to make any real progress on universal disarmament. The fact that successive NPT Review Conferences have discussed disarmament without representation from a quarter of the world's NWS probably explains the lack of any reasonable progress on the issue. Engaging in comprehensive discussions on disarmament with participation from all the stakeholders would only strengthen the NPT regime and reinforce the commitment of the NWS towards disarmament. Institutions that don't evolve to reflect realities of the time end up losing their relevance.

If implemented, amendment of the NPT would represent a monumental modification in the nonproliferation structure that has governed the world for the last 50 years. Extensive, constructive and proactive deliberations will allow a reformed NPT to take shape, inspire confidence, build credibility and mature into a strengthened version of its previous self.

Reforms to such legacy institutions will not come easy and negotiations will take a long time to conclude. If implemented, amendment of the NPT would represent a monumental modification in the nonproliferation structure that has governed the world for the last 50 years. Extensive, constructive and proactive deliberations will allow a reformed NPT to take shape, inspire confidence, build credibility and mature into a strengthened version of its previous self.

Source: https://thediplomat.com/, 04 January 2019.

OPINION – Daniel R. DePetris

North Korea could have 100 Nuclear Warheads by 2020

Decked out in a dark suit, surrounded by leather-bound books and sitting comfortably on a plush sofa, North Korean leader Kim Jong-un delivered an olive branch of sorts to the United States during his annual New Year's Day speech. His meeting with U.S. president Donald Trump last June in Singapore was a helpful and productive exchange of ideas, Kim told his countrymen—one he would like to continue in 2019. But, Kim continued, if Washington continues to push for one-sided demands or pressure it into unilateral nuclear disarmament, "we [the North] may be compelled to find a new way for defending the sovereignty of the country and the supreme interests of the state and for achieving peace and stability of the Korean peninsula."

Kim Jong-un's rejoinder should be taken seriously. The North Koreans have options, and their Plan B in the event of a full-blown collapse of nuclear talks with the United States will likely be adding onto their small nuclear weapons stockpile. Pyongyang certainly has the capability to ramp things up the moment it chooses; the North Koreans could theoretically possess 100 nuclear warheads by 2020.

Kim Jong-un's rejoinder should be taken seriously. The North Koreans have options, and their Plan B in the event of a full-blown collapse of nuclear talks with the United States will likely be adding onto their small nuclear weapons stockpile. Pyongyang certainly has the capability to ramp things up the moment it chooses; according to Robert Litwak, a vice president at the Woodrow Wilson International Center for Scholars, the North Koreans could theoretically possess 100 nuclear warheads by 2020. Needless to say, this is not what President Donald Trump would like in a presidential election year, particularly when the skeptics and cynics camped out in every corner of Washington are already highly unimpressed with the notion that

his dalliances with the North Korean dictator will go anywhere.

Depending on the actual size of Pyongyang's current nuclear arsenal—U.S. intelligence estimates range from as low as twenty to as high as sixty—it is certainly possible Kim could bring his stockpile into the triple-digits by the time Trump is deep into his re-election campaign. It doesn't take a Ph.D. in international relations or thirty years of experience in the bowels of the State Department to recognize that Kim Jong-un's most prized possession is his collection of nuclear warheads—a strategic asset that provides his regime with the ability to deter countries infinitely more powerful than his own. The larger the arsenal is, the more credible the deterrent becomes.

The North Koreans and Americans may be talking, exchanging letters and sending each other communications through diplomatic channels, but the process seems gummed up. Since Singapore, we have been operating in a catch-22 situation, with neither side moving from their original demands and waiting for the other to make the first move.

Therein lies the rub for President Trump. He likely sees his pen-pal friendship with Kim Jong-un as a historic opportunity in the annals of diplomatic history. Trump views every personal letter written and sent by Kim as an affirmation that his brand of personal diplomacy is working. [Recently], Trump held up papers during a televised cabinet meeting—presumably of Kim's latest letter to the White House—as proof that contacts between Washington and Pyongyang are not in the doldrums as most in the "fake news" media assume. "We've really established a very good relationship," Trump insisted. In Trump's mind, that relationship will help consummate an agreement that solves the North Korean problem once and for all and lands him the world's most coveted peace prize.

Up to the present time, there isn't much evidence lending credence to Trump's hypothesis. The North Koreans and Americans may be talking, exchanging letters and sending each other communications through diplomatic channels, but the process seems gummed up. Since Singapore, we have been operating in a catch-22 situation, with neither side moving from their original demands and waiting for the other to make the first move. The fact the diplomatic process remains alive and the Trump and Kim are still talking, however, is nothing to sneeze at and is surely better than the alternative: no dialogue at all, more missile and nuclear tests, more U.S. bomber flights over the Korean Peninsula, and a return to "fire and fury."

Last May, Jeffrey Lewis of the Middlebury Institute predicted that the United States will eventually come around to de-facto recognizing North Korea as a nuclear weapons state along the same lines of Israel, Pakistan and India. As long as Kim doesn't openly test his weapons or openly talk about sending warheads to Guam or the continental United States, Washington would pretend the nuke issue is solved and everyone will go on their merry way. As long as President Trump can market it as a win, he may be sympathetic to the arrangement.

Source: https://nationalinterest.org, 03 January 2019.

OPINION – Kenneth Keulman

New House, New Vision for America's Nuclear Weapons?

A new House of Representatives has taken power. And with it comes much needed change to how the U.S. approaches nuclear weapons. It's about time. Over the course of the last two years, the U.S. has been on a perilous path when it comes to nuclear weapons policy. President Trump moved to pull out of the INF Treaty, a 1987 milestone agreement with the Soviet Union that prohibited a comprehensive class of nuclear weapons and helped usher in the end of the Cold War. At the same time, a long-term project of nuclear weapons modernization is under way, and likely to expand once the INF Treaty is abandoned, during which nuclear forces will undergo "upgrading."

Together, these developments point to a dangerous future, one where nuclear conflict is looking increasingly likely. Yes, the INF treaty is not perfect. But it banned the Soviet Union and the U.S. from retaining, testing and deploying ground-launched ballistic and cruise missiles with ranges between 300 and 3,400 miles. Since the Obama administration, Washington has censured Moscow for violating the terms because of its deployment of cruise missiles. Actually revoking the agreement though will ignite a new era of nuclear proliferation by permitting the United States to acquire comparable missiles. That opens the door to host of dangerous developments.

