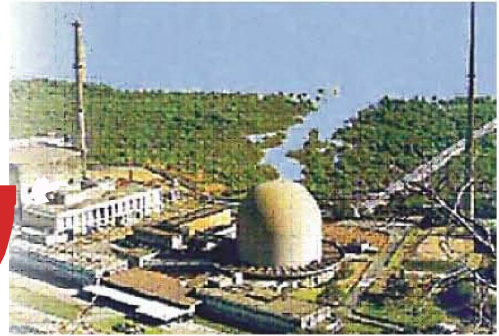


# NUCLEAR SECURITY



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

## OPINION – David Logan

### Did Putin Just Inch Russia and the U.S. Closer to Nuclear War?

Russian President Putin announced that Moscow will suspend implementation of New START, the last remaining treaty between Russia and the United States limiting deployed nuclear weapons. New START limits the number of “strategic” nuclear warheads that Russia and the United States can deploy to 1,550 and the number of deployed strategic nuclear-capable missiles and bombers to 700. The agreement, like its predecessors, was important in limiting arms race pressures, strengthening strategic stability and facilitating communication, transparency and predictability between the world’s two largest nuclear powers.

Putin’s decision, a “suspension” rather than a full withdrawal, is a partial measure. Russia is still party to the agreement. Moscow has claimed that it would continue to adhere to the numerical ceilings established in New START and that it would continue to comply with a 1988 agreement with the U.S. to exchange notifications of launches of intercontinental ballistic missiles and submarine-launched ballistic missiles.

The immediate effects of the suspension are likely limited. The U.S. can still

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Vol 17, No. 09, 01 MARCH 2023

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monitor Russian compliance through what are called “national technical means,” which include satellite imagery. Russia’s ongoing nuclear modernization is already costly and behind schedule and the sanctions against Russia could further jeopardize those efforts. However, Russian suspension of the treaty will, for now, likely mean an end to treaty-mandated data exchanges, on-site inspections and meetings of the Bilateral Consultative Commission (BCC), a body established by the treaty to facilitate implementation and compliance.

The treaty was already under pressure. Earlier this year, the US State Department, in a report to Congress, stated that Russia was not complying. Under the treaty, each side is permitted to conduct a limited number of on-site inspections of the other's nuclear bases annually and may convene meetings of the BCC to discuss compliance concerns. According to the State Department report, Moscow has denied American inspectors' access to Russian nuclear facilities and failed to convene a session of the BCC in a timely fashion.

Putin's decision may give legal cover to Russia's previous decisions to deny U.S. inspectors access and is a sop to domestic hardliners already skeptical of arms control agreements. But his decision may have had other motives as well. It likely also signals a willingness to impose costs on the U.S. for its support of Ukraine when Russia lacks other credible military or economic tools. The decision could also entail costs for Russia. The U.S. could match Russian suspension and stop providing data or permitting inspections.

Indeed, a U.S. official stated that "The principles of reciprocity, mutual predictability, and mutual stability will continue to guide the U.S. approach to implementation of the New START Treaty." The suspension will further increase Russia's diplomatic costs worldwide. Commenting on Putin's announcement, a spokesperson for China's Foreign Ministry, while refraining from criticizing Russia, still noted that Beijing "hopes the two sides can properly resolve the differences through constructive dialogue and consultation to ensure the treaty's sound implementation."

Russian suspension of New START is only the latest arms control casualty. In 2019, President Trump, citing evidence of Russian noncompliance, suspended and ultimately withdrew from the Intermediate-Range Nuclear Forces Treaty with Russia, which prohibited deployments of ground-based missiles with ranges between 500 and 5,500

kms. In 2020, the U.S. announced it would withdraw from the Open Skies Treaty, an agreement that facilitated transparency by permitting reciprocal unarmed aerial surveillance flights. The U.S. withdrawal, which was opposed by NATO allies (and also Ukraine), was premised on allegations of Russian violations — and was followed shortly afterward by Russian withdrawal. So what does Putin's latest move mean?

First, it demonstrates that Russia is increasingly unwilling to compartmentalize elements of its relations with the United States. In the past, Russia and the U.S. managed to negotiate, extend and implement nuclear arms agreements while clashing on other issues.

**First, it demonstrates that Russia is increasingly unwilling to compartmentalize elements of its relations with the United States. In the past, Russia and the U.S. managed to negotiate, extend and implement nuclear arms agreements while clashing on other issues.**

Second, it further undermines nuclear arms control efforts, placing a unique agreement — set to expire in 2026 — on life support. The treaty is the last of its kind; no other nuclear states have ever negotiated limits to their nuclear forces. Its poor

health may signal to other nuclear-armed states that arms control may not be worthwhile.

It will be important for the United States not to react rashly or get drawn into an arms race. U.S. strategic nuclear forces are still strong and the balance is unlikely to change in the near-term. But nuclear arms control as an international project has certainly been further diminished.

*Source: <https://www.latimes.com/opinion/story/2023-02-23/russia-putin-us-nuclear-war-treaty>, 23 February 2023.*

**OPINION – Roshneesh Kmaneck**

**As Vladimir Putin Raises Nuclear Threat One Year into the War, a Look at Russia's Nuclear Arsenal**

The Russia-Ukraine conflict has completed a year with both countries preparing for new offensives. Putin has said that he is ready to use 'all instruments to counter any threat', raising fears

of a nuclear war. But how many nukes does he have and what dangers do they pose to the world? Is Russia preparing for a nuclear war as the conflict in Ukraine enters its second year?

On 24 February 2022, Russian president Vladimir Putin announced the special military operation into Ukraine... (a)nd now one year on, there's a more palpable fear that this war could go nuclear. Three days ago, Vladimir Putin in his state-of-the-nation address announced

Russia's suspension of the New START treaty, the last remaining nuclear arms control treaty with the United States. When asked to react to Putin's announcement, US president Joe Biden said: "Big mistake." His Secretary of State Blinken added that it was "deeply unfortunate and irresponsible. Putin has once again reiterated that Russia was ready to "use all the instruments at its disposal to counter a threat against its territorial integrity", raising the spectre of waging a nuclear war. The terrifying but true reality is that we cannot know for certain if Putin will use nuclear weapons at this point of time, but it still begs the question — how many nuclear weapons is in Russia's arsenal?

**Counting Russia's Nukes:** Russia, which inherited the Soviet Union's nuclear weapons, has the world's biggest store of nuclear warheads. According to the Federation of American Scientists, Russia has 5,977 nuclear warheads as of 2022. Of this, around 1,500 warheads are retired, 2,889 are in reserve and around 1588 are deployed strategic warheads. The Federation of American Scientists add that about 812 of Russia's nuclear warheads are deployed on land-based ballistic missiles, about

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US have 90 per cent of the world's nuclear weapons. There's also talks that Russia in view of the war is expanding and modernising their nuclear forces, causing more concerns among the West and Ukraine's allies.

**Owning a significant number of nuclear weapons is no doubt a big responsibility and in Russia, this responsibility lies on the shoulders of the president. The nuclear codes of the country are held in the nuclear briefcase called the Cheget and is in the president's possession at all times.**

called the Cheget and is in the president's possession at all times. News agency *Reuters* reports that Russia's defence minister and the chief of the general staff, are also thought to have such briefcases.

The briefcase is a communication tool which links the president to his military top brass and hence, to rocket forces. If Russia thought it faced a strategic nuclear attack, the president, via the briefcases, would send a direct launch order to general staff command and reserve command units which hold nuclear codes. Such orders cascade swiftly down different communications systems to strategic rocket force units which then fire at the United States and Europe.

**Compare this to the World:**

The United States has 5,428 weapons of a nuclear nature, while China has a growing arsenal of 350 warheads. France has 290 warheads, followed by UK's 225 warheads. Pakistan and India have 165 and 160 warheads respectively followed by Israel having 90 warheads. North Korea with 20 warheads is currently increasing its stockpile. This means that Russia and

**Who Controls Russia's Nuclear Weapons?**

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### **How Destructive are Putin's Nuclear Weapons?**

The short answer to this is: Catastrophic. Understand this: The atomic bomb that was dropped in Hiroshima during World War II was 15 kilotons. This attack killed up to 146,000 people, maimed hundreds of thousands of people, and their effects are still being felt today.

Today's nuclear warheads can be more than 1,000 kilotonnes — that's more than six times more potent than the Hiroshima bomb. Russia's intercontinental ballistic missiles, which have the capability of carrying nuclear warheads, can reach and destroy major global cities such as London or Washington. On the eve of the Russia-Ukraine first year anniversary, Putin also announced that the delayed Sarmat intercontinental ballistic missile would be deployed this year. Dubbed Satan 2 by Western analysts, it can be deployed with 10 or more warheads on each missile and can hit any target on Earth. According to experts, this missile has a range of 18,000 km, but some estimate this to be higher. Incidentally, the distance between Moscow and Washington is around 9,000 km, meaning the Sarmat could reach US twice over — if that's even possible.

### **Will Putin Use Nuclear Weapons in 2023?**

While no one knows what Putin is thinking and which direction will he choose in the Russia-Ukraine war, the shadow of nuclear weapons is hanging even more prominently now. His suspension of the New START treaty is just an indication of that. The Nobel Peace Prize-winning ICAN has said that as the war prolongs, the more likely nuclear weapons will become a greater part of this conflict. However, some experts believe that all of Putin's

mentions and warnings of nuclear weapons is just sabre-rattling....

Source: <https://www.firstpost.com/explainers/one-year-russia-ukraine-war-vladimir-putin-russia-nuclear-weapons-12200572.html>, 24 February 2023.

### **OPINION – Hiroshi Minegishi**

### **What Makes South Koreans So Eager for Nuclear Deterrent?**

Recent polls show that more than 70% of those surveyed support the deployment of nuclear arms in the country. "We must make overwhelmingly superior war preparations [to ensure peace]," said South Korean President Yoon Suk Yeol in December last year, echoing the public sentiment on the issue.

At a meeting with U.S. Defense Secretary Austin on Jan. 31 in Seoul, Yoon said he wants to see "an effective and powerful system of extended deterrence" to help dispel public concerns, basically telling the Pentagon chief that the current level of U.S. nuclear deterrence is not sufficient to counter the rising threat from North Korea. Austin replied that the U.S. will "make efforts" to gain the trust of South Koreans.

On January 30, Gallup Korea released the results of a recent poll that showed 76% of respondents said the country needs to develop its own nuclear weapons, three times as many as opposed the idea. A separate survey by a private think tank, conducted in May 2022, also found 70% in support of South Korea possessing nuclear weapons.

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Behind this strong support are growing concerns about North Korean intentions. Various polls indicate that 80% to 90% of South Koreans think it will not be possible to achieve the denuclearization of the Korean Peninsula anytime soon, given the North's intransigence. Compared with Japan, the only country ever hit by atomic bombs, South Korea has few qualms about acquiring a nuclear deterrent. With North Korea hinting at the possible use of tactical nuclear arms, many South Koreans think that it is futile to try to persuade Pyongyang to give up its nuclear arms, and that it is best to respond to nuclear threats with nuclear weapons of its own.

It is not just when conservatives are in power that the public has shown strong interest in a nuclear deterrent. In a survey result published by the Korea Institute for National Unification, a government-backed think tank, in late 2021 71% of South Koreans backed the idea of the country going nuclear. There is also growing public wariness of China. According to a joint survey conducted in Japan and South Korea between July and August 2022, nearly two in three South Koreans said they see China as a "military threat." A survey taken in February through June of the same year by the U.S.-based Pew Research Center found that 80% of respondents had negative views of China.

Given the country's painful history of exploitation and oppression by foreign powers, both liberals and conservatives tend to seek greater self-reliance in defense, with many seeing nuclear weapons as an effective means of ensuring national sovereignty and survival. Unlike many other countries, liberals tend to be more nationalistic than conservatives in South

Korea....In the 1970s, South Korea, which still lagged the North in terms of military power, embarked on a covert nuclear weapons development program under President Park Chung-hee, who feared that the U.S. would abandon South Korea at some point.

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American willingness to risk its security to protect South Korea. Yoon's recent statement regarding nuclear arms reflects public concern about the credibility of the U.S. nuclear umbrella.

Earlier this year, Yoon said South Korea may have to consider acquiring its own nuclear deterrent if the North further escalates its nuclear provocations. U.S. President Biden's administration quickly denied that the U.S. had any plan to reintroduce nuclear weapons into South Korea, as it continues to push for the denuclearization of the Korean Peninsula. The U.S., which deployed nuclear weapons to the country in 1958, withdrew them in 1991.

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Biden is also critical of the idea of South Korea developing its own nuclear arms. In response, Yoon said he would seek "a realistically possible option. Based on an accord between Seoul and Washington, South Korean forces will

come under U.S. operational command in a military emergency. The alliance would probably collapse if Seoul pursues nuclear development in the face of U.S. opposition. Yoon is unlikely to risk that possibility, many pundits say.