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Russia's expansion of its Novator 9M729 cruise missile program is already in a more mature state, so it can be utilized broadly once the agreement is ended. Russia will also have autonomy to deploy an intermediate range ballistic missile without restriction. The U.S. decision to withdraw from the INF could even speed up the expansion of this capacity. Moscow maintains that abandoning the pact might also restart the Cold War nuclear arms race. Russian President Vladimir Putin has stated that Russia will react "in kind" if new American missiles are positioned in Europe. And he warned that any European states accommodating these weapons would be in danger of Russian attack. That could lead to serious international confrontations, which will jeopardize future national security concerns and test the support of U.S. allies in Europe at a time when support for Trump's policies is already low on the continent.

Nations possessing nuclear weapons are already modernizing their stockpiles all across the globe. Russia, China, and America are embarking on vast modernization agendas that involve new warheads and forms of delivery systems that are more destabilizing since they incentivize an adversary to strike first to immobilize the foe at the beginning of warfare.

Withdrawal from the agreement will probably also damage the 2010 START Treaty regulating Russian and American long-range nuclear missiles. START will automatically terminate in 2021 unless Washington and Moscow decide to prolong it. Without the INF treaty in place, the chances of it dissolving are increasing. To go along with these concerning moves, the Trump administration has initiated an alarming new program of nuclear weapons acceleration. Trump has supported his predecessor's weapons modernization agenda. But he has also pledged to significantly enlarge current nuclear resources. America is now engaging in the most excessive nuclear weapons expansion since the collapse of the Soviet Union.

In abandoning another nuclear pact, the Trump administration is showing a lack of long-term strategy. The INF Treaty, accompanied by the New START accord, holds at bay a renewed great power nuclear arms competition. Since one of the objectives in withdrawing is to modernize U.S. nuclear capabilities, this will only accelerate the expansion of a more hazardous world. Nations possessing nuclear weapons are already modernizing their stockpiles all across the globe. Russia, China, and America are embarking on vast modernization agendas that involve new warheads and forms of delivery systems that are more destabilizing since they incentivize an adversary to strike first to immobilize the foe at the beginning of warfare. Any additional fodder for nuclear proliferation is likely to increase these efforts.

Thankfully, the new Congress has some ability to push back on this nuclear agenda. With Rep. Adam Smith (D-Wash.) running the House Armed Services Committee there is a new voice in power

pushing for the downsizing of our country's nuclear program. One way to accomplish this would be to abolish the most hazardous element of the nuclear weapons system—one leg of the nuclear triad—ICBMs. These are susceptible to unintended nuclear conflict if they are released as a result of miscalculation by a leader functioning under intense pressure to make a decision, or by accident. While the House's power is limited in making these types of changes, we can only hope that these new, reasonable voices at the table will help steer our country away from a dangerous, and costly, nuclear arms race.

That the United States needs the new low-yield Trident warhead "because a high-yield, long-range U.S. response to Russia's first, limited use of a low-yield nuclear weapon against a military target is not credible. The Russians believe we are not likely to risk a global thermonuclear war in response to a 'tactical' nuclear attack by them.

Source: https://thehill.com/blogs, 07 January 2019.

NUCLEAR STRATEGY

USA

America Already has Low-yield Nuclear Warheads

The Trump administration plans to build new "low-yield" nuclear weapons that would be launched from Trident submarines. Its rationale? It insists they are needed to counter Russia's low-yield weapons.

This plan has resulted in a lot of confused—or perhaps deceptive—verbiage on the part of some of our elected officials. They seem not to know or neglect to mention that the United States already deploys a wide array of low-yield nuclear weapons. Or it could be that they have their own set of alternate facts?

Alternate Facts in the House: For example, on May 22, Mike Roger (R-Ala.), who chairs the Strategic Forces Subcommittee of the House Armed Services Committee, laid out his reasons for supporting the new warhead. Discussing the possibility of a Russian attack with low-yield weapons, he said:

"…[W]e have to understand Russia has this capability. … I think one of the reasons they don't believe we would respond is we don't have the capability [emphasis added] to do it without all-out nuclear war. They have to understand that we can, with precision, do exactly what they would do to us."

Given Roger's position in Congress, you would expect him to know quite a bit about US nuclear weapons. Yet he seems to believe that the United States has no low-yield nuclear weapons, so that the only US option would be to use its regular-size nuclear weapons and start an all-out nuclear war. (He also seems to believe that using low-yield nuclear weapons could not itself lead to an all-out nuclear war, but let's ignore that for now.)

Alternate Facts in the Senate: More recently, Jon Kyl (R-Ariz.), who was then serving on the Senate Armed Services Committee, weighed in with a November 29 op-ed on *The Washington Post* website, "Why America needs low-yield nuclear warheads now." He and his co-author Michael Morell, who is a former deputy director and acting director of the CIA, argue that the United States needs the new low-yield Trident warhead "because a high-yield, long-range U.S. response to Russia's first, limited use of a low-yield nuclear weapon against a military target is not credible. The Russians believe we are not likely to risk a global thermonuclear war in response to a 'tactical' nuclear attack by them."

Again, the claim is that if Russia were to use low-yield nuclear weapons, the United States would have only two options: no response or launching a global thermonuclear war by using its regular-size weapons. Again, given the responsibilities and experience of these two men, one would expect them to know a fair amount about the US arsenal. Yet they seem not to know—or at least don't acknowledge—that the United States has

other options because it already deploys a wide array of low-yield nuclear weapons, and has for decades.

The Real Facts: Exactly what low-yield weapons does the United States have in its arsenal? The B61 bombs—which include 150 deployed at US air bases in six NATO countries—have variable explosive yields. The lowest available option has an explosive power of 0.3 kilotons of TNT—just 2 percent of the yield of the bomb that destroyed Hiroshima. The bombs also can be set to a yield of 1.5, 10, 45 or 60 kilotons.

The planned new warhead—the W76-2—will have a yield of 6.5 kilotons and will replace some of the existing 100-kiloton W76 warheads on US submarines. It would add yet another weapon to the low-yield nuclear arsenal that our elected officials apparently don't know exists.

The United States also deploys air-launched cruise missiles with yields of 5 to 150 kilotons. The United States is upgrading these weapons to extend their lifetimes for several decades and to add improvements, such as greater accuracy. The planned new warhead—the W76-2—will have a yield of 6.5 kilotons and will replace some of the existing 100-kiloton W76 warheads on US submarines. It would add yet another weapon to the low-yield nuclear arsenal that our elected officials apparently don't know exists. You have to admit, though, the W76-2 will nicely fill in the gaping hole between 5 and 10 kilotons.

Source: Lisbeth Gronlund, https://allthingsnuclear.org, 08 January 2019.