The U.S. will continue working to strengthen its extended deterrence. The U.S. would deploy more

advanced tactical weapons to South Korea, including F-22 and F-35 stealth fighters and nuclear-powered aircraft carriers. Washington and Seoul continue to tread a fine diplomatic line: While Yoon does not hide his interest in obtaining nuclear arms, the U.S. has refrained from criticizing him harshly, showing some understanding of South Korean sentiment.

While engaging in a tug of war over nuclear issues, Washington and Seoul are well aware of the impact such talks could have on Beijing, which is increasingly concerned about the prospects of “nuclear dominoes” falling in East Asia, the potential for nuclear proliferation from South Korea to Taiwan to Japan. It seems the tussle between the U.S. and South Korea has also had an effect on North Korea, which has stepped up its nuclear and missile development programs, but has so far refrained from holding a seventh nuclear test.

Source-<https://asia.nikkei.com/Politics/Defense/What-makes-South-Koreans-so-eager-for-nuclear-deterrent2>, 19 February 2023.

#### OPINION – Marc Deschamps

### Nuclear 2.0 in the Race to Net Zero

Nuclear power is staging a comeback in the face of growing concerns about climate and energy independence. But rather than the conventional, large-scale nuclear plants of the past, a new breed of reactor — the SMR — is in the limelight. SMRs are simpler, safer and cheaper than traditional reactors and look set to play a key role in the race to net zero.

#### **Conventional Nuclear: Too Little, Too Late.**

Nuclear power production has been around since the late 1950s and saw massive growth worldwide in the 70s and 80s, at one stage regarded as the future of electricity generation. However, Three Mile Island in the US in 1979, the Chernobyl

disaster in 1986, and more recently the Fukushima meltdown in Japan in 2011 showed how dangerous nuclear power could be. As a result, public anxiety and anti-nuclear sentiment shut down plants and slowed new approvals.

In the UK, five of six nuclear plants are expected to be decommissioned over the next six years, with only two under construction (although the government is targeting another six to begin construction by 2030). In the US, 12 reactors have been closed, and nuclear programmes have ended in Japan and Germany.

Some countries plan to build new conventional reactors, but these won't be nearly enough to meet the 2050 net-zero target, even if we accelerate new construction now. According to the IEA, hitting

net zero requires doubling the current rate of nuclear capacity addition, and it takes eight years to build a conventional nuclear plant after 10-19 years of deliberation, according to the IPCC. Plants also require an enormous upfront capital investment, easily reaching tens of billions of dollars, requiring substantial state support that's not always available.

Even so, nuclear remains a reliable baseload contributor. In France, nuclear power provides 20% of the country's baseload energy requirements. The UK has a similar reliance, albeit slightly lower, and nuclear provides a significant proportion of baseload supply for the whole European continent. While it's true that the future European power system will be predominantly renewables, they still must be complemented with stable baseload electricity production derived from nuclear, which remains far more efficient than fossil fuels and is the only proven carbon-free alternative to coal and fossil fuels for reliable baseload power.

**SMRs Provide an 'Answer':** SMRs are the driving force behind nuclear 2.0. The World Nuclear Association describes SMRs as nuclear reactors,

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typically 300MW equivalent or less, designed with modular technology using module factory fabrication. A variant is vSMRs, or very Small Modular Reactors, up to 15MW. Both types link easily with other energy sources, including fossil fuels and renewables, to increase overall baseload power and grid stability.

SMRs have a much smaller footprint than conventional reactors, which must be built on-site using unique and complex designs. They are manufactured much more quickly and safely in factories with standardised designs, then shipped for installation to remote locations that might be inaccessible to a conventional power plant. Standardised designs bring the benefits of scaled production and reduced costs.

SMRs have a significant safety edge over conventional plants. Older conventional plants are complex and rely on external power systems to cool reactor fuel in case of a power loss, which increases the risk of accidents. SMRs are less reliant on active safety systems like pumps, generators and batteries, instead relying on passive systems that remove the heat from the core without external interference like water reservoirs.

SMRs also largely avoid the maintenance and refuelling complexity of traditional plants. For example, in France, half of the country's reactors are currently shut down because of corrosion problems, maintenance, refuelling and technical issues. The resulting outages have cut French power output to a nearly 30-year low just as the EU faces its worst energy crisis in decades. In contrast, SMRs require less maintenance and have longer refuelling cycles, some up to 20-25 years. SMRs are currently under construction in China and Russia, with a prototype in Argentina and more set to roll out in 2023 in the US and Europe.

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**The Nuclear Option is Back on the Table:** For decades investors kept away from nuclear power. However, SMRs are shifting attitudes, and there is a growing realisation that nuclear is a vital part of the sustainable energy mix to hit net zero. The US, UK, France, Canada, and China, five major nuclear markets, have all already signalled growing support for SMRs and investment is beginning to flow from governments and private investors too for new generation technologies such as micro-reactors, which provide less than 50MWe, molten salt reactors and fast breeding reactors which are experimentally established but yet to be widely commercially deployed. Both the US and Europe now recognise the necessity for nuclear through substantial financing programs, such as the Climate Act in the US and the EU's green taxonomy.

But challenges remain and SMRs promises to enable faster and cheaper construction and remote-location deployment are being put to the test. SMR has been studied for several decades, but none has yet taken shape. Many risks must be framed: uranium supply, waste, security, financing needs, approval regulation, conception, and industrialisation....

Source: <https://environment-analyst.com/global/109138/expert-opinion-nuclear-20-in-the-race-to-net-zero>, 24 February 2023.

**OPINION – Ben Abbs**

**Nuclear Energy Security: Sleep Walking into the Next Energy Crisis?**

Nuclear energy produces roughly one fifth of electricity in the EU and USA. Commentators focus on Russia's dominance over European and American nuclear power in three areas. Firstly, Russia is a major uranium supplier, the material mined for nuclear fuel. Secondly, Russia is even more dominant in developing uranium into

nuclear fuel via conversion and enrichment processes, representing 46% of the world's enrichment capacity. On average, the EU and USA depend on Russia for over 20% of their supplies and services in these areas. Thirdly, commentators note that many nuclear plants in Eastern Europe are Russian made and rely on Russia for maintenance and fuel supply. While Europe and the USA have some counter measures—principally restarting or building processing capacity—these will take time, money, and a thus far absent urgency.

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Focusing on these areas, particularly Russia's dominance in processing, is an insufficient analysis of the risks to the West's nuclear energy security. A broader, more holistic view reveals that uranium is potentially the most vulnerable facet of the nuclear sector. Russia can target the uranium supply beyond its services and trade, and a tight uranium market will amplify the impact of disruptive action.

**Kazakhstan and Uzbekistan, producing over half of the world's uranium supply, are geopolitically vulnerable to Russia. Together with Russia, these countries account for 44% and 49% of the uranium supply to the EU and USA respectively. Kazakh and Uzbek uranium exports often transit through Russia, via St Petersburg or Russian airspace.**

**Russia's Influence Over the West's Uranium:** The uranium market and trade routes are concentrated, making them susceptible to disruption. Kazakhstan and Uzbekistan, producing over half of the world's uranium supply, are geopolitically vulnerable to Russia. Together with Russia, these countries account for 44% and 49% of the uranium supply to the EU and USA respectively. Kazakh and Uzbek uranium exports often transit through Russia, via St Petersburg or Russian airspace. The main alternative route, touted as a Russia-free substitute, is also vulnerable, including land,

maritime, and air routes across the Black Sea, Caspian Sea, Georgia, Azerbaijan, and Armenia. Russia could block transit through its territory, and a particularly desperate Russia could even use its regionally active military forces to interfere with nearby air or maritime trade. New routes for the West are unlikely as they would cross Iran, Afghanistan, or China—which often stockpiles imported uranium rather than exporting it.

Russia could also exert pressure or take action to disrupt uranium production and trade in Kazakhstan, Uzbekistan, and 'alternative route' countries. It has substantial influence over these countries, which were all in the Soviet Union. In Kazakhstan, Russian soldiers propped up President Tokayev in January 2022 and Russian companies are also heavily integrated in Kazakh uranium production. Russia could exert influence on Armenia and Azerbaijan as a militarily-involved broker in the Nagorno-Karabakh conflict, and on Georgia through its puppet breakaway republic of South Ossetia and Abkhazia. Russia also has military bases in and around these states.

Given Russia's military focus in Ukraine, action is likely to be covert or represent 'grey zone' warfare. Threats, pressure, and the modicum of deniability afforded by fake explanations, could drive these pivotal countries in the uranium market to be politically pragmatic, acquiescing or turning a blind eye to Russia disrupting their uranium trade or production. Disruptive action could come in the guise of corporate sabotage,



damage by 'democratic agitators', or technical, environmental, and operational issues, which disrupt uranium supply, just as 'technical issues' initially stopped Russian gas supply to Europe via Nord Stream 1.

**A Global Uranium Deficit will Amplify Any Disruption:**

An emerging structural uranium demand-supply imbalance would amplify the impact of Russian disruption. Demand for nuclear energy is surging as countries begin to recognise it is fundamental to the energy transition; providing reliable energy capacity to complement intermittent power from renewable sources. Supply cannot meet rising demand. Uranium prices have been low for a decade, disincentivising mine development, following the unpopularity of nuclear energy after the Fukushima disaster. Since 2019, uranium prices have doubled, as stockpiles have plummeted, and mine supply has fallen to 77% of global demand. New uranium production to combat the supply deficit will emerge slowly, it takes 10-15 years to build a mine and roughly two years to restart a suspended one.

**The Cost of Action and Inaction:**

Whether Russia, or less likely the West, will pursue this new front in the economic conflict—especially as tensions rise—is unknown. Russia currently holds most the cards in the nuclear sector, particularly uranium supply; patchy Western stockpiles will not provide comprehensive resilience. Indeed, Russia could probably tolerate the economic consequences of weaponizing the sector considering its readiness to risk gas revenue from EU customers. Gas earned it c.US\$55Bn since February 2022 from the EU alone, while

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A uranium supply shock could spark sky-high prices. While the nuclear industry can absorb a

higher uranium price, as the material is a small component of operating costs, being able to pay elevated prices does not guarantee supply. As the global scramble for PPE during the COVID-19 pandemic shows, financial firepower has limits and possession can become king, with the 'have' and 'have nots' quickly becoming apparent. In

2023, being a 'have' could simply mean keeping the lights on.

*Source: <https://globalriskinsights.com/2023/02/opinion-nuclear-energy-security-sleep-walking-into-the-next-energy-crisis/>, 16 February 2023.*

**OPINION – Jonas Kristiansen Noland**

**Nuclear Power is a Friend of Nature and the Environment**

They say "Misfortune never comes alone". That is certainly the case for the current climate crisis. The climate crisis is closely followed by nature and energy crises, and the three mutually influence each other, like the parties of an insoluble triangular drama.

Nuclear power exhibits a higher energy density than that of natural gas power plants, considering the land use of pipelines and mining to feed gas-fired power plants. The generation density of a nuclear power plant included the exclusion zone in addition to the nuclear power plant itself. This land area is approximately three times larger than the nuclear power generation facility. It shows that

even when we take the most challenging assumptions, nuclear power is the world's most area-efficient source of clean energy. Our research shows that human intervention in nature will increase sixfold by 2050 if we follow the energy mix predicted by the International Energy Agency (IEA). It is impossible to solve the climate policy without seriously compromising with nature if today's energy policy is implemented. With today's energy plan, the world's electricity production would require an area one and a half times the size of India or the entire European Union – assuming we become climate neutral.

**Nuclear Power is a Friend of Nature:** If you consider all energy sources, nuclear power is the clear winner in terms of energy density. On an area approximately half the size of the island of Hawaii, nuclear power could supply the entire world with emission-free energy after the fossil age. Nuclear power has a land use that is 99,7 percent less than wind power - in other words, 350 times less.

This should be seen in light of our predicted land use crisis in 2050 if today's energy policies are implemented. An energy transition based on nuclear power alone would save 99,75 percent of natural interventions in 2050. We can even remove most of the natural footprint we have already caused today, which would be a way to restore nature....

**"Not in my back yard" vs. "Yes in my back yard"?** Nuclear power has had a public relations problem

for a number of years. Today, nuclear power is outside the definition of renewable but will presumably be considered renewable in the long term.

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Uranium - the fuel of nuclear power – will, in the future, be obtained from the sea, where uranium is naturally replenishable. In addition, used uranium can probably be reused with new technology. Nuclear power would then be qualified as a renewable energy source.

Land use is a factor that increasingly influences the popularity of competing energy sources to nuclear power. This is found in the

well-known acronym NIMBY, which stands for "Not in my back yard". This is often used in the context of unpopular wind and solar power developments that affect people, animals, and nature where they're suggested. On the contrary, recent studies show that nuclear power is a desirable neighbor, as it provides local communities with the security of energy supply for business development and jobs. We are therefore talking about the reverse NIMBY effect. Or YIMBY, Yes, in my back yard.