BALLISTIC MISSILE DEFENCE

CHINA

China Mobilises DF-26 Ballistic Missiles Capable of Sinking US Warships in the South China Sea

Beijing has announced it has deployed intermediate ballistic missiles to the country's north-west region, saying the weapons have the capacity to destroy US ships entering disputed waters in the South China Sea. The DF-26 missiles — which have been previously dubbed the 'Guam Killer' or 'Guam Express' by Chinese media and defence experts — are capable of carrying conventional or nuclear warheads.

They have a range of 4,500 kilometres, making them capable of reaching as far as Guam in the east and Indonesia in the south, providing Beijing with a powerful weapon as tensions continue to rise in the South China Sea. According to Chinese state media publication The Global Times, the DF-26 missiles are now stationed in north-west China's sparse plateau and desert areas, carried on the backs of trucks able to traverse the harsh terrain.

Speaking on condition of anonymity, a Beijing-based military expert told *The Times* that positioning the missiles deep in China's mainland made them more difficult to intercept as it allowed the missile to enter its final stages at a high speed. The missiles were first paraded in 2015 and China confirmed they were now operational in April last year, but this is the first footage of the missiles outside of a parade. It is unclear when the missiles were moved to the northwest region, *The Times* reported.

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Source: https://www.abc.net.au, 10 January 2019.

NUCLEAR ENERGY

CHINA

China's Fourth AP1000 Nuclear Reactor is Operational and China has 45 GW of Nuclear Power

China will add another 11 nuclear reactors that would add 11 GWe of electricity over the next two years. Afterwards, there is a gap in China's development of nuclear power. Only two nuclear reactors are scheduled to come online from 2021 to 2024.

China currently has the third most nuclear power of any country. They are behind the USA which has about 100 GWe and 800 TWh of nuclear power and France which has about 62 GWe and 382 TWh of nuclear power. Based upon China's operation of nuclear reactors they will generate about 6.75 TWh per GWe of nuclear plant. This means about 303 TWh from 45 GWe. This same amount of per GWe of nuclear plant would mean 378 TWh from 56 GWe of nuclear power.

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France is only producing about 6.2 TWh per GWe of nuclear plant. France has limitations on operating nuclear power at maximum levels because they have 71% of their electricity from nuclear power. This puts more limitations on how flexible they are in operating their nuclear reactors. The US is producing 8 TWh of power per GWe. The limit for a plant that was operating at maximum capacity for an entire year is 8.76 TWh per GWe. China has been improving the operational performance of their nuclear power. China is still on track to have the second most power generated from nuclear power.

The commissioning of EPRs in France and Finland would conclude a sorry saga of delays and cost overruns for the reactor design. Construction started in 2005 on the first EPR, Olkiluoto 3 in Finland, with an estimated start date of 2010. Not only has the project taken almost three times as long to build, but it has also seen costs balloon.

Source: Brian Wang, https://www. nextbigfuture. com, 09 January 2019.

EUROPE

Europe's EPR Nuclear Reactor Model may Finally Go Live in 2019

It's a new year, and it could be the year to end a construction saga surrounding Europe's ill-fated EPR commercial nuclear reactor model. French-built EPRs could deliver power for the first time on European soil before the end of 2019, according to an S&P Global Platts report. The commissioning of EPRs in France and Finland would conclude a sorry saga of delays and cost overruns for the reactor design. Construction started in 2005 on the first EPR, Olkiluoto 3 in Finland, with an estimated start date of 2010.

Not only has the project taken almost three times as long to build, but it has also seen costs balloon. In 2012 the project was already expected to cost about €8.5 billion ($9.8 billion at today's exchange rate), nearly three times the reactor's original €3 billion ($3.5 billion) price tag. The project has also been blighted by competing compensation claims from the developer, Areva (which rebranded as Orano last year), and the owner, Teollisuuden Voima Oyj.

Areva's second EPR, being built at the Flamanville Nuclear Power Plant in France, has not fared much better. Construction started at the end of 2007 and was slated to end in 2012, at a cost of €3.3 billion ($3.8 billion). On current estimates it will cost €10.9 billion ($12.6 billion).

Given the history of delays, there is still uncertainty over when both projects will be completed. The S&P Global Platts piece said both could deliver first power before the end of the year, but also noted that Olkiluoto 3 is not due to enter full operation until early 2020.

Dr. Jonathan Cobb, senior communication officer at the World Nuclear Association, confirmed regular electricity generation is unlikely to commence before January 2020. Olkiluoto 3 passed

key pre-operational hot functional tests on its coolant circuits and safety systems in May 2018, he said.

Fuel will be loaded into the reactor core this June, and the reactor should be connected to the grid in October, at which point it will be considered to be in operation. The Flamanville 3 reactor is following close behind, but appears unlikely to come online this year. Hot testing of the reactor is due to begin shortly, said Cobb, with fuel loading likely to happen in the fourth quarter of 2019 and full operation next year.

Last July, Reuters reported that trouble with welds had forced the plant's owner, EDF, to postpone grid connection to the first quarter of 2020, with commercial operation slated to follow in the second quarter. It's this kind of hiccup that makes it hard to gauge whether start-date estimates will slip again. However, said Cobb: "As projects move into the final stages of testing and commissioning, there should be greater certainty with the projected schedules."

And at least there is one EPR in the world that is already up and running. After Olkiluoto 3 and Flamanville 3, Areva sold two more EPRs to China for a nuclear power plant in Taishan, Guangdong. True to form, both reactors suffered delays, but Taishan 1 finally started delivering electricity to the grid in June last year and began commercial operation in December. Taishan 2 is scheduled to follow suit this year.

The haphazard progress of EPR deliveries has cast doubt over the viability of the design. The concept is being proposed for new nuclear installations in the United Kingdom, India and Saudi Arabia, and is likely to be championed if further plants are built in France. ...After the lackluster performance of EPR projects to date, the fact that even the French are unwilling the back the reactors could render possible buyers wary.

Source: JasonDeign, https:// www. greentechmedia. com, 09 January 2019.

INDIA

India to Bring 21 More Reactors Online by 2031

In a written answer to a question in the Rajya Sabha, Jitendra Singh said: "At present, there are nine nuclear power reactors at various stages of construction." These include two units in each of the states of Gujarat, Rajasthan and Haryana, plus three in Tamil Nadu. All these units are scheduled to be completed by 2024-2025, Singh was cited as saying by *The Times of India*. "In addition, 12 more nuclear power reactors have been accorded administrative approval and financial sanction by the government in June 2017," he told parliament. "Thus, 21 nuclear power reactors, with an installed capacity of 15,700 MWe are under implementation, envisaged for progressive completion by the year 2031."

In addition, 12 more nuclear power reactors have been accorded administrative approval and financial sanction by the government in June 2017, "Thus, 21 nuclear power reactors, with an installed capacity of 15,700 MWe are under implementation, envisaged for progressive completion by the year 2031.

Singh also noted that five sites have been granted "in principle" approval to establish a further 28 reactors. These sites are Jaitapur in Maharashtra, Kovvada in Andhra Pradesh, Chhaya Mithi Virdi in Gujarat, Haripur in West Bengal and Bhimpur in Madhya Pradesh. In response to a separate question in the Rajya Sabha, Singh stated: "There are presently no proposals for accord of administrative approval and financial sanction of nuclear power projects pending with the government." India currently has 22 power reactors in operation at seven plant sites with a combined capacity of 6780 MWe.

Source: http://world-nuclear-news.org, 04 January 2019.

15,000 Tonnes of Uranium Needed to Achieve Supply Security of Fuel for Nuclear Plants

A stockpile of 15,000 tonnes of uranium is required for achieving supply security of fuel for nuclear plants in the country, the DAE, which manages atomic energy installations, has told a parliamentary panel. The panel report, which was tabled before the Lok Sabha in the on-going Parliament session, also recommended that necessary steps should be taken to ensure new uranium mines are opened as soon as possible to reduce the dependance on the imported uranium.

Currently, a major portion of domestic production of uranium comes from the Jaduguda mines of Jharkhand, which are "old" and the ore is found at "great depths." Moreover, the high extraction cost makes it "unviable" as compared to imported uranium, the panel noted. Besides the Jaduguda mines, the uranium is extracted from the Tummalapalle mines in Andhra Pradesh. Apart from Jaduguda, uranium reserves are available in Meghalaya, Andhra Pradesh, Rajasthan, Haryana, Karnataka and Tamil Nadu.

The government also plans to build a Strategic Uranium Reserve to ensure that there is no shortage of uranium for its power reactors. For the 10 PHWRs, there will be a requirement of about 1250 metric tonnes of natural uranium dioxide fuel.

India has 22 nuclear power reactors and domestic uranium is used in nuclear plants which are not under the international nuclear energy watchdog, IAEA. India currently imports uranium from Kazakhstan, Canada and Russia. "The committee notes that the DAE aims at a stockpile of 15,000 tonnes of uranium for achieving a level of comfort in so far as achieving supply security of nuclear fuel for nuclear plants is concerned," the panel said in its report.

The government also plans to build a Strategic Uranium Reserve to ensure that there is no shortage of uranium for its power reactors. For the 10 PHWRs, there will be a requirement of about 1250 metric tonnes of natural uranium dioxide fuel, the report said. The panel also noted that although nuclear plants are heavily capital intensive, the cost per unit power generation is low. It stated that the tariff for the two BWRs of Tarapur Nuclear Power Plant with a capacity of 160 MW each is as low as 90 paise per unit whereas it is Rs 2.70 per unit for the new plants.

Source: https://economictimes.indiatimes.com, 30 December 2019.

RUSSIA

Russia Retires Reactor No 1 at the Leningrad Nuclear Plant

Russian nuclear officials say they have taken a Soviet-built nuclear reactor have out of operation after 45 years of service, in what is only the third project to decommission a civilian reactor that Moscow has undertaken. The state-controlled Rosatom corporation reported shortly before Christmas that Reactor No 1 at the Leningrad nuclear power plant has been shut down as planned and said its uranium fuel would take until 2023 to fully unload.

The power station's energy production will eventually be replaced by reactors at the Leningrad Nuclear Power Plant II, which is currently under construction alongside the first in the town of Sosnovy Bor, 70 kilometers west of St Petersburg on the Gulf of Finland. Launched in 1973, the reactor became the first unit of the RBMK-1000 type to be built in the Soviet Union. A reactor of that type exploded in Chernobyl in April 1986 in the world's worst nuclear accident, and Rosatom was at pains in its announcement to stress that the Leningrad reactor had operated "reliably and safely" throughout its career.

Another three RBMKs were built at the Leningrad site throughout the 1970s, which Rosatom has said it intends to take out of services by 2021. ...Currently, Russia has taken on only one other full-scale decommissioning project on a commercial reactor. In 2011, Rosatom shut down the first two units of the Novovoronezh Nuclear Power Plant with the aim of decommissioning them fully.

Like the four RBMKs at the Leningrad plant, the older VVER-type reactors at the Novovoronezh will be replaced by VVER-1200 units at a new plant named for the old: The Novovoronezh nuclear power plant II. These three decommissioned reactors therefore offer something of a test case for more than a dozen other reactors of these older types that Rosatom intends to shut down and replace over the next 12 years.

Aside from watching how Rosatom handles the pressing environmental issue of safely storing the tons of spent nuclear fuel and radioactive waste resulting from these decommissioning projects, it will be interesting to watch how this work is financed. Like many other countries operating nuclear reactors, Russia funds decommissioning and dismantlement on the back of electricity tariffs charged by its nuclear power plants.

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But where other countries have been collecting these tariffs for more than half a century, it was only in 1995, after the fall of the Soviet Union, that the Russian nuclear industry began earmarking a portion of its revenues toward the work of eventual decommissioning. One way Russia has sought to deal with this lack of funds is to simply extend the run-time of many of its older reactors. But where these extensions are common practice throughout the international nuclear industry, experts have often worried c that Moscow takes the practice to extremes.

For instance, officials with the Kola nuclear plant have sought to extend the runtime of its four VVER-440 reactors – which are already operating on extension. If the new round of extensions is granted, these 1970s-generation reactors would operate until 2040 and beyond.

Likewise, the Leningrad's plant 's Reactor No 1 was originally meant to operate for 30 years, but was granted an extension 15 years ago. How much money Russia spends on its decommissioning projects is, meanwhile, something of an official secret, leading many environmental groups to conclude that the government will simply have to divert money from other resources to get the job done.

Decommissioning the RBMK units at the Leningrad plant may present added difficulties as the reactor design is so fundamentally different from most other commercial reactors in the world. Unlike boiling water reactors, RBMKs are moderated by graphite, and their design was derived from reactors that were principally used for producing plutonium for nuclear bombs. As a result, safely dismantling RBMK reactors entails not only safely securing spent uranium, but also isolating their bulky irradiated graphite stacks from the environment.

The only other project like this that Russia has addressed is the decommissioning of its five graphite moderated plutonium production reactors at the Mayak Production Association. According to documents made public by Mayak officials, Moscow intends not so much to dismantle these reactors as bury them on site, rather than dismantle and store their graphite stacks.

Source: Charles Digges, http://bellona.org, 09 January 2019.