**Climate and Environment Must be Solved Together:** Just as the three crises – climate,

nature, and energy – have arisen together, they must also be solved together. For many years, the focus has been on climate-smart solutions while the environmentally and nature-smart solutions have gone under the radar. We have forgotten how nature conservation and

restoration can play a vital role in mitigating climate effects.

Therefore, we should focus on land use. Our recent study hits on precisely this matter, as it has area

efficiency as its focal point. There is no doubt that in such a competition among clean energy sources, nuclear power would be a clear winner. At the same time, it would be the nail in the coffin for the biggest loser – bioenergy. Is it time to stop cutting down our forests to make on-demand electricity and go nuclear instead?

Source: <https://sciencenorway.no/climate-energy-environment/nuclear-power-is-a-friend-of-nature-and-the-environment/2153787>, 10 February 2023.

**OPINION – Tara Kartha**

**Ticking ‘Doomsday Clock’: How Russia’s suspension of New START Treaty can be a Threat to World’s Nuclear Security**

Few would have noticed a rather more than alarming event recently. The Bulletin of Atomic Scientists, a body founded in 1945 by Albert Einstein, and examines global nuclear and conflict issues, announced that for the first time ever, the ‘Doomsday Clock’ stood at 90 seconds to midnight. The ‘Clock’ has been a reliable indicator for decades of the world’s vulnerability to global catastrophe due to nuclear weapons and other dangers. As President Putin announces his decision to withdraw from one of the most important arms control treaties, that clock probably moved in another second. This is not a question of theories by academics or inane and complex treaties. This is deadly serious. And it has serious implications for us and the region.

**Putin Makes a Speech:** In a speech ahead of the one year ‘anniversary’ of the Ukraine war, the Russian President Vladimir Putin announced that he was submitting a bill to Parliament to ‘suspend’ – not withdraw – from an arms treaty.... Each of them are trying to sharpen their missile capabilities in a race that is as mad as it is expensive. In an attempt to reach some form of stability, the treaty also calls for up to 18 inspections of strategic nuclear weapons sites every year to ensure the other has not breached the treaty’s limits. This, to be clear, is the last

remaining important nuclear treaty that claims to hold the world back from nuclear annihilation. That it hasn’t done so, is apparent in Ukraine, where every day the danger of war gets closer. In other words, these two are holding the rest of the world hostage.

**Arms Control Going Downhill:** Arms control efforts had been rewarding in earlier years, with a series of treaties at least making an effort to put some controls on a reckless arms race. This included not just earlier iterations of the START but also a ban on ABM, 1972 and the INF. This was in fact, the only actual arms limitation treaty, since it banned an entire class of weapons, that is, all nuclear- and conventionally-armed ground-launched ballistic and cruise missiles with ranges of 500-5,500 km.

Besides, the Treaty did allow deployments of about 100 interceptors, more than enough for North Korea, assuming that missile defence worked at all, which was doubtful. What it did extremely effectively was to alarm Russia and China, and lead each to look for counters to a possible missile defence. That included a Russian intercontinental hypersonic glider, a nuclear-powered cruise missile, as well as its own ABM system. China went in for multiple warheads on its missiles and tests of an orbital weapon capable of delivering a hypersonic glide bomb. The end result. No one has a perfect ballistic missile defence and they all have more nuclear weapons programs.

...In short, if START lapses, there is now not a single confidence building measure between the two for the first time in nearly half a century. And this is between powers who are in effect and on the ground – at war with each other. That is evident not just from reports of American casualties on the ground, but also the fact that Europe and NATO have been training and advising Ukraine since its independence. The state of affairs is dangerous particularly for a world already battling climate change, severe inflation and a threatened global recession. It also means that those countries like China and India, who

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have stubbornly kept to a 'minimum' in nuclear numbers, will probably be forced to review their policies. China seems to have done so already, with 120 new silos across Gansu province, though these could also be alternate locations for existing missiles. If China increases its arsenal, Delhi may be forced along the same path. Neither can afford it, and neither should. It's perhaps time for the world to take note and bring an end to a war that has brought a once prosperous Ukraine to its knees, and hit the global economy hard.

There is a view that Putin has made their threat precisely as a negotiation tactic. If it is, then that's all to the good. But as elections loom, Biden is unlikely to agree to allowing any concessions to Russia. But he also has to acknowledge that bipartisan support for Ukraine in the US is slowing, and surveys show increasing pessimism at home as inflation bites. More people are blaming vested interests for a war that seems to benefit only the rich...

Source: <https://www.firstpost.com/opinion/ticking-doomsday-clock-how-russias-suspension-of-new-start-treaty-can-be-a-threat-to-worlds-nuclear-security-12201402.html>, 24 February 2023.

## NUCLEAR STRATEGY

### CHINA

#### China to Triple its Nuclear Warheads by 2035: Report

Beijing has closely monitored the ongoing situation in Russia and reflected that Moscow's strong nuclear deterrence policy had prevented the likes of the US or NATO to open up a war front. In the backdrop of Taiwan tension, China is mulling tripling its nuclear warheads arsenal to 900 by

2035, according to Japan's Kyodo News. Citing Chinese sources, the publication stated that the plans formulated by the People's Liberation Army had been approved by Chinese President Xi Jinping.

The current plan is to raise the number of nuclear warheads to 550 by 2027, the centenary of the foundation of the armed forces, and later take it to 900 by 2035. Politburo understands that the lethal capabilities of nuclear weapons can be a good

bargaining chip, if and when it goes for a Taiwan invasion.

Notably, this is not the first instance when reports of China attempting to expand its nuclear arsenal have swirled around. Last year, a Pentagon report suggested that China was planning to take its nuclear warhead stockpile to 1,500. The report stated that "the Department of Defense estimates that (China's) operational nuclear warheads stockpile has surpassed 400." By 2035, China "will likely field a stockpile of about 1,500 warheads" if its nuclear development pace is maintained.

"They've got a rapid buildup that is kind of too substantial to keep under wraps. It does raise questions about whether they are kind of shifting away from a strategy that was premised on what they referred to as a lean and effective deterrent," a US military official was quoted as saying by Reuters. Notably, Russia currently leads the chart in the number of nuclear warheads in possession. It has 5,977 warheads while the US comes behind at second with 5,428 warheads, according to a report by the Stockholm International Peace Research Institute.

Source: <https://www.wionews.com/world/china-to-triple-its-nuclear-warheads-by-2025-report-561307>, 13 February 2023.

**Countries like China and India, who have stubbornly kept to a 'minimum' in nuclear numbers, will probably be forced to review their policies. China seems to have done so already, with 120 new silos across Gansu province, though these could also be alternate locations for existing missiles. If China increases its arsenal, Delhi may be forced along the same path. Neither can afford it, and neither should.**

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JAPAN

Deterrence by Denial: Japan's New Strategic Outlook

In "the most severe and complex" Japanese security environment of the post-war period, new strategic documents outline a policy of deterrence by denial. In December 2022, the Japanese government approved three security-related strategic documents: the National Security Strategy, the National Defense Strategy, and the Defense Buildup Program. As PM Kishida discussed in his speech in January at Johns Hopkins University, the three documents include the decision to fundamentally reinforce defense capabilities within five years, budget measures to increase defense-related expenditures to two percent of GDP, and the introduction of a long-range counterstrike capability. These, at least, are unprecedented decisions in the history of postwar Japan.

The strategy documents' premise is that the international community is facing its "greatest postwar trial" and that the security environment surrounding Japan is "the most severe and complex" in the postwar era. The documents defined China as the "greatest strategic challenge," North Korea as a "grave and imminent threat," and Russia as a "strong security concern," making three major fronts upon which Japan faces an increasingly complex defense challenge.

Tokyo's strategy documents strongly emphasize, therefore, the need to reinforce deterrence capabilities.

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**The U.S. is developing new operational concepts and enhanced future warfighting capabilities against Chinese aggression. This involves Joint Force combat credibility to fight in-theater operations, as well as integrated support from a distance. The U.S. National Defense Strategy pursues integrated deterrence, where deterrence by denial ("develop asymmetric approaches and optimize ... posture for denial") is also a key concept.**

*Operationalizing Deterrence by Denial:* Therefore, the approach that the three strategy documents seek to take is to operationalize deterrence by denial and new ways of fighting. First, given a status of structural inferiority vis-à-vis China, Japan's goal is not to quantitatively balance the amount of Japanese SDF equipment against the scale of China's conventional forces. Instead, the strategy documents aim to develop SDF capability enough to "[make] the opponent realize that the goal of invasion of Japan is not achievable" and the "damage the opponent will incur makes the invasion not worth the cost." In other words, denying adversaries' prospects of operational success is the essence of the strategy of denial.

The sequence of operationalizing denial strategy is: Disrupting and defeating invasion over long distances through standoff defense capabilities. If the deterrence fails, ensuring asymmetric superiority through cross-domain operations that integrate space, cyber, and electromagnetic domains; and conducting swift and persistent operations to dissuade conflict escalation. In the next five years, until 2027, Japan will strengthen its existing defense equipment enough to prevent or eliminate the possibility of an invasion of Japan, and by roughly 2032 it will fundamentally strengthen its defense capability to "disrupt and defeat invasion much earlier and at places further afield."

Second, another key element of defense strategy is to strengthen the deterrence capabilities of the Japan-U.S. alliance. The U.S. is developing new operational concepts and enhanced future

warfighting capabilities against Chinese aggression. This involves Joint Force combat credibility to fight in-theater operations, as well as integrated support from a distance. The U.S. National Defense Strategy pursues integrated deterrence, where deterrence by denial (“develop asymmetric approaches and optimize ... posture for denial”) is also a key concept.

The essence of the integrated deterrence in the Japan-U.S. alliance lies in joint promotion of the strategy of denial. Fundamental reinforcement of Japan’s defense capability will lead not only to Japan’s own defense but also to the effective projection of U.S. power. Integrated air and missile defense capabilities, sustained and robust operations, and the strengthening of domestic and international facility areas will be key elements for U.S. forces conducting operations in the war zone.

Third, Japan will strengthen its strategic relationships with partner countries in the Indo-Pacific and Europe. Institutional arrangements including the Reciprocal Access Agreement (RAA), the Acquisition and Cross Servicing Agreement (ACSA), and the Defense Acquisition and Technology Transfer Agreement, which both Australia and UK have already signed with Japan, as well as capacity-building support, are particularly important to strengthen cooperation with partner countries.

**Implementation is the Key:** In line with these basic policies, the government has derived seven functions and capabilities: standoff defense capability, integrated missile defense capability, unmanned defense capability, cross-domain operation capabilities, command and control and intelligence functions, mobile deployment capability and national protection, and sustainability and resilience. Most importantly, the key to the success of the three strategy documents in confronting the challenging security environment will be the implementation of the security and defense strategy over the next decade, bringing the core denial strategy to fruition and maintaining peace in the nation and the region.

*Source-<https://www.stimson.org/2023/deterrence-by-denial-japans-new-strategic-outlook/> 22 February 2023.*

## **NORTH KOREA**

### **South Korea-US to Hold Tabletop Exercise; North Korea Threatens ‘Strong Response’**

North Korea fired ICBMs this year that could strike anywhere in the United States. South Korea and the United States are planning to stage a tabletop exercise next week to work towards preparing a joint strategy and response to North Korea’s potential use of nuclear weapons. The North has been carrying out missile launches, including potential ICBMs, which has worried the South and US. South Korea’s Defence Ministry said that the exercise will be led by the alliance’s high-level Deterrence Strategy Committee and will be conducted on February 22 at the Pentagon. It will comprise senior defence policymakers from both sides, the ministry said.

Meanwhile, North Korea threatened an “unprecedentedly persistent, strong” response to the US-South Korea annual military exercises. The North’s foreign ministry slammed the United States for stoking tensions and using the UNSC as “a tool for illegal hostile policy” to pressure Pyongyang. North Korea had “refrained from any special military action” this year except for regular activities, a statement by North’s foreign ministry said. “If it is the US option to show its muscle and counter everything with muscle, the same is true of the DPRK’s option,” the ministry said in a statement carried by state media KCNA. DPRK refers to the Democratic People’s Republic of Korea. North Korea has also resumed preparations for its first nuclear test since 2017....

*Source: <https://www.wionews.com/world/south-korea-us-to-hold-tabletop-exercise-north-korea-threatens-action-563042>, 17 February 2023.*

## **RUSSIA**

### **Putin Says Russia to Deploy Sarmat Nuclear Missiles this Year**

President Vladimir Putin has said the delayed Sarmat intercontinental ballistic missile will be

deployed this year, in comments made on the eve of the first anniversary of Russia's full-scale invasion of neighbouring Ukraine.