NUCLEAR COOPERATION

JAPAN–UK

Japan's Nuclear Rethink could Derail UK Energy Plans

Japan's prime minister Shinzo Abe is in London, and it seems likely in his meeting with Theresa May that the Japanese-backed nuclear power plant in Wales will come up. The Wylfa project, to be built by Hitachi and its subsidiary Horizon, is one

of a clutch of planned nuclear power stations which the UK government has heavily prioritised for security of power supply, and meeting the country's climate obligations.

Late last year another of the 6 major projects, the proposed Moorside plant in Cumbria, was effectively abandoned after Toshiba pulled out. And another has come under fire as questions are raised about security issues flowing from the Chinese builders.

These developments effectively illustrate that UK nuclear power policy is heavily dependent on overseas developers. What is less understood is that there are significant shifts underway in Japan which strongly suggest Hitachi's projects may too be at risk.

'Nuclear Export Superpower': The most advanced of Horizon's nuclear plans is a large power station to be built at Wylfa on Anglesey, North Wales. In fact, with the collapse of Moorside, the Wylfa plant is the only nuclear project that could realistically be built before 2030, in addition to the plant already under construction at Hinkley Point in Somerset.

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Japan, however, is reconsidering its nuclear export strategy. Because it keeps going wrong. Until recently it had 3 companies interested in building nuclear power stations abroad: Toshiba, Mitsubishi and Hitachi. These companies have experience building nuclear stations at home but since the Fukushima disaster in 2011, they have had to look elsewhere. Seeking to help these giants of Japanese industry to maintain their businesses, Prime Minister Abe reportedly wanted to turn Japan into a "nuclear export superpower".

Misfires: Toshiba pulled out of Moorside last year because it had run up huge losses in building 2 nuclear plants in USA. One, the Summer project in South Carolina, was abandoned altogether despite it being nearly half-built. Toshiba has pulled out not just of Moorside, but of building new nuclear power stations altogether.

Meanwhile, another of Japan's nuclear groups, Mitsubishi Heavy Industries (MHI), has also been struggling to get its international project off-the-ground. It had one nuclear power station in the offing, at Sinop in Turkey, following an agreement years ago between the two countries' prime ministers. However it seems clear that MHI is preparing to leave the project amid its "ballooning costs". This is the only nuclear power station project MHI had an interest in.

The last of the companies involved in Japan's nuclear export push is Hitachi. It has one active overseas nuclear project in UK at Wylfa, North Wales, and one more speculatively planned at Oldbury in Gloucestershire. Hitachi, however, are reportedly be thinking of scrapping the project as its costs and risks become unmanageable. Hitachi could be looking at Toshiba's near-bankruptcy and thinking 'let's not go there'. According to their chairman the project was in "an extremely severe situation" as it struggled to attract investors, even though UK government may have promised as much as two thirds of the build cost.

Despite this already generous largesse (on behalf of UK taxpayers, not offered to any other energy projects) Hitachi are intending to come back to UK government and ask for more. It looks like no assessment of the risks by a private funder come back looking good, and the only way nuclear plants can be built is with government stepping into very risky projects that require taxpayers to shoulder the risk.

The aversion from private investors may not only be because of the rising costs, but also that the operating performance of the proposed reactor is pretty poor (albeit partly due to earthquakes). Notably Hitachi continues to be happy to spend many billions of pounds on power grid investments, but not its own nuclear reactor, which it wants UK taxpayers to fund.

Second Thoughts: Unsurprisingly this tale is making many in Japan have second thoughts.

Major Japanese newspapers have opposed their own taxpayers lending support to the Wylfa project, even though a home-grown company would be getting the benefits. And during the Xmas break, Japan's third largest newspaper called for the nuclear export strategy to be abandoned. Another paper attacks the 'bottomless swamp' of nuclear funding in UK and remarks upon how few countries seem to be following the UK-style nuclear-focused policy.

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Reportedly Japanese government has asked its development banks to fund the 'nuclear export strategy', and Wylfa in particular, but they don't want to. It is quite difficult to see how Hitachi can manage the risks of this project without some home support, and support in Japan is ebbing away.

Few other countries will be stepping into the UK's nuclear hole. The South Korean company KEPCO – that once might have taken over the Moorside project – is also finding exporting nuclear power tough to export, as 'shoddy' construction in a nuclear plant in United Arab Emirates, with attendant delays and extra costs, is showing. For the UK, which has made a heavy bet on new nuclear to cover for retiring plants and make up a significant share of its decarbonisation targets, news from the other side of the world makes that bet look a dodgy one.

Source: Doug Parr, https://unearthed. greenpeace.org, 09 January 2019.

USA–UK

Status of US-UK 123 Agreement Regarding Nuclear Trade

As we reported in 2017, the United Kingdom's exit from the European Union, set for March 29, 2019, will also include withdrawal of the United Kingdom from the European Atomic Energy Community (Euratom). Exports of nuclear materials, goods, and services from the United States to the United Kingdom currently are authorized through the US–Euratom agreement and the Euratom Cooperation Act of 1958. Essentially, these arrangements are the substitute for a bilateral agreement for cooperation in the peaceful uses of nuclear energy pursuant to Section 123 of the Atomic Energy Act of 1954, as amended (a 123 Agreement), with each of the 28 member countries of Euratom.

In order to address the UK withdrawal from Euratom, the United States and United Kingdom have negotiated a bilateral 123 Agreement, which President Trump transmitted to Congress in May 2018. Staff from the US Senate Foreign Relations Committee have confirmed to us that the required 90 days of review during continuous session of Congress has expired with no congressional action. As such, President Trump is now free to implement the 123 Agreement.

On November 12, 2018, the British government transmitted the US–UK 123 Agreement to Parliament, and later in the month it presented the Nuclear Safeguards Regulations required to comply with the terms of the 123 Agreement. It is expected that the 123 Agreement will enter into force on a date to be agreed by the United States and United Kingdom through a ministerial exchange of diplomatic notes, which presumably will coincide with the UK withdrawal from Euratom. Thus, we do not anticipate any disruption in nuclear trade between the United States and United Kingdom.

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Source: https://www.lexology.com, 08 January 2019.

NUCLEAR PROLIFERATION

NORTH KOREA

North Korea's Kim Looking to 'Achieve Results' with Trump in 2nd Summit

North Korean leader Kim Jong Un has reportedly told the leader of his only major ally, China, that he wants to "achieve results" on the nuclear standoff on the Korean Peninsula during a second summit with U.S. President Donald Trump. The comments, contained in Chinese state media reports, came a day after Kim left Beijing on his special armored train after a two-day visit to the Chinese capital. Kim's trip to China — his fourth in the past 10 months — is believed to be an effort to coordinate with Beijing ahead of a possible second summit with Trump. It comes after U.S. and North Korean officials are thought to have met in Vietnam to discuss the site of the summit.

While North Korea hasn't conducted any test launches or detonations in more than a year, it has displayed no real intention of abandoning the programs that are seen as guaranteeing the government's survival.

North Korea will "make efforts for the second summit between (North Korean) and U.S. leaders to achieve results that will be welcomed by the international community," Kim was quoted as saying by China's official Xinhua News Agency. All sides should "jointly push for a comprehensive resolution of the Korean Peninsula issue" and North Korea will "continue sticking to the stance of denuclearization and resolving the Korean Peninsula issue through dialogue and consultation," Xinhua quoted Kim as saying.

Kim also said North Korea hopes its "legitimate concerns" will be given due respect, a reference to its desire for security guarantees and a possible peace treaty to formally end the 1950-53 Korean War. He also credited Chinese President Xi Jinping with helping reduce regional tensions, saying "the Korean Peninsula situation has been easing since last year, and China's important role in this process is obvious to all."

... Kim's Beijing visit was seen as part of an effort to win Chinese support for a reduction of U.N. sanctions imposed over his nuclear weapons and ballistic missile programs. The sanctions have severely impacted his country's already ailing economy. While North Korea hasn't conducted any test launches or detonations in more than a year, it has displayed no real intention of abandoning the programs that are seen as guaranteeing the government's survival.

The trip also came after he expressed frustration in his annual New Year's address over the lack of progress in negotiations with Washington since the Singapore summit, saying that if things don't improve — meaning that if sanctions relief and security guarantees aren't in the offing — North Korea might have to find "a new way" forward.

While Trump says he considers Xi key to enticing Kim into taking concrete steps toward denuclearization, the president's own relationship with his Chinese counterpart has frayed over the U.S.-China trade war. Officially, at least, China says it considers the tariff battle and North Korea's weapons programs to be entirely separate. At the daily Chinese foreign ministry briefing, spokesman Lu Kang said Beijing remains supportive of efforts to end tensions over U.S. demands for a halt to North Korea's nuclear and missile programs. ...

Source: Christopher Bodeen, https://www.militarytimes.com, 10 January 2019.

NUCLEAR SAFETY

CANADA

How a Nuclear Reactor Got Shut Down by Accident in Ontario

Canadian nuclear safety officials have been dealing with a split-second mistake that shut down a reactor at the Pickering nuclear station

east of Toronto. There was no radioactive leak, no injury, no damage to equipment. But there were red faces when someone pushed the wrong button, and a machine that can produce half a billion watts of electricity stopped.

It happened like this: The reactor had been shut down for planned maintenance. It was starting up again at low power with one of its two control computers still down for maintenance but the other one running. Fine so far.

Then, a nuclear operator pushed the wrong button and shut off the computer that was still running. With both computers now down, staff were required to shut down the entire reactor manually. That led to this exchange, shown in transcripts of the Nov. 8 meeting of the Canadian Nuclear Safety Commission, between commission vice-president Kathy Penney and Stephanie Smith, director of operations and maintenance at Pickering Nuclear. (The DCC referenced below is a computer.)

"MEMBER PENNEY: I had a question about the Appendix C with respect to the DCC. So in my world if I ask my computer to delete something, it comes back and asks me, do I really want to delete it, and it strikes me that shutting down a nuclear reactor there should be some check, you know. So I'm just asking and it's maybe a naïve question, but you can push a button and it doesn't come up and say, do you really want to do this, it just does it?

"MS SMITH: Again, Stephanie Smith, for the record. Yes. That would actually be very helpful, but, unfortunately, these computers were designed back probably late '50s, early '60s when those types of things were not thought of. So these are just very simple computers. There's actually a picture in Appendix B that you can see and there's actually just two push buttons and if you hit the wrong one you do turn off that computer."

Another Pickering official told the commission that "There is a principle here, though, where we want to keep those machines as simple as possible. As you add layers of protection or layers of software, then there are other opportunities for that software not to do what you expect it to." The reactor was running again a few hours later. Ontario Power Generation said it has undertaken corrective action that focuses on training and mentorship. The nuclear operator was removed from the job temporarily and sent for "remediation."

Source: Tom Spears, https://ottawacitizen.com, 03 January 2013.

GENERAL

National Strategies for Nuclear Safety Regulatory Competence Needed

Establishing a national strategy is a must to ensure a sustainable supply of competent, well-trained regulatory staff who can effectively oversee nuclear safety. That was one of the key conclusions of the IAEA-supported Steering Committee on Regulatory Capacity Building and Knowledge Management, held 17-21 December 2018 in Vienna.

Establishing a national strategy is a must to ensure a sustainable supply of competent, well-trained regulatory staff who can effectively oversee nuclear safety. That was one of the key conclusions of the IAEA-supported Steering Committee on Regulatory Capacity Building and Knowledge Management, held 17-21 December 2018 in Vienna.

Regulators from 27 countries assessed the status of education and training for regulatory bodies, exchanged experiences and offered feedback during the meeting, which was the committee's 10th since its establishment in 2009.

A few countries have strategies and many others have begun working on them, but more work is needed, meeting participants noted. Without a strategy in place, there is a risk that regulatory bodies won't find competent candidates to fill future needs. Meeting participants emphasized the need for regulators to support each other across borders, and encouraged the IAEA to continue offering general guidance and tailored assistance. The IAEA established the Steering Committee to help regulators ensure that they

have the competence needed to maintain a high level of nuclear safety, based on the IAEA Safety Standards. ...

During the week-long meeting, IAEA experts updated the committee members on the services and tools the Agency offers in education and training in nuclear installation safety. The participating regulators shared good practices in regulatory competence management, training for leadership, priorities and challenges. The meeting's conclusions will contribute to the development of the IAEA's approach to education and training in nuclear safety after 2020, when its current Strategic Approach to Education in Training in Nuclear Safety ends.

Source: Laura Gil, https://www.iaea.org, 03 January 2019.

NUCLEAR SECURITY

USA

Can Nuclear Power Plants Resist Attacks of Electromagnetic Pulse?

Yes. Specifically, the small modular nuclear reactor company, NuScale, out of Oregon, has made their reactor resistant to EMP and most other reactor designs should follow. EMPs are one of those things that many people think is fake, or over-blown, or a conspiracy theorists' dream. But they are real. EMPs can be either natural, from things like extreme solar geomagnetic disturbances, or man-made like a large thermonuclear detonation or a cyberattack. If they are coordinated with physical attacks then things can get real dicey real fast.