The RS-28 Sarmat liquid-fuelled missile – dubbed Satan 2 by Western analysts – was first announced by Putin in 2018 and was supposed to have been deployed last year. CNN reported that the United States believes Russia carried out a test of the Sarmat just before US President Joe Biden visited Ukraine earlier this week, but that the test failed. The Russian defence ministry has not commented on that report.

**The 35-metre (115 feet) missile, which Putin says will make Russia's enemies "think twice", has a range of 18,000km (11,185 miles). Some estimate this to be higher. It can carry at least 10 multiple targetable re-entry vehicles – each with a nuclear warhead – which can each be aimed at a different target. It can also deliver hypersonic Avangard glide vehicles that can travel further and faster, flying in an unpredictable path to spoof missile defences.**

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"We pay special attention, as before, to strengthening the nuclear triad. This year, the first launchers of the Sarmat missile system will be put on combat duty," Putin said in a video released by the Kremlin to mark the "Defender of the Fatherland Day", known in Soviet times as Red Army Day. Last June, Putin had also said the missile would be deployed by the end of 2022.

A year since ordering the invasion of Ukraine, Putin has signalled he is ready to rip up the architecture of nuclear arms control – including the big powers' moratorium on nuclear testing – unless the West

backs off in Ukraine. During a state of the nation address, Putin said Russia would be suspending its participation in the New START treaty, the last remaining nuclear arms pact with the US. But

Moscow later said it would still comply with the treaty until it expires in early 2026. In his address, Putin also said Russia would continue mass production of air-based hypersonic Kinzhal systems and start mass supplies of sea-based Zircon hypersonic missiles. "With the adoption of the Borei-A nuclear-powered submarine project Emperor Alexander III into

the navy, the share of modern weapons and equipment in the naval strategic nuclear forces will reach 100 percent," Putin said.

Source: <https://www.aljazeera.com/news/2023/2/23/putin-says-russia-to-deploy-sarmat-nuclear-missiles-this-year>, 23 February 2023.

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### **Russia to Suspend Participation in Last Nuclear Pact with US**

Russian president Putin announced the suspension of participation in the last remaining nuclear treaty

with the United States. President Putin also cited new ground-based strategic nuclear weapons on combat duty that Russia possessed...(t)he new START Treaty is due to expire on 4 February 2026.

**What is New START Treaty?** The Treaty between the United States and Russia on Measures for the Further Reduction and Limitation of Strategic Offensive Arms, also known as the New START Treaty, was signed between then Presidents

Barack Obama and Dmitry Medvedev in 2010. The New START treaty caps the number of strategic nuclear warheads that the United States and Russia can deploy. It came into force in 2011 and was extended in 2021 for five more years after US President Joe Biden took office. The New START Treaty limited both sides to 1,550 warheads on deployed intercontinental ballistic missiles, submarine ballistic missiles and heavy bombers. Both sides met the central limits by 2018. Together, Russia and the United States account for about 90% of the world's nuclear warheads, and both sides have stressed that war between nuclear powers must be avoided at all costs.

**Repercussions:** Vladimir Putin during his major speech said Russia was tilting towards Asia after the West hit it with the most severe sanctions in modern history. This being said, Russia's hunger for newer weapons and missiles, could take Putin to North Korea, wherein, even a relatively modest arms deal would help lift the country's cash-starved and stagnant economy into growth. North Korea's border closure during the pandemic put its already anemic economy into its biggest contractions in decades. Therefore US' allegation that North Korea has already been supplying arms to Russia for the war with Ukraine, and North Korea's refusal, a deal would possibly turn the economy future of the country.

Notably, Russia has in recent months used its veto power at the United Nations Security Council to block additional sanctions on North Korea for its ballistic missile tests. North Korea is one of the few countries that have recognized the Kremlin-controlled "People's Republics" in Donetsk and Luhansk in eastern Ukraine. Would this mean a complete revival of the Cold War with clear division between the East and the West?

Source: [https://www.livemint.com/news/world/russia-to-suspend-participation-in-new-start-pact-fact-check-repercussions-all-you-need-to-know-](https://www.livemint.com/news/world/russia-to-suspend-participation-in-new-start-pact-fact-check-repercussions-all-you-need-to-know-11676979236441.html)

[11676979236441.html](https://www.livemint.com/news/world/russia-to-suspend-participation-in-new-start-pact-fact-check-repercussions-all-you-need-to-know-11676979236441.html), 21 February 2023.

## **USA-SOUTH KOREA**

### **US-ROK on the Deterrence Strategy Committee Table Top Exercise DSC TTX**

The United States and the Republic of Korea (ROK) conducted the 8th U.S-ROK DSC TTX, February 22, 2023 at the Pentagon in Washington, D.C. Following the TTX, the ROK and U.S. delegations visited the Naval Submarine Base Kings Bay in Georgia, February 23, 2023. During the 54th U.S.-ROK Security Consultative Meeting, November 3, 2022, the ROK Minister of National Defense and the U.S. Secretary of Defense pledged to conduct a DSC TTX annually. This TTX is the first to be conducted during the administration of ROK President Yoon Suk-yeol.

ROK and U.S. defense officials, military officers, and diplomats participated in the TTX.... Participants held in-depth discussions on various approaches to the Alliance's deterrence and response posture in the face of the DPRK's evolving nuclear and missile capabilities. Given the DPRK's recent aggressive nuclear policy and advancements in nuclear capabilities, the TTX scenario focused on the possibility of the DPRK's use of nuclear weapons.

The U.S. and ROK delegations focused their discussion on Alliance deterrence to maintain peace and stability on the Korean Peninsula and potential options for responding to DPRK nuclear weapons use. Both sides discussed various options to demonstrate the Alliance's strong response capabilities and resolve to respond appropriately to any DPRK nuclear use.

The U.S. side highlighted that 2022 Nuclear Posture Review states that any nuclear attack by North Korea against the United States or its Allies and partners is unacceptable and will result in the end of that regime. Both sides affirmed that the Alliance stands ready to respond to the DPRK's

**The New START Treaty limited both sides to 1,550 warheads on deployed intercontinental ballistic missiles, submarine ballistic missiles and heavy bombers. Both sides met the central limits by 2018. Together, Russia and the United States account for about 90% of the world's nuclear warheads, and both sides have stressed that war between nuclear powers must be avoided at all costs.**



nuclear threats. Participants highlighted that improvements in the ROK's advanced conventional capabilities have strengthened deterrence. As such, the delegations discussed how best to leverage ROK non-nuclear capabilities to support nuclear deterrence against DPRK nuclear threats. Both sides concurred on the need to continue to strengthen extended deterrence, including through robust consultative mechanisms and crisis communication, as well as information-sharing, and joint planning and execution.

Both sides agreed that events such as the DSC TTX contribute to improving mutual understanding regarding the utilization and enhancement of Alliance capabilities. The delegations agreed on the importance of joint efforts to deter the DPRK's nuclear use, and the crucial value in preparing potential response measures during armistice and reinforcing existing consultation mechanisms to execute those measures. Additionally, both sides agreed to reflect the strategic approaches discussed during the DSC TTX in the ongoing revisions of the Tailored Deterrence Strategy (TDS) and to conduct follow-on TTXs involving political, military, and interagency participants in the near future to continue the joint planning and coordination process.

Following the DSC TTX, the U.S. and ROK delegations visited U.S. nuclear submarine training facilities located at Naval Submarine Base Kings Bay in Georgia... and emphasized that SSBN forces operated by the U.S. are a key means of

**The U.S. side highlighted that 2022 Nuclear Posture Review states that any nuclear attack by North Korea against the United States or its Allies and partners is unacceptable and will result in the end of that regime. Both sides affirmed that the Alliance stands ready to respond to the DPRK's nuclear threats. Participants highlighted that improvements in the ROK's advanced conventional capabilities have strengthened deterrence.**

**The United States will continue to field flexible nuclear forces suited to deterring regional nuclear conflict, including the capability to forward deploy strategic bombers, dual-capable fighter aircraft, and nuclear weapons to the region.... In light of the DPRK's ongoing missile and nuclear development, the ROK and the United States will maintain close cooperation and continue a range of efforts to enhance extended deterrence.**

providing U.S. extended deterrence to Allies. The United States will continue to work with the ROK to ensure an effective mix of capabilities, concepts, deployments, exercises, and tailored options to deter and, if necessary, respond to coercion and aggression by the DPRK. The United States will continue to field flexible nuclear forces suited to deterring regional nuclear conflict, including the capability to forward deploy strategic bombers, dual-capable fighter aircraft, and nuclear weapons to the region.... In light of the DPRK's ongoing missile and nuclear development, the ROK and the United States will maintain close cooperation and continue a range of efforts to enhance extended deterrence.

Source: <https://www.defense.gov/News/Releases/Release/Article/3308356/8th-us-rok-deterrence-strategy-committee-table-top-exercise-joint-press-release/>, 23 February 2023.

## **BALLISTIC MISSILE DEFENCE**

### **NORTH KOREA**

#### **North Korea Says Surprise ICBM Drill is 'Proof' of 'Nuclear Counterattack' Capabilities**

A North Korean Hwasong-15 intercontinental ballistic missile was fired from Pyongyang International Airport. North Korea said that it had fired off an ICBM a day earlier, in what Pyongyang called a "sudden launching drill" that demonstrated "actual proof" of the country's "fatal nuclear counterattack" capabilities.

The Japanese Defense Ministry said that its reclusive neighbor had launched one of its most

powerful long-range missiles into waters some 200 kilometers off Hokkaido's Oshima Island, inside Japan's EEZ. "The surprise ICBM launching drill ... (is) clear proof of the sure reliability of our powerful physical nuclear deterrent," the state-run Korean Central News Agency said in a report.

This was believed to be the first time that such a drill had been conducted with an ICBM. It was also the first time that North Korea had formally introduced its new Missile General Bureau to the outside world. The bureau is thought to handle missile development, planning, production and procurement, as well as logistics support. Saturday's (18 Feb) launch was significant in that Kim hoped to deliver a message to his enemies that "his country, too, is conducting its own 'drills' and exercises to sharpen its wartime reflexes," said Soo Kim, policy practice area lead at consultancy LMI and a former North Korea analyst at the CIA.

The KCNA report also confirmed that the launch had been conducted at a high-angle, meaning it had been shot nearly straight up so as to avoid overflying neighboring countries, and was intended to highlight the Hwasong-15's maximum range. It said the missile had flown 989 kilometers and hit a maximum altitude of 5,768.5 km, while traveling for nearly 67 minutes "before accurately hitting the preset area" in the Sea of Japan. Speaking on the sidelines of a security conference in Munich, the top diplomats of Japan, South Korea and the United States condemned the launch, vowing to bolster trilateral cooperation — and urging others to strictly enforce United Nations sanctions on Pyongyang.

Pyongyang is banned from using ballistic missile technology under a raft of U.N. sanctions, but China and Russia — both veto-wielding members of the U.N. Security Council — are believed to have taken a more lax stance on sanctions enforcement amid the increasingly acrimonious Sino-U.S. rivalry and Moscow's war against Ukraine. Tensions over

the North's nuclear and missile programs soared in 2022 as it fired off a record number of weapons in the face of calls by the U.S. and its allies to return to denuclearization talks. Experts say this year could prove to be even more perilous, with signs already emerging that Kim remains determined to follow through on a 2021 pledge to build even more advanced missiles and nuclear bombs...

Source-<https://www.japantimes.co.jp/news/2023/02/19/asia-pacific/north-korea-icbm-suprise-launch/> 19 February 2023

## **SOUTH KOREA**

### **North Korea Fires Unspecified Ballistic Missile, Says South Korea**

Tokyo also confirmed the launch, with the defence ministry saying that Pyongyang had launched a "possible ballistic missile," without giving further details. North Korea fired at least one unspecified ballistic missile. Pyongyang's first test since the start of the year that comes days

before Seoul and Washington are due to start joint tabletop exercises.

Tokyo also confirmed the launch, with the defence ministry saying that Pyongyang had launched a "possible ballistic missile," without giving further details. Military tensions have risen on the Korean peninsula after a year in which North Korea declared itself an "irreversible" nuclear state, and carried out sanctions-busting weapons tests nearly every month. In response, Seoul has ramped up joint military drills with key security ally Washington, in a bid to convince the increasingly nervous South Korean public of America's commitment to deter Pyongyang.

**No Talks, More Missiles:** South Korea also called the nuclear-armed North its "enemy" in a defence document earlier this week, the first time in six years it has used the term, signalling a further

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hardening of Seoul's position toward Pyongyang. North Korea's missile tests last year also included one that landed near South Korea's territorial waters for the first time since the end of the Korean War in 1953. At a military parade in Pyongyang last week, North Korea showed off a record number of nuclear and intercontinental ballistic missiles, including what analysts said was possibly a new solid-fuelled ICBM.