As the U.S. Commission to Assess the Threat to the United States from EMP Attack points out, "the physical and social fabric of the United States is sustained by a system of systems – a complex and dynamic network of interlocking and interdependent infrastructures whose harmonious functioning enables the myriad actions, transactions, and information flow that undergird the orderly conduct of civil society."

EMP effects represent arguably the largest-scale common-cause failure events that could affect our electric power grid and undermine our society, leaving it vulnerable on many fronts. High-voltage control cables and large transformers that control the grid are particularly vulnerable.

According to the Commission, EMP effects represent arguably the largest-scale common-cause failure events that could affect our electric power grid and undermine our society, leaving it vulnerable on many fronts. High-voltage control cables and large transformers that control the grid are particularly vulnerable. Transformers weigh 400 tons, take two years to build, and cost $7 million apiece. We are already way behind in having backup transformers ready, so if many go out at once, we have a big problem powering our country.

So can we do anything about it? The phenomenon of a large electromagnetic pulse is not new. The first human-caused EMP occurred in 1962 when the 1.4 megaton Starfish Prime thermonuclear weapon detonated 400 km above the Pacific Ocean. One hundred times bigger than what we dropped on Hiroshima, Starfish Prime resulted in an EMP which caused electrical damage nearly 900 miles away in Hawaii. It knocked out about 300 streetlights, set off numerous burglar alarms, and damaged a telephone company microwave link that shut down telephone calls from Kauai to the other Hawaiian islands. And that was from 900 miles away.

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On the natural side, in 1989, an unexpected geomagnetic storm triggered an event on the Hydro-Québec power system that resulted in its complete collapse within 92 seconds, leaving six million customers without power. The storm

resulted from the Sun ejecting a trillion-cubic-mile plume of superheated plasma, or ionized gas.

It took two days for this cloud to smash into the Earth's magnetosphere overwhelming its normal ability to throw off charged cosmic particles, triggering hundreds of incidents across the globe and causing undulating, multicolored auroras to spread as far south as Texas and Cuba. Such storms occur every 60 years or so, and in 1989, we weren't anywhere near as electrified and electronically interconnected as we are today, or as we will be in 30 years. This is the most likely EMP to occur.

A new 2018 study by the U.S. Air Force Electromagnetic Defense Task Force addresses direct EMP threats to the United States and its allies. While some issues have existed for decades, the window of opportunity to mitigate some of these threats is closing. Meanwhile, many existing threats have gained prominence because of the almost universal integration of vulnerable silica-based technologies into all aspects of modern technology and society.

In 2008, the Commission to Assess the Threat to the United States from Electromagnetic Pulse Attack made a compelling case for protecting critical infrastructures against EMP and solar geomagnetic disturbances. To avert long term outages, the U.S. must assure the availability of survivable power sources with long-term, readily accessible and continuous fuel supplies to blackstart the grid, sustain emergency life-support services, and reconstitute local, state, and national infrastructures. Long term outages are defined as the interruption of electricity for months to years over large geographic regions.

The Nuclear Regulatory Commission tracks this issue closely, and has been examining these issues for more than 30 years, starting in the late 1970s when the agency studied how EMP could affect nuclear power plant safe-shutdown systems. The agency concluded as recently as two years ago that nuclear power plants can safely shut down following an EMP event. NRC drafted a rule last year on maintaining key plant safety functions after a severe event, particularly on how to keep spent fuel pools cool.

Protection of electric power plants, and upgrading our infrastructure, will be essential in preventing long term outages and in restarting portions of the grid that have failed in the face of wide-area threats. It would be good at this point to understand some of the technical steps to an EMP. The first pulse occurs when gamma rays emanating from the burst interact with the Earth's atmosphere and eject electrons that stream down the Earth's magnetic field to generate an incredibly fast electromagnetic pulse within about a billionth of a second after the burst. That pulse peaks around 50,000 V/m on the Earth's surface.

This first pulse is of the most concern because of its high amplitude and wide bandwidth, allowing it to inject significant energy into conductors as short as twelve inches. Fortunately, this pulse only lasts a millionth of a second, but still time to wreak havoc. Another pulse occurs just after this, resulting from a second set of gammas produced by energetic neutrons. The peak fields are much lower, about 100 V/m and last less than a second.

The final pulse is a wave similar in nature to naturally-occurring geomagnetic storms associated with coronal mass ejections from the Sun's surface. These are low frequency, low amplitude pulses that lasts from minutes to hours. Although this may appear to be less intense, these can cause direct damage to equipment connected to long electrical lines, and can damage transformers, uninterruptible power supplies and generators.

Fortunately, the same protection devices we have developed to withstand natural solar events will work with this third pulse. So new protection strategies need to focus on the first two short pulses. Nuclear power plants have a special place in any strategy because of perceived threats of meltdowns of the core and of nuclear fuel pools, as well as from public concern over all things nuclear. But in addition, nuclear plants could be the most likely power generators to restart quickest after a pulse and would be the baseload power that could keep critical parts of society operating.

At present, the NRC has no regulatory framework to address the EMP risk to nuclear power stations, although NRC is currently working to create new fuel storage standards and most nuclear plants are EMP-hardening their back-up generators. So while there are differing opinions as to the direct threat of an EMP to a nuclear power plant, it is generally agreed that the threat should not be ignored.

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So NuScale didn't ignore it, and set about to actively deter EMP effects in the design of their new SMR. NuScale's SMR is already the most resilient, reliable and flexible of any energy source in history, with Black-Start Capability, Island Mode and First Responder Power, without needing external grid connections, capable of withstanding earthquakes, category 5 hurricanes and F5 tornados, planes crashing into it, floods, and cyberattacks. Now it has added EMP threats and geomagnetic disturbances.

Safety-related systems are electrically-isolated from the main plant electrical system, and all sensor cables penetrate the reactor containment vessel at a single location (containment vessel top plate), thereby reducing the EMP pathway. In addition, the reactor building provides effective electric shielding of EMPs by being several-foot thick concrete walls laced with steel rebar.

Fortunately, NuScale is the first SMR company to file a license and design certification application with the NRC, and it is the first one to have the NRC complete their Phase 1 review – in record time. So the first unit should roll out in only a few years. NuScale evaluated support systems of their SMR as either likely vulnerable or inherently resilient to an EMP. The evaluation involved a qualitative vulnerability assessment of above and below ground subsystems, including communications, controls, switches, transformers and machinery within the SMR with special attention to the nuclear plant's ability to safely shut down and the potential to provide continuous power during and after exposure to an EMP pulse.