The weapons on show included at least 10 of the North's largest Hwasong-17 ICBMs, as well as vehicles apparently designed to carry a solid-fuelled ICBM. North Korea has long sought to develop a solid-fuel ICBM because such missiles are easier to store and transport, are more stable and quicker to prepare for launch, and thus harder for the United States to detect and destroy pre-emptively.

Source: <https://www.ndtv.com/world-news/north-korea-fires-unspecified-ballistic-missile-says-south-korea-3793669>, 18 February 2023.

**USA-SOUTH KOREA-JAPAN**

**US, South Korea and Japan Perform Ballistic Missile Defence Exercise**

This exercise focused on bolstering the interoperability of the three forces and the trilateral cooperation. Three warships of the US, South Korea, Japan carried out trilateral ballistic missile defence exercise just days after the recent North Korea's ICBM test. The defence drill was undertaken in the Sea of Japan on 22 February. This trilateral exercise saw participation of the Arleigh Burke-class guided-missile destroyer USS Barry (DDG 52), Japan Maritime Self-Defense Force's Atago-class guided missile destroyer JS

Atago (DDG 177), and Republic of Korea Navy's destroyer ROKS Sejong the Great (DDG 991).

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Besides bolstering the interoperability of the participating forces, the drill intended to strengthen the trilateral cooperation, and their commitment to uphold a free and open Indo-Pacific. On 18 February, North Korea test-fired a long-range ballistic missile Hwasong-15 ICBM, which is claimed to be capable of hitting targets in the US.

On 19 February, the US carried out separate air exercises – one with the Japanese and the other with South Korean air forces – to boost response capability in the event of any regional threat. The drill with Japan was carried out above the Sea of Japan, and saw the deployment of US Indo-Pacific Command's (INDOPACOM) F-16 fighter jets and B-1 bomber aircraft, along with the Japan Air Self-Defense Force (JASDF) B-15 fighter aircraft. The air training exercise between the US and South Korea saw participation of ROK Air Force's F-35A, F-15K and F-16 fighters, and the USAF's B-1B bombers.

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On 20 February, DPRK fired two short-range ballistic missiles towards the East Sea with their strike ranges claimed to be about 340km and 390km. Now the latest

trilateral missile defense exercise has taken place for the first time after October 2022. On 6 October 2022, a naval exercise was conducted that saw participation of ROKS Sejong the Great, Ticonderoga-class guided-missile cruiser USS Chancellorsville and Arleigh Burke-class guided-missile destroyer USS Benfold, part of the USS Ronald Reagan Carrier Strike Group, and Japan's destroyers JS Chokai and JS Ashigara.

Source: <https://www.naval-technology.com/news/us-south-korea-japan-exercise/>, 23 February 2023.

## EMERGING TECHNOLOGY AND DETERRENCE

### BELGIUM

#### Radiation Detection Drones Tested at Belgian Site

**Test flights of drones fitted with equipment to identify and measure the radiation being emitted from a plume source have been conducted at the Mol site of Belgium's Nuclear Research Centre (SCK-CEN). Further tests flights are planned for later this year to prove a new, precise measurement technique.**

In October last year, a team from Canadian Nuclear Laboratories (CNL) conducted a major drone testing campaign at the BR-1 reactor at Mol as part of a collaboration with SCK-CEN. More than simply airborne plume tracking and measurement, this project explored using drones to identify and measure the radiation being emitted from the plume source.

This campaign was specifically about testing how a shielded, upward-facing gamma spectrometer can be used to monitor the quantity of radioactivity being emitted during an incident, including individual isotopes, by flying transects (predetermined routes) which cross the plume from underneath. The BR-1 reactor was used because it emits an argon-41 plume from its stack during normal operation. These plumes can be picked up by radiation detectors, providing information which could be invaluable to emergency response teams during an accident, and to the recovery team after the initial emergency.

The sensor package - including a Kromek Sigma50 gamma spectrometer and CNL-designed tungsten collimator - were flown by the Belgian civil

protection agency on their drone's platform. CNL said its contribution to this collaboration lies in the customised detection equipment, flight plan development, and interpretation of the results. CNL noted that measurement of plumes has been done with drones many times in the past, but this was an opportunity to enhance the practices, technologies and results being gathered.

A collimator is a device which filters a stream of rays so that only those traveling parallel to a specified direction are allowed through. In this case, a specially designed collimator was used which allows only those gamma rays travelling in a particular direction (parallel to the collimator axis) to pass through. All other rays would be absorbed by the tungsten collimator. This collimator, when paired with a precise flight path, enabled the team to build a very. Above all, there is no longer any need for human intervention in high-risk areas, so you protect yourself at all times while being able to measure much longer, cheaper and better....

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Source: <https://www.world-nuclear-news.org/Articles/Radiation-detection-drones-tested-at-Belgian-site>, 16 February 2023.

### CANADA

#### Canadian University Launches Subcritical Assembly Project

A subcritical assembly - sometimes called a "teaching reactor" - is based on the same nuclear science principles as critical nuclear reactors but remains in a subcritical state, relying on an external source of neutrons to sustain the nuclear fission chain reaction. Unlike a nuclear power plant, which operates in a "critical" state where the nuclear chain reaction is self-sustaining, a subcritical assembly cannot sustain a chain reaction on its own, and stops operating unless the external source of neutrons is proactively supplied. It is incapable of generating power or electricity, or heat that requires cooling.



Ontario Tech says its Subcritical Assembly Project would enable enhanced hands-on, experiential learning opportunities for students, as well as supporting research to develop nuclear technologies and strategies to protect the environment and combat climate change.

The university said it expects to begin the full regulatory approval process shortly, and has already informed the Canadian Nuclear Safety Commission (CNSC) that it intends to apply for an operation licence during the 2023/2024 financial year. It will “actively engage with Indigenous communities and the

broader public” as the project develops. The CNSC’s licensing process also encourages public participation (t)hese assets are currently in storage at Ontario Tech’s campus and, although they could possibly be used “as is”, the university intends to amend the original design to make it better suited to meet its intended training and research purposes and to further enhance safety.

*Source: <https://www.world-nuclear-news.org/Articles/Canadian-university-launches-subcritical-assembly>, 23 February 2023.*

## **USA**

### **Minuteman III Test Launch Showcases Readiness of US Nuclear Force’s Safe, Effective Deterrent**

A team of Air Force Global Strike Command Airmen launched an unarmed Minuteman III intercontinental ballistic missile equipped with a test re-entry vehicle from Vandenberg Space Force Base, California. This test launch is part of routine and periodic activities intended to demonstrate that this U.S. nuclear deterrent is safe, secure, reliable, and effective to deter twenty-first century threats and reassure our allies.

Such tests have occurred over 300 times before, and this test is not the result of current

world events. “A test launch displays the heart of our deterrence mission on the world’s stage, assuring our nation and its allies that our weapons are capable and our Airmen are ready and willing to defend peace across the globe at a moment’s notice,” said Gen. Bussiere, commander of Air Force Global Strike Command.

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The ICBM’s reentry vehicle traveled approximately 4,200 miles to the Kwajalein Atoll in the Marshall Islands. These test launches verify the accuracy and reliability of the ICBM weapon system and provides valuable data to ensure a continued safe, secure and

effective nuclear deterrent. “This launch showcases the redundancy and reliability of our strategic deterrence systems while sending a visible message of assurance to allies,” said Col. Christopher Cruise, 377th Test and Evaluation Group commander. “This multilateral team reflects the precision and professionalism of our command, and our joint partners.”

The ICBM community, including the Department of Defense, the Department of Energy, and U.S. Strategic Command, uses data collected from test launches for continuing force development evaluation. The ICBM test launch program demonstrates the operational capability of the Minuteman III and ensures the U.S.’s ability to maintain a strong, credible nuclear deterrent as a key element of U.S. national security and the security of U.S. allies and partners. Air Force Global Strike Command is a major command with headquarters at Barksdale Air Force Base, Louisiana, in the Shreveport-Bossier City community. The command oversees the nation’s three intercontinental ballistic missile wings, the Air Force’s entire bomber force, to include B-52 Stratofortress, B-1B Lancer and B-2 Spirit wings, the Long-Range Strike Bomber program, Air Force Nuclear Command, Control and Communications systems, and operational and

maintenance support to organizations within the nuclear enterprise.

The LG-35A Sentinel will replace the Minuteman III ICBM with an initial capability of 2029. Until full capability is achieved in the mid-2030s, the US Air Force is committed to ensuring Minuteman III remains a viable deterrent.

Source: <https://www.af.mil/News/Article-Display/Article/3297454/minuteman-iii-test-launch-showcases-readiness-of-us-nuclear-forces-safe-effecti/>, 14 February 2023.

## NUCLEAR ENERGY

### INDIA

#### **Northern India's First Nuclear Plant to Come Up in Haryana's Gorakhpur: Jitendra Singh**

The DAE has also been given permission to set up joint ventures with PSUs for resources to open atomic energy plants, having the potential to fulfill India's energy needs in times to come. North India's first nuclear power plant is coming up in Gorakhpur, Haryana, about 150 km north of the national capital, said Union Minister Jitendra Singh. He added that during PM Modi's regime, one of the major achievements would be the installation of nuclear/ atomic energy plants in other parts of the country, which were earlier confined mostly to the southern states like Tamil Nadu and Andhra Pradesh or in the west in Maharashtra.

According to Department of Atomic Energy, Gorakhpur Haryana Anu Vidyut Pariyojana's (GHAVP) having two units of 700 MWe capacity each of PHWR indigenous design is under implementation near Gorakhpur village in Fatehabad district in Haryana. Till date, an amount of ₹ 4,906 crore has been spent out of total allocated funds ₹ 20,594 crore. Construction of other Main Plant buildings/structures viz. Fire Water Pump House (FWPH), Safety Related Pump

House (SRPH), Fuel Oil storage area-1&2 (FOSA-1&2), Ventilation stack, overhead tank (OHT), Switchyard Control Building, Safety related & Non-safety related Tunnel & Trenches, Retaining walls and Garland Drain is progressing well. Ground improvement in Turbine Building -1 & 2, 220 kV Switchyard and IDCT-1A is completed. Ground improvement in other areas IDCTs, 400kV Switchyard, Emergency makeup water pond and station roads are in progress. The contractors for IDCT package and Turbine Island Package have mobilized site.

Source: <https://www.livemint.com/industry/energy/northern-india-s-first-nuclear-plant-to-come-up-in-haryana-s-gorakhpur-jitendra-singh-11676717190746.html>, 18 February 2023.

### EU

#### **Nuclear Energy Included in EU's New Rules on Green Hydrogen**

The European Commission proposed new rules under which hydrogen produced with nuclear energy is to be considered green. Rather than being labelled as "renewable" though, hydrogen made using

nuclear electricity will be termed as "low-carbon" hydrogen. According to EU officials, there is "no place" for nuclear energy when producing renewable hydrogen, even if this low-carbon alternative will be allowed in the mix. The new rules are part of two delegated acts that the European Commission has implemented, after a year-long delay. France had been pushing to include so-called red hydrogen – made using nuclear electricity – in the green rules, but there had been opposition from both Germany and Spain, with a compromise seemingly made to have the low-carbon alternative.

Renewable hydrogen is a crucial component of our strategy for a cost-effective clean energy transition and to get rid of Russian fossil fuels in some industrial processes. Clear rules and a reliable certification system are key for this emerging market to develop and establish itself

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in Europe. These delegated acts provide much-needed legal certainty to investors and will further boost the EU's industrial leadership in this green sector. There are no financial incentives for being labelled as either a renewable or low-carbon hydrogen, but member states can choose to give state aid to producers of either, according to EU officials. Renewable Energy Directive targets, but could end up making things more expensive....

Source: <https://www.euronews.com/my-europe/2023/02/13/nuclear-energy-included-in-eus-new-rules-on-green-hydrogen>, 13 February 2023.

## FRANCE

### EU Rules that France can Use Nuclear Energy to Make "Green" Hydrogen

But Germany will contest the new definition of "low-carbon" energy. The European Parliament has ruled that hydrogen made with France's nuclear-powered electric grid will be classified as "low carbon." The ruling is part of a set of new EU agreements designed to develop the European hydrogen market, and will be contested by Germany, which has no nuclear power of its own, and argues that nuclear power, while low-carbon, is not renewable and so shouldn't qualify as green energy.

**Pro-Nuclear Definition:** France has backed nuclear power heavily and now gets between half and three-quarters of its electricity from that source, which can make hydrogen with a carbon intensity of only 2.77 kgCO<sub>2e</sub> per kgH<sub>2</sub>. Within its hydrogen plans, the industry committee ruled that this low carbon intensity qualifies it as "green" energy - even though the nuclear fuel used is not technically renewable.

The committee adopted the "low-carbon" definition for any hydrogen which is produced with less than 3.38kgCO<sub>2e</sub> per kg of hydrogen. As it takes around 50kWh of electricity to produce 1kg of hydrogen, the carbon intensity of the electricity used would be 60g of carbon per kWh. Under this definition, hydropower, nuclear and all forms of

solar and wind power would qualify biomass (230g per kWh) would not, and gas (490g) and coal (820g) would be way outside the scope, according to figures cited by Wikipedia.

Hydrogen is classified according to a rainbow of colors, with "grey" hydrogen produced from fossil gas having a carbon intensity of 11kgCO<sub>2e</sub> per kgH<sub>2</sub>. Although nuclear hydrogen has got the go-ahead in the EU hydrogen strategy, France will face an argument to get it included in the wider EU Renewable Energy Directive, which is also under debate. France argues that it is simply realistic to include nuclear power. If EU definitions of "green" energy exclude nuclear, then this would exclude a major resource from the bloc's efforts to decarbonize.

France has eight other European nations on its side, while the anti-nuclear lobby is led by Germany, and German MEP Markus Pieper has upped the ante by stalling a round of talks on the renewable energy Directive, blaming the halt on a lack of clarity over renewable hydrogen. On a smaller stage, the UK is believed to be moving towards labeling nuclear as "green" energy. If nuclear power is billed as "green" then it could encourage investment from the public sector, as such investments would be classified as "sustainable," and the government could also offer funds from green gilts and saving bonds.

Source: <https://www.datacenterdynamics.com/en/news/eu-rules-that-france-can-use-nuclear-energy-to-make-green-hydrogen/>, 13 February 2023.

## POLAND

### Poland Moves Forward with Country's First Nuclear Power Plant

Westinghouse and Poland's Polskie Elektrownie Jadrowe (PEJ) have finalized a contract for pre-design work on what would be that country's first NPP. The agreement announced Feb. 22 moves forward a project that began late last year when Westinghouse was selected by the Polish

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government to build a nuclear plant using AP1000 reactor technology. The project will be located in Pomerania. Government officials said the nuclear plant would feature six AP1000 pressurized water reactors, with total generation capacity of 6 GW to 9 GW. The country's energy plan calls for construction of the plant to begin over the next few years, with the first unit commissioned in 2032 or 2033. Subsequent units would be commissioned after that date, with all six units expected online by 2040.

Poland is exploring nuclear power and renewable energy resources in an effort to reduce carbon emissions from its power generation sector. The country at present gets about 70% of its electricity from stations burning black and brown coal.

PEJ in a news release said, "The signed contract makes it possible to commence the first works preceding the design before the conclusion of the very time-consuming process of agreeing [to] the execution contract. This type of solution is a result of lessons learned from other nuclear projects around the world. This will make it possible for the pace and schedule of activities to be maintained." Moskwa, Poland's minister of Climate and Environment, said, "We have decided to implement and bring about the success of a key project for Poland's energy security, which is the project to build a nuclear power plant in Poland. The project is being built with a stable, experienced and safe partner, a project that is part of Polish-American cooperation. This agreement makes this project even more possible."...

Source: <https://www.powermag.com/poland->

*moves-forward-with-countrys-first-nuclear-power-plant/, 22 February 2023.*

NUCLEAR SECURITY

UKRAINE

IAEA Releases Report on Nuclear Safety, Security and Safeguards in Ukraine

The IAEA issued a report on Nuclear Safety, Security and Safeguards in Ukraine, covering the period between February 2022 and February 2023. The 52-page report provides an overview of the situation and the IAEA's activities to reduce the likelihood of a

nuclear accident during the armed conflict.

"One year has passed since the beginning of the war in Ukraine, marking the first time in history that a war is being fought amid the facilities of a major nuclear power programme," IAEA DG

Mariano Grossi said in a foreword of the report. "As this tragic war enters its second year, I want to reassure the people of Ukraine and the international community that they can count on the IAEA, and me as its Director General, to do everything possible within our remit to assist them and to avert the danger of a nuclear accident that could cause even more suffering where there is already far too much."

In the past year, DG IAEA noted, several of Ukraine's five nuclear power plants and other facilities have come under direct shelling. Every single one of the IAEA's seven indispensable pillars for ensuring nuclear safety and security in an armed conflict has been compromised in Ukraine, including the physical integrity of nuclear

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**In the past year, DG IAEA noted, several of Ukraine's five nuclear power plants and other facilities have come under direct shelling. Every single one of the IAEA's seven indispensable pillars for ensuring nuclear safety and security in an armed conflict has been compromised in Ukraine, including the physical integrity of nuclear facilities; the operation of safety and security systems; the working conditions of staff; supply chains, communication channels, radiation monitoring and emergency arrangements; and the crucial off-site power supply.**



facilities; the operation of safety and security systems; the working conditions of staff; supply chains, communication channels, radiation monitoring and emergency arrangements; and the crucial off-site power supply.

“The IAEA has been closely monitoring the situation and assisting Ukraine every single day since the start of the war,” Director General Grossi said. “This assistance has involved the continuous engagement of the IAEA’s Incident and Emergency Centre; nine IAEA missions to Ukraine; the stationing of IAEA safety and security experts at every Ukrainian nuclear site, including Zaporizhzhya Nuclear Power Plant on the front lines of the war; facilitating an international assistance package totalling over €7 million; and keeping the world informed of the situation at Ukraine’s nuclear sites in more than 140 web updates, four reports and multiple briefings, including to the United Nations General Assembly and Security Council.” Director General Grossi further highlighted his efforts since September 2022 for the implementation of a nuclear safety and security protection zone at the Zaporizhzhya Nuclear Power Plant. The report also gives an overview of relevant aspects of the implementation of safeguards under the current circumstances in Ukraine.

*Source: <https://www.iaea.org/newscenter/pressreleases/iaea-releases-report-on-nuclear-safety-security-and-safeguards-in-ukraine>, 23 February 2023.*

### **IAEA Director General Statement on Situation in Ukraine**

Director General Rafael Mariano Grossi appealed for constructive efforts by all involved parties to facilitate this month’s already delayed rotation of IAEA experts to and from Ukraine’s Zaporizhzhya

Nuclear Power Plant (ZNPP), where they are carrying out activities to help ensure nuclear safety and security during the current military conflict.

Director General Grossi stressed the vital importance of the continued presence of the IAEA Support and Assistance Mission to Zaporizhzhya (ISAMZ) at Europe’s largest NPP, which has gained worldwide recognition and support since it was established almost half a year ago. However, a planned rotation of the three ISAMZ experts present at the ZNPP since early January has been delayed for more than two weeks now, with the replacement team already in Ukraine. “The nuclear safety and security situation in Ukraine – especially at the Zaporizhzhya Nuclear Power Plant

**The nuclear safety and security situation in Ukraine – especially at the Zaporizhzhya Nuclear Power Plant – continues to be dangerous and unpredictable. ISAMZ has been playing a key role in helping to protect this major nuclear facility – with its six reactors – during the war. Their presence is contributing to the maintenance of nuclear safety and security, which is in everybody’s interest. The Agency is doing everything it can to conduct the safe rotation of our staff there as soon as possible. Their safety and security are my top priority.**

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are my top priority” DG Grossi said.

The DG said he was aware of recent statements and positions by both sides. “While these reflect their opposing views about the situation, it is important to approach this in a practical spirit bearing in mind the importance of the mission, for people in Ukraine and beyond,” he said.

Director General Grossi established ISAMZ on 1 September last year, and the current Agency team at the plant is the fifth so far. During rotation, the IAEA teams cross the frontline between Ukrainian- and Russian-controlled territory.

The missile attacks across Ukraine resulted in the reduction of power at all three operating NPPs.

This was reported to the IAEA by Ukraine and confirmed by the IAEA teams on the sites. In view of persistent nuclear safety and security risks, the Director General said he remains determined to agree and implement a nuclear safety and security protection zone around the ZNPP as soon as possible, even though the negotiations with Ukraine and the Russian Federation have made slower progress than he had hoped for. The IAEA teams continue to review the nuclear safety and security situation at all

**The IAEA teams continue to review the nuclear safety and security situation at all sites against the IAEA Seven Indispensable Pillars for ensuring nuclear safety and security during an armed conflict and to support the identification of further assistance to the nuclear facilities. The IAEA is continuing to organize and coordinate deliveries of equipment to help Ukraine ensure nuclear safety and security. The tenth such delivery of equipment has just taken place....**

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Source: <https://www.iaea.org/newscenter/pressreleases/update-147-iaea-director-general-statement-on-situation-in-ukraine>, 20 February 2023.

**Scientific and technical assistance under the agreement will promote physical protection of the Armenian NPP; implementation of nuclear non-proliferation guarantees; the safety of radioactive materials & waste; environmental monitoring; and development of safety-related regulatory documents.**

## USA-ARMENIA

### Armenia to Expand Nuclear Security Cooperation with US

The government of Armenia has approved signing a nuclear safety co-operation agreement with the US Nuclear Regulatory Commission (NRC). Under the agreement with the Nuclear Safety Regulatory Committee of Armenia, NRC will support Armenia to strengthen its regulatory body and to develop the skills and abilities of the Armenian NPP personnel. This includes the licensing stages for construction of a new NPP, as well as analysis and assessment of safety.

Scientific and technical assistance under the agreement will promote physical protection of the Armenian NPP; implementation of nuclear non-proliferation guarantees; the safety of radioactive materials & waste; environmental monitoring; and development of safety-related regulatory documents.

Cooperation between Armenia and the US on technical exchange of information on nuclear safety issues began in 1995 and the first formal agreement was signed in 1997. It has since been renewed every 10 years, in 2007 and 2017. In December 2021, the US proposed a new agreement providing for cooperation on nuclear & radiation safety regulation in the field of atomic

energy use. In March 2014, Armenian government decided to extend the plant's service life up to 2026. The extension was financed by a Russian \$270m loan and a \$30m grant. In June 2022 the Armenian NPP and the Rusatom Overseas JSC (part of Rosatom) signed a memorandum of understanding to start preparations for construction of a new nuclear unit.

Source: <https://www.neimagazine.com/news/newsarmenia-to-expand-nuclear-security-cooperation-with-us-10593161>, 14 February 2023.

## SMALL MODULAR REACTORS

### CANADA

#### Canada Launches \$30 Million Small Modular Reactor Funding Program

The Canadian government has put its support in small nuclear to support decarbonizing provincial

grids and heavy-emitting industries, as well as help remote communities transition away from diesel. Canada is launching a new funding program to help promote the commercial deployment of SMRs. The announcement was made Feb. 23 at the Canadian Nuclear Association's annual conference. The program would provide \$29.6 million over four years to develop supply chains for SMR manufacturing and fuel supply and security. Funding would also be used for research on safe SMR waste management solutions. In January 2023 GE Hitachi (GEH), Ontario Power Generation (OPG), SNC-Lavalin and Aecon inked a commercial contract for a 300 MW SMR at OPG's Darlington new nuclear site. The reactor would be Canada's first SMR.

GEH would provide the reactor design, engineering licensing support, construction, testing, training and commissioning for its BWRX-300 SMR. The BWRX-300 is a 300 MWe water-cooled, natural circulation SMR with passive safety systems that leverages the design and licensing basis of GEH's ESBWR boiling water reactor.

Source: <https://www.power-eng.com/nuclear/canada-launches-30-million-small-modular-reactor-funding-program/#gref>, 23 February 2023.

## **CANADA-POLAND**

### **Canadian and Polish Regulators Announce SMR Collaboration**

Canadian and Polish nuclear regulators have extended their cooperation under a newly signed memorandum on joint activities in the field of SMRs, particularly the BWRX-300.

The agreement was signed on the side-lines of the IAEA conference on *Effective Nuclear and Radiation Regulatory Systems* in Abu Dhabi. The pact will see the regulators expand their cooperation on activities associated with advanced and small modular reactor technologies, sharing best practices and experience. The agreement specifies that this cooperation "may expand to facilitate a joint technical review of advanced and small modular reactor designs, including the BWRX-300".

Such a joint technical review may, amongst other things, include cooperation in: Development of shared technical review approaches for advanced and small modular reactor technologies that facilitate resolution of common technical questions to enable regulatory reviews that address each participant's national regulations.

Collaboration on pre-application activities to ensure mutual preparedness to efficiently review advanced and small modular reactor designs, including sharing independent regulatory review results; Collaboration on research, training, and the development of regulatory approaches to address unique and novel technical considerations for ensuring the safety of advanced and small modular reactor technologies. "Today we took the first step enabling joint activities with CNSC in the field of small modular reactors," G<sup>3</sup>owacki said. "The experience gained in the field of regulatory review will contribute to the optimisation of the licensing process and the harmonisation of the regulatory approach. This, in turn, will enable more efficient implementation of these technologies in Poland and in the world." Polish company PKN Orlen recently said it was

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preparing to announce locations for up to 79 GE-Hitachi BWRX-300 SMRs....