Several design features allow the SMR to withstand an EMP attack. There are no safety-related electrical loads, including pumps and electric motor-operated safety valves. Because natural convective core heat removal is used, electrically-operated pumps are not needed to circulate coolant. This means that, if necessary, the reactor can shut down and cool itself for indefinite periods without the need for human intervention, adding water, or external electrical power. So the inherent safety of the reactor is impervious to an EMP and can't melt-down due to an event.

But just being safe isn't good enough. It would be great to be able to start up right away or, better yet, keep operating right through the event, so that power is available to mitigate, recover and respond to the worst of attack. The SMR can go into Island Mode operation, not requiring a connection to the grid to provide electrical power, and allowing for a rapid recovery to full power following the event. The reactor modules can keep safely running and go into stand-by mode such that they can be rapidly put back into service.

Also, safety-related systems are electrically-isolated from the main plant electrical system, and all sensor cables penetrate the reactor containment vessel at a single location (containment vessel top plate), thereby reducing the EMP pathway. In addition, the reactor building provides effective electric shielding of EMPs by being several-foot thick concrete walls laced with steel rebar, effectively making it into a Faraday Cage, which is an enclosure or structure that can block an electromagnetic field. Electrical conducting lines are underground, which significantly attenuates the first burst effects. NuScale uses redundant fiber optic cable for communication links, which are immune to EMP effects.

The NuScale plants feature multiple reactors, multiple turbine generators, an Auxiliary AC Power

Source (AAPS), two 2MW backup diesel generators for blackstarting the plant, multiple main power transformers (MPTs) and unit auxiliary transformers (UATs), and redundant backup battery banks. Such redundancy is essential for addressing these complex threats. The design also provides good grounding practices, lightning protection systems, surge arrestors for connections to the switchyard, delta-wye transformers, and circumferentially-bonded stainless-steel piping. So new nuclear plants are able to be designed, and old ones upgraded, to withstand EMPs better than most energy systems. Their inherent isolation from the rest of the world is similar to why they can so effectively withstand cyberattacks.

Source: James Conca, https://www.forbes.com, 03 January 2019.

The state Environment Department approved a controversial change to how federal officials measure the amount of nuclear waste buried some 2,000 feet underground in Southern New Mexico salt beds. Proponents of the change say it merely clarifies that the storage site will measure the actual volume of transuranic waste deposited there rather than the volume of the massive exterior waste drums.

NUCLEAR WASTE MANAGEMENT

ARMENIA

Armenia Government Approves Radioactive Waste Safe-Management 8-Year Action Plan

At its first Cabinet session of the year, the Government of Armenia approved the 2019-2026 action plan for the safe management of radioactive waste and used nuclear fuel in the country, as well as the action plan-timetable that was developed for the implementation of this program. The objective of the abovementioned legal act is to ensure the fulfillment of Armenia's obligations under international treaties with respect to safe use of atomic energy, and to meet the respective requirements specified by the safety standards of the IAEA and by the Armenian laws and legal acts.

Source: https://news.am/eng/news/489871.html, 10 January 2019.

USA

More Nuclear Waste could Come to New Mexico

In the final days of Republican Gov. Susana Martinez's administration, the state Environment Department approved a controversial change to how federal officials measure the amount of nuclear waste buried some 2,000 feet underground in Southern New Mexico salt beds. Proponents of the change say it merely clarifies that the storage site will measure the actual volume of transuranic waste deposited there rather than the volume of the massive exterior waste drums, called overpack containers — and the air inside. But critics say the result will be an increase in the quantity of material stored at the U.S. Department of Energy's Waste Isolation Pilot Plant near Carlsbad.

Several nuclear watchdog groups, which say they intend to appeal the decision, also fear the change in WIPP's hazardous waste permit from the state could open the door to allowing high-level nuclear waste to be brought into New Mexico. It's unclear whether the Democratic administration of Gov. Michelle Lujan Grisham, who took office, will support the Environment Department's decision in December or take any action to overturn it. The governor hasn't yet appointed a Cabinet secretary to lead the Environment Department.

Tripp Stelnicki, a spokesman for Lujan Grisham, said the administration will be reviewing the potential impacts of the modification. But, Stelnicki said in an email, "that's the case for all of the prior administration's decisions." The governor "certainly recognizes safety at WIPP, for the public and for workers, is utterly paramount," he added. "Safety is the expectation and that expectation will guide decision-making."

Under the Land Withdrawal Act of 1992, Congress limited WIPP's capacity to 6.2 million cubic feet, or just over 175,500 cubic meters. The plant, now about 52 percent full, is the only permanent repository for nuclear waste in the nation. The 1992 law also limits the type of nuclear material that can be stored at the underground facility. Under WIPP's hazardous waste permit from the state, the volume of material stored at the plant has been measured based on the size of each exterior waste container.

Last year, however, the Department of Energy and Nuclear Waste Partnership LLC, a private company that operates the plant, told the New Mexico Environment Department the permit should be altered because it was forcing them to over-calculate the amount of waste at WIPP. Language in the permit required them to count empty space in large packing containers used to store smaller waste vessels — like hulking Russian nesting dolls.

Plant managers and Energy Department officials said that without the permit change, WIPP would ultimately reach its full capacity too soon — with far less nuclear material than Congress intended. Following a public comment period and a three-day hearing in Carlsbad in October, a hearing officer issued an opinion in favor of the permit change.

Still, critics believe the waste measurement change — after nearly 20 years of consistent measurement procedures — is a thinly veiled effort to expand the size and mission of WIPP. ... The permit modification, he said, was allowing the Department of Energy to redefine how much nuclear waste it can dispose of at WIPP without going through Congress.

Without Yucca Mountain, the Department of Energy has considered placing 34 metric tons of weapons-grade plutonium at WIPP. While the plutonium would first be diluted through a complex process, Hancock and others have said it would still be a higher-level material than is allowed at WIPP.

The federal government was planning to open a separate repository for higher-level waste in Nevada. But development of the Yucca Mountain site stalled in 2010 amid opposition, and funding for the project ended the following year. Without Yucca Mountain, the Department of Energy has considered placing 34 metric tons of weapons-grade plutonium at WIPP. While the plutonium would first be diluted through a complex process, Hancock and others have said it would still be a higher-level material than is allowed at WIPP. Reports suggest the waste storage plant's capacity isn't large enough to even accommodate all of the transuranic waste planned for disposal there.In 2017, the Government Accountability Office reported that WIPP does not have enough capacity for all of the transuranic waste kept at federal nuclear sites around the country, and to further expand the facility would require a lengthy regulatory process. ...

Source: Rebecca Moss, http://www.santafenewmexican. com, 05 January 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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