Source: <https://www.world-nuclear-news.org/Articles/Canadian-and-Polish-regulators-announce-SMR-collab>, 14 February 2023.

**ROMANIA**

**New Steps in Romania’s Drive to Produce SMRs**

Romania can become a hub for new green energy capacity, PMCiuca having a meeting in this respect with representatives of the US company Fluor Corporation, listed on the New York Stock Exchange, with a turnover of about \$15 billion a year. The company is the largest financier and shareholder of the small modular reactor technology, NuScale – the only technology in this class of nuclear power plants certified by a regulatory body (US NRC).

Nuclearelectrica and NuScale Power in November 2021 signed an agreement to advance the implementation of NuScale’s innovative technology of small modular reactors in Romania, this decade.

On June 27, 2022, at the launch of the Partnership for Global Infrastructure and Investment, presented at the G7 Leaders’ Summit, US President Joe Biden announced a \$14 million grant for the development phase of the Small Modular Reactors in Romania by NuScale – Preliminary Front-End Engineering and Design Study for the SMR project in Romania.

The US company NuScale Power and the Romanian company RoPower Nuclear (equally owned by Nuclearelectrica and Nova Power & Gas) have signed the contract for phase 1 of the Front-End

**The US company NuScale Power and the Romanian company RoPower Nuclear (equally owned by Nuclearelectrica and Nova Power & Gas) have signed the contract for phase 1 of the Front-End Engineering and Design (FEED) work for the first SMR power plant in Romania. In November 2021, Energonuclear S.A., the project company, signed the first contract with Candu Energy, which will provide engineering services for the preparation and updating of documentation required to start the CANDU Units 3&4 Project.**

**Belarus’s Energy Minister Viktor Karankevich has held a meeting with executives from Russian nuclear fuel firm TVEL over future cooperation and joint projects in a range of areas including ensuring a balanced fuel cycle and training personnel in radioactive waste management.**

Engineering and Design (FEED) work for the first SMR power plant in Romania. In November 2021, Energonuclear S.A., the project company, signed the first contract with Candu Energy, which will provide engineering services for the preparation and updating of documentation required to start the CANDU Units 3&4 Project.

So far, the project includes in Joint Venture (JV) US partners Fluor Corporation, Candu Energy and Sargent & Lundy. The JV’s main responsibilities are to provide project management and conceptual engineering development, an activity mainly carried out by Candu Energy, Sargent & Lundy and Ansaldo.

Source: <https://energyindustryreview.com/power/new-steps-in-romanias-drive-to-produce-smrs/>, 23 February 2023.

**NUCLEAR COOPERATION**

**BELARUS–RUSSIA**

**Belarus to Expand nuclear Cooperation with TVEL**

Belarus’s Energy Minister Viktor Karankevich has held a meeting with executives from Russian nuclear fuel firm TVEL over future cooperation and joint projects in a range of areas including ensuring a balanced fuel cycle and training personnel in radioactive waste management.

The TVEL delegation visited Minsk and the Belarusian nuclear power plant - with the continued supply of Russian fuel for the plant one of the areas covered as well as “the possibilities of improving the efficiency of power units by



increasing the fuel burnup and introducing extended fuel cycles”.

The talks noted that joint work had already taken place on a national strategy for radioactive waste management and a concept for the future decommissioning of the Belarusian nuclear power plant. TVEL is the fuel division of Russian nuclear power giant Rosatom and provides nuclear fuel to 75 reactors in 15 countries.

Belarus’s first nuclear power plant at Ostrovets is close to completion. The first power unit was connected to the grid in November 2020 and, the energy ministry says, the second unit’s trial connection to the grid should happen in the next two months. It says that once both units - Russian VVER-1200 reactors - are commissioned the plant will produce about 18.5 TWh of electricity per year, equivalent to 4.5 billion cubic metres of natural gas, with an annual effect on the country’s economy of about USD550 million.

Source: <https://www.world-nuclear-news.org/Articles/Belarus-to-expand-nuclear-cooperation-with-TVEL>, 23 February 2023.

## **INDIA–USA**

### **India, U.S. Making Fresh Efforts for Practical Cooperation in Civil Nuclear Energy Sector**

The U.S. Assistant Secretary of State for Energy Resources described India as a very crucial partner for the U.S. in ensuring global energy security in view of serious disruptions in supplies of fossil fuel. In the face of growing global concerns over energy security triggered by the Ukraine conflict, India and the U.S. are giving a fresh look at exploring practical cooperation in the civil nuclear energy sector after failing to move forward since inking a historic agreement over 14 years back for partnership in the area.

**The actual cooperation in the civil nuclear energy sector eluded in the last over 14 years primarily due to differences between the two sides over liability rules relating to seeking damages from suppliers in the event of an accident.**

Ways for bilateral cooperation in areas of clean energy, including nuclear commerce under the framework of the India-U.S. nuclear agreement of 2008, figured prominently in the talks. U.S. Assistant Secretary of State for Energy Resources Geoffrey R Pyatt had with Indian interlocutors in Delhi on February 16 and 17. In an exclusive interview to PTI, Mr. Pyatt described India as a very crucial partner for the U.S. in ensuring global energy security in view of serious disruptions in supplies of fossil fuel resulting from Russia’s “brutal” invasion of Ukraine.

Mr. Pyatt said the U.S. supports Prime Minister Narendra Modi’s “incredibly ambitious” energy transition goal of having 500 GW (gigawatt) of energy from non-fossil fuel sources by 2030. “I am very focused on how we can develop opportunities for future civil nuclear cooperation, recognising that if we are stuck at issues, we have to work them through, the famous liability question,” he said.

“The business model of the civil nuclear industry is changing. In the US, we made a huge commitment to small and marginal reactors which could be particularly suitable to the Indian environment as well,” he said without elaborating further. The actual cooperation in the civil nuclear energy sector eluded in the last over 14 years primarily due to differences between the two sides over liability rules relating to seeking damages from suppliers

**The U.S. Assistant Secretary of State for Energy said the “civil nuclear renaissance” that the people were talking about got derailed to some considerable degree following the accident at Japan’s Fukushima nuclear power plant in 2011. However, he said Japan is now reconsidering the importance of nuclear power as part of its overall response to the “incredible disruptions of the global energy markets.**

in the event of an accident. “It was the first big thing that our two governments did together. It was so powerful for the rest of the world,” Mr. Pyatt said about the 2008 pact.

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people were talking about got derailed to some considerable degree following the accident at Japan's Fukushima nuclear power plant in 2011. However, he said Japan is now reconsidering the importance of nuclear power as part of its overall response to the "incredible disruptions of the global energy markets that Putin has caused with his invasion of Ukraine," he said, adding the climate crisis is another reason for preferring clean energy.

Mr. Pyatt suggested that New Delhi is very keen to take forward civil nuclear energy cooperation as part of the overall bilateral energy ties. "The US-India energy and climate agenda is one of the most important that we have anywhere in the world," he said. The U.S. Assistant Secretary of State for Energy said overall energy cooperation between India and the U.S. will form a major part of the strategic ties between the two sides. "When I look at where our strategic relationship is going, I see the issues that I am now responsible for as being right at the centre of the picture because there is so much potential to build on the strong foundation to do even more," he said. Mr. Pyatt said the U.S. is keen on forging strong cooperation with India in areas of green hydrogen energy as well....

Source: <https://www.thehindu.com/news/national/india-us-making-fresh-efforts-for-practical-cooperation-in-civil-nuclear-energy-sector/article66528776.ece>, 14 February 2023.

## URANIUM PRODUCTION

### GENERAL

#### Uranium Gaining Traction, but Experts Say Patience Still Needed

**Uranium experts believe the industry is poised for significant growth, but patience is required for now.** At the most recent Vancouver Resource Investment Conference (VRIC), uranium investors

were treated to plenty of advice from top experts who overwhelmingly pointed to growing global appreciation for the commodity.

**The narrative is shifting on uranium and nuclear stocks. As attitudes toward uranium change, and as plans for new project plans emerge, investors are curious to know how they can get exposure to this trend.... When exactly the uranium market will take off remains to be seen, but there's a broad consensus that momentum is shifting in the sector.**

#### Uranium Sentiment Changing for the Better:

At several panels the notion asserted were that perspectives are shifting around the world when it comes to uranium and that the biggest catalyst for

uranium is renewed broad acceptance. The narrative is shifting on uranium and nuclear stocks. As attitudes toward uranium change, and as plans for new project plans emerge, investors are curious to know how they can get exposure to this trend.... When exactly the uranium market will take off remains to be seen, but there's a broad consensus that momentum is shifting in the sector. Investors looking for ways to get exposure to the narrative will need to choose stocks carefully, especially if improvements in the market create a rapid expansion of junior miners to pick from. All in all, experts agree a turnaround for uranium is brewing, but is still in an early stage.

Source: <https://investingnews.com/uranium-gaining-traction-patience-needed/>, 17 February 2023.

## NUCLEAR PROLIFERATION

### AUSTRALIA

#### AUKUS Nuclear Submarine Cooperation Threatens Indo-Pacific Security

According to a recent report on the Guardian website, the US Secretary of Defense Lloyd Austin said at the beginning of February that "significant progress" had been made in building a nuclear-powered submarine fleet for Australia as soon as possible. The US, the UK and Australia's decision to conduct and advance nuclear submarine cooperation has drawn growing international concern.

**The US is Unable to Deliver Submarines:** According to the AUKUS pact signed in September 2021 by

the US, the UK and Australia, Australia will become the second ally to acquire the US nuclear-powered submarine technology after the UK. However, over the past year, the cooperation has not proceeded as smooth as expected by the three countries. The Guardian reported that there was growing concern that the US might not be able to provide nuclear-powered submarines to Australia.

It is reported that the US currently has possessed more than 50 nuclear-powered submarines, but the US Navy need 66. The US military personnel once admitted that the relevant US factories have been going all out to build its own Virginia class nuclear-powered attack submarines, and the US has been too busy to provide nuclear-powered submarines to Australia in short term.

### **Australia May Get More Harm than Good:**

Although the AUKUS submarine deal is plagued with problems and has been denounced by the international community, the US, the UK and Australia are still determined to promote cooperation on nuclear-powered submarines. In fact, the AUKUS partnership has been widely regarded as a tool to serve the strategic interests of the US since its establishment. This is especially true for Australia, which is actually just tied to the US' chariot more tightly and further reduced to a pawn of the US in the Asia-Pacific region.

### **It May Deal a Heavy Blow to the Asia-Pacific Security Order:**

According to experts, the trilateral security dialogue between the US, the UK and Australia to be held in March may focus on the expansion of AUKUS, the strengthening of military

and intelligence cooperation, and the enlargement of military operations in the Asia-Pacific region, as shown by information unleashed from all the three parties.

**According to the AUKUS pact signed in September 2021 by the US, the UK and Australia, Australia will become the second ally to acquire the US nuclear-powered submarine technology after the UK. However, over the past year, the cooperation has not proceeded as smooth as expected by the three countries. The Guardian reported that there was growing concern that the US might not be able to provide nuclear-powered submarines to Australia.**

What the US, the UK and Australia cannot ignore is that the voices against the AUKUS submarine deal have been rising instead of declining both in their own countries and in the international community over the past year or so. All parties are worried about the huge security risks that the deal may bring to the international community.

It is noteworthy that the US, the UK and Australia have said that in addition to strengthening the technical cooperation for nuclear-powered submarines, they would further deepen cooperation in the R&D of hypersonic and anti-hypersonic weapons, and the development of

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network capabilities, artificial intelligence, quantum technology and submarine capabilities. It is foreseeable that the AUKUS submarine deal is to promote military cooperation at higher levels, and the relevant practices will bring a serious impact on the

international security order.

Source: [http://eng.chinamil.com.cn/OPINIONS\\_209196/Opinions\\_209197/16201957.html](http://eng.chinamil.com.cn/OPINIONS_209196/Opinions_209197/16201957.html), 16 February 2023.

## **IRAN**

### **Iran Enriched Uranium to 84 Percent — But Can it Make a Nuclear Bomb?**

Iran appears to have made a new and worrying advance in its nuclear program. Bloomberg reported that it has reached the level of 84 percent enriched uranium, a significant

advance on the 60 percent previously announced. The magic number needed for making an atomic bomb is 90 percent.

The new figure was discovered by monitoring equipment operated by the world's nuclear watchdog, the IAEA. But the Bloomberg report did not reveal how much uranium enriched to this extent Iran has produced. The amount needed for a nuclear bomb is about a grapefruit-sized worth, which would weigh around 33 pounds. (Uranium metal is even more dense than lead.)

**That change was discovered by chance. The IAEA can carry out three types of inspections: "announced" (i.e., planned in advance with Iran's cooperation), "unannounced" (inspectors suddenly turning up and demanding access), and "random" (a variation of unannounced but much rarer).**

This latest revelation comes just a few days after news emerged that Iran had altered the piping joining two groups of centrifuges in its Fordow plant, a change that would allow faster enrichment to higher levels. That change was discovered by chance. The IAEA can carry out three types of inspections: "announced" (i.e., planned in advance with Iran's cooperation), "unannounced" (inspectors suddenly turning up and demanding access), and "random" (a variation of unannounced but much rarer). The piping alteration at Fordow caught the eye of an experienced inspector on such a random inspection, a detail that his well qualified but less experienced colleagues may have missed.

The Bloomberg report suggests the higher enrichment level may not be definitive. Was it reached on purpose or accumulated by accident? An Iranian nuclear scientist has claimed, correctly, that it is in the nature of the enrichment process that the spinning centrifuges produce a range of enrichment values above and below the target level.

Even at a notional 6 percent less than the level needed for a nuclear bomb, the 84 percent figure is worrying. Uranium enrichment 101 is that the process is all about the separation of two isotopes

of uranium, the slightly lighter U235 isotope from the heavier but more numerous U238 isotope. The ratio of such isotopes in natural uranium is 993 U238 atoms to just 7 U235 atoms. The enrichment process alters the ratio. The 90 percent level is when the ratio is just 1:7 — i.e., 992 atoms of U238 have been stripped out. Eighty-four percent is roughly this ratio, so a workable bomb may need just a pound or two more of U235 to function. And Twitter feeds, milking the Bloomberg story, are reminding us that the first U.S. bomb, dropped on the Japanese city of

Hiroshima in 1945, used material of roughly the 84 percent level.

So, the new level that Iran reportedly has reached is well beyond most people's "red line" of concern. It doesn't necessarily mean that Iran is close to actually making a nuclear bomb. Officials say that Iran still seems to be challenged when it comes to making the gaseous uranium hexafluoride used in centrifuges into solid metal and casting it into hemispheres that, when placed together as a sphere, could be the explosive core of a nuclear bomb.

But officials also acknowledge that their level of confidence in knowing what Iran is doing on weapon design is significantly less than its enrichment activities. And if

Iran were to settle for a bomb delivered by an aircraft, rather than on a long-range missile, the sophistication of design needed could be less. Of course, if Iran were to test a device in a remote desert area, it could be much cruder than a deliverable bomb.

A new additional concern for officials is that the Russian military may slip Iran a critical mass or two of 90 percent enriched uranium, as China did to jump-start Pakistan's program in the early 1980s. Moscow's historical record against such proliferation has been exemplary. But the Ukraine



war and Iran's supply of drones to Russia may prompt some elements to give Tehran a special "thank you."

More details may emerge in the next few days.

The IAEA, headquartered in Vienna, said that it is "discussing with Iran the results of recent Agency verification activities." The issue probably will figure high on the agenda of the next meeting of its board of governors, due on March 6.

Source: <https://thehill.com/opinion/national-security/3865793-iran-enriched-uranium-to-84-percent-but-can-it-make-a-nuclear-bomb/>, 20 February 2023.

## **NORTH KOREA**

### **S Korea Defence Paper Says N Korea Increased Plutonium Stockpile**

North Korea has increased its stockpile of weapons-grade plutonium from 50kg to 70kg, South Korea's new defence paper estimates. South Korea has released its latest defence white paper in which it described North Korea as an "enemy" and reports that Pyongyang has increased its stockpile of weapons-grade plutonium by an estimated 40 percent.

The defence paper published offered a glimpse into North Korea's growing number of nuclear weapons and missile stockpiles, as well as its conventional military capabilities, with an estimated North Korean troop strength of 1.28 million active-duty personnel.

North Korea has continued reprocessing spent fuel from its nuclear reactor and possesses about 70kg (154 pounds) of weapons-grade plutonium, up from 50kg (110 pounds) estimated in the previous report, according to the white paper. According to South Korea's Yonhap News Agency, approximately 6kg (13 pounds) of plutonium is required to build one nuclear bomb, and the increase in North Korea's stockpile of the substance is due to operations at the country's "mainstay nuclear complex" in Yongbyon.

North Korea's launches in 2022 of intercontinental ballistic missiles (ICBM), including the new Hwasong-17 ICBM, were noted in the report but further analysis was needed to verify whether

Pyongyang had acquired improved missile re-entry technology, the defence paper states.

The paper also outlines South Korea's deterrence planning, known as the "three-axis", according to Yonhap. "The three-pronged system consists of the Korea Massive Punishment and Retaliation (KMPR), an operational plan to incapacitate the North Korean leadership in a major conflict; the Kill Chain preemptive strike

platform; and the Korea Air and Missile Defence system," Yonhap reported.

Source: <https://www.aljazeera.com/news/2023/2/16/s-korea-defence-paper-says-n-korea-increased-plutonium-stockpile>, 16 February 2023.

## **SOUTH KOREA**

### **South Korea's Ruling Party Leader Hints at Need for Nuclear Weapons**

South Korea's ruling party leader hints at need for nuclear weapons. Recent North Korean missile launches raise questions about US commitment to Seoul's defence North Korea launched what it said was a Hwasong 15 ICBMs, which experts believe is capable of striking the mainland US.

The leader of South Korea's ruling party has warned that the country may have to "seriously consider" developing its own nuclear weapons as a deterrent to its northern neighbour in the wake of Pyongyang's latest barrage of missile tests. South Korea has grown increasingly anxious about the unrelenting progress of North Korea's nuclear weapons programme. Last month, North Korean leader Kim Jong Un declared he would "exponentially increase" nuclear weapons production in 2023 and stressed his willingness

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to use his nuclear arsenal for offensive purposes, as well as defensive ones. South Korean president Yoon Suk Yeol has also raised the prospect of Seoul pursuing an independent nuclear deterrent in response to escalating provocations from its northern adversary. "If problems become more serious, [South Korea] could deploy [US] tactical nuclear weapons here, or we could acquire our own nuke as well," Yoon told defence officials and experts last month. "If that happens, it would not take long to [develop] one for ourselves in a short period of time."

Yoon's comments marked the first time in the post-cold war era that a South Korean president has publicly acknowledged that Seoul could acquire its own nuclear weapons, although he has since clarified that it was not an active policy....

Source: <https://www.ft.com/content/ef4d3f20-72db-4e0e-82b6-eb36ecfc4c84>, 20 February 2023.

## **NUCLEAR WASTE MANAGEMENT**

### **JAPAN**

#### **Japan Insists Release of 1.3m Tonnes of 'Treated' Water is Safe**

Neighbouring countries and local fishers express concern as 12th anniversary of nuclear disaster looms. Almost 12 years have passed since the strongest earthquake in Japan's recorded history resulted in a tsunami that killed more than 18,000 people along its north-east coast. As the country prepares to mark the 11 March anniversary, one of the disaster's most troubling legacies is about to come into full view with the release of more than 1m tonnes of "treated" water from the destroyed Fukushima Daiichi nuclear power plant. The tsunami knocked out the plant's backup electricity supply, leading to meltdowns in three of its reactors, in the world's worst nuclear

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accident since Chernobyl.... Progress on decommissioning is being held up by the accumulation of huge quantities of water that is used to cool the damaged reactor cores. Now, 1.3m tonnes of water – enough to fill about 500 Olympic-sized swimming pools – is being stored in 1,000 tanks that cover huge swathes of the complex. And space is running out.

Two steel pillars protruding from the sea a kilometre from the shore mark the spot where, later this year, the plant's operator, Tokyo Electric Power [Tepco], plans to begin releasing the water into the Pacific Ocean, in the most controversial step in the Fukushima Daiichi cleanup to date. The water will be treated and, if necessary, treated again until the concentration of radionuclides other than tritium have fallen below government limits, said Hikaru Kuroda, a Tepco official overseeing the decontamination and decommissioning of Fukushima Daiichi.

"By the time the liquid is diluted with seawater, tritium levels will be at less than 1,500 becquerels per litre, or 1/40th of the government standard for discharging water into the environment," he said. The fiercest opposition has come

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from Fukushima's fishers, who say releasing the water risks destroying their livelihoods because consumers will shun their catch and send prices plummeting. The Fukushima prefectural government says that, post-disaster, its food safety standards are among the strictest in the world. The

government-set upper limit for radioactive caesium in ordinary foodstuffs such as meat and vegetables is 100 becquerels a kilogram, compared with 1,250Bq/kg in the EU and 1,200Bq/kg in the US.

While officials attempt to reassure the public and other countries that Fukushima produce is safe

for consumers, Tepco and the government have embarked on a PR offensive, holding regular briefings on the water discharge for Tokyo-based diplomats and journalists, and running ads on TV, in newspapers and online. The campaign has had mixed results. South Korea and China have voiced opposition to the discharge, while the Pacific Islands Forum (PIF) said recently it had "grave concerns".

Environmental groups have challenged the Japanese government's claims that the water will not affect marine life or human health, while the US National Association of Marine Laboratories has pointed to a lack of adequate and accurate scientific data to support its reassurances on safety....

Source: <https://www.theguardian.com/environment/2023/feb/15/fukushima-japan-insists-release-of-treated-water-is-safe-nuclear-disaster>, 15 February 2023.

## **SOUTH KOREA**

### **Korea Urged to Secure More Nuclear Waste Disposal Sites**

Korea should promptly outline plans to build a greater number of nuclear waste disposal facilities, in an immediate measure to fortify radioactive waste management capabilities.

Propelling the urgent recommendation is the earlier-than-expected saturation of local radioactive waste storage, brought on in large part by the Yoon Suk Yeol administration's fostering of the previously demonized source of energy, which is more affordable and stable compared to renewables. The country may not be able to operate nuclear reactors as early as 2030, they say, since storage facilities will be full by then. This is why experts are pushing for the construction of on-site storage sites at nuclear reactors, as soon as possible, because it takes at

least seven years to help guarantee the safe construction and operation of these types of sites.

The government first began commercial operation of a nuclear reactor in 1978, and nine attempts to select disposal sites have since failed. Gyeongju, North Gyeongsang Province was selected as a site in 2005 to store mid- and low-level radioactive waste. But the high-stakes decision to choose a site for the high-level waste has been pushed back indefinitely since 2009, when government efforts to seek public consensus through hearings and discussions were met by the fierce protests of local

residents. The pace of the development on this issue will be set by whether the lawmakers and the energy and science ministries can reach an agreement to establish an organization separate from the state-run Korea Radioactive Waste Agency, the current overseer of radioactive waste disposal. It will develop technologies to ensure the safe and permanent decommissioning of nuclear power plants and function as a comprehensive platform to advance radioactive waste analysis.

Source: [https://www.koreatimes.co.kr/www/tech/2023/02/419\\_345783.html](https://www.koreatimes.co.kr/www/tech/2023/02/419_345783.html), 14 February 2023.

## **UK**

### **UK Grant for Deep Isolation Corrosion-Resistant Canister**

US-based Deep Isolation EMEA Ltd has been awarded a grant by the UK Department for Energy Security & Net Zero (formerly part of BEIS) to develop a corrosion-resistant canister for the deep disposal of used nuclear fuel. The project is a collaboration between the Nuclear Advanced Manufacturing Research Centre (NAMRC), the University of Sheffield and US-based NAC

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International. Funding comes from the Energy Entrepreneurs Fund, part of the Net Zero Innovation Portfolio. The canister must ensure the safe encapsulation of used fuel assemblies in deep borehole repositories 1-3 km underground.

The project includes the manufacture and testing of a prototype canister tailored to UK requirements and will establish a canister manufacturing supply chain. The project will support the UK's net-zero targets for 2050 by addressing the need for safe, secure, scalable and cost-effective used fuel disposal solutions. This is seen as a key challenge to the deployment of SMRs. Royce SMR aims to complete its first unit in the UK in the early 2030s and build up to 10 by 2035. Woods says the innovation it is bringing to market is small, modular disposal of radioactive waste in deep boreholes. This "will be an important enabler of the international SMR market, and a great export opportunity for UK manufacturers", he notes.

Deep Isolation says the work will help advance the technological maturity level of its disposal

canister designs intended disposal in a deep borehole. This brings greater flexibility and potential cost savings for disposal of used fuel and high-level waste," says Chris Parker, Global Head of Business Development and Managing Director of Deep Isolation EMEA. "By giving the UK choice and flexibility in disposal, it helps ensure new nuclear as a vital component of the UK's 2050 net zero strategy."

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Parker acknowledges that the UK deep borehole technology cannot replace the need for a traditional mined geological disposal facility (GDF). However, it "has the potential to reduce costs and save time for the UK's GDF programme because it can accept selected high heat generating waste streams at much greater depth". A deep borehole disposal is of particular interest to countries with small waste inventories where a conventional mined geological repository is not economically efficient.

*Source: <https://www.neimagazine.com/news/newsuk-grant-for-deep-isolation-corrosion-resistant-canister-10593255>, 14 February 2023.*



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