



**JOINT STATEMENT: Science Academies of G7 Countries**

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**Nuclear Arms Control**

After a sustained period of declining numbers of nuclear warheads, there is a risk this trend could now reverse.

The decrease in the number of warheads was the combined effect of numerous treaties. Following the 1970 NPT, the US and Russia established a set of bilateral arms reduction and verification treaties, which greatly reduced the risk of a nuclear confrontation. These treaties significantly reduced the stocks of nuclear weapons in the USA and Russia and helped increase confidence and stability in international relations.

Recent years have seen an inversion of this trend, associated with increased international tensions which led to the withdrawal from several treaties.

The increase in geopolitical crises and new wars being fought involving countries possessing nuclear weapons threaten regional and global stability. New threats have been made to use tactical nuclear weapons. These are designed to be used on the ground against military targets. However, in addition to their large destructive power, the use of such weapons is associated with severe and widespread effects from radioactive fallout. Most importantly, the use

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of such weapons could lead to the escalation and the use of strategic nuclear weapons.

Efforts have also been made against the use of nuclear weapons. On 3 January 2022, the five NPT nuclear-weapon states declared that “A nuclear war cannot be won and must never be fought”. Later that year, G20 leaders declared at the Bali Summit on 16 November 2022, that “The threat of use or use of nuclear weapons is inadmissible”. At the Hiroshima Summit in 2023, G7 leaders declared, for the first time ever, their commitment to

achieving a world without nuclear weapons.

In the context of the current global instability, it is imperative to highlight the known consequences of nuclear warfare. There is a strong scientific basis for the following points. The speed of any war can be rapid. Hundreds of multi-warhead missiles can be launched over a short period of time.

**A full-scale nuclear war between the nations with the largest arsenals would result in de- vastation to those nations and would cause harm worldwide. In addition, several recent scientific studies conclude that also nuclear wars between nations with smaller arsenals could have substantial effects beyond the early fatalities, which themselves could range up to hundreds of millions of people.**

The multifaceted damages resulting from a nuclear conflict have been the object of intensive scrutiny by the scientific community in thousands of technical publications.

1) Survivors of the blasts and fires who are exposed to high radiation doses would face acute radiation sickness and most would die within hours or weeks. Those exposed to lower but still substantial doses would have an increased risk of developing radiation-related diseases in the future;

2) Among the long-term effects on survivors are the increased rates of cancer and other diseases, including cardiovascular diseases and immune dysfunction as shown by epidemiological studies of the Hiroshima and Nagasaki survivors and other exposed populations;

3) A full-scale nuclear war between the nations with the largest arsenals would result in de- vastation to those nations and would cause harm worldwide. In addition, several recent scientific studies conclude that also nuclear wars between nations with smaller arsenals could have substantial effects beyond the early fatalities, which themselves could range up to hundreds of millions of people

4) Nuclear explosions and the fires they cause are

likely to inject soot into the stratosphere, reducing sunlight and temperatures on Earth. While there is uncertainty about how much soot reaches the stratosphere and how long it remains there, these effects could significantly reduce agricultural output and fish catch following a nuclear war, exacerbating food insecurity globally

beyond the direct disruption from the war;

5) Depending on the scale of use of nuclear weapons, there is the potential for the destruction of entire ecosystems and extinction of species, due to the direct impact of explosions and fires and altered climatic conditions. In the worst cases this could be on the scale of a mass extinction.

**Among the roles of the scientific community are to continue to develop and communicate the scientific evidence base that shows the catastrophic effects of nuclear warfare on human populations and on the other species with which we share our planet, to develop means to monitor, detect, and verify agreements, and to support the governments as they seek to fulfil the commitments described above.**

Historical evidence suggests that the primary way to shift from growth to reduction of nuclear weapons, to reduce the risks of nuclear use, and to reduce the proliferation of nuclear weapons is by means of international agreements that limit numbers and types of weapons, establish means of monitoring and verification, establish

means of communication and conflict resolution, and verifiably restrict uses of nuclear materials and technologies, all to implement the renewed commitments against the use of nuclear weapons.

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commitments described above.

The science academies of the G7 countries, in light of the rise in international tensions and wars, call on the G7 leaders to once more reaffirm their commitment to achieving a world without nuclear weapons and to take the necessary steps to help the world to realise this goal safely and securely.

Source: <https://royalsociety.org/-/media/about-us/international/g-science-statements/2024-nuclear-arms-control.pdf>, 2024.

**OPINION – Manuel G. Pascual**

**Why Data Centers Want to Have Their Own Nuclear Reactors**

Sam Altman, CEO of OpenAI, the company that created ChatGPT, issued a warning in January at the World Economic Forum in Davos: the artificial intelligence (AI) industry is about to cause an energy crisis. The new generation of generative AI will consume much more energy than expected, he told the world's leaders and entrepreneurs, to the point of straining global energy grids. "There's no way to get there without a breakthrough," he said curtly.

The breakthrough he was alluding to is the so-called advanced nuclear energy, a term that includes small reactors and nuclear fusion, both still in the experimental phase. Several companies are focusing on this alternative, which would provide them with energy autonomy and greater cost control. The Biden Administration does not frown on it, either. In March, Energy Secretary Jennifer Granholm met with representatives of several technology companies, including Amazon, Google

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and Microsoft, to explore imaginative ways to cover their energy needs. One of the topics discussed was the possibility of using small nuclear reactors in data centers, the extensive warehouses full of processors running day and night.

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energy powers the processors on which the models are trained and the systems are hosted. That figure, as Altman recently predicted, will soon fall short, as new users are added and new versions of ChatGPT, Gemini and Copilot emerge, which will require more and more computing power. "I'm glad he said that in Davos. "I'm glad he said it. I've seen consistent downplaying and denial about the AI industry's environmental costs since I started publishing about them in 2018," wrote Kate Crawford, one of the leading researchers on the AI footprint, in Nature.

Big tech has already taken the first steps towards the nuclear age, a declining energy source in the West (where plant closures outpace openings) with some major exceptions: the United States, France, the United Kingdom and several Eastern European countries. Companies, for their part, see nuclear power as a way to ensure a stable and lasting supply of energy in a context in which the existing supply is not

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enough. Senior Google executives told The Wall Street Journal that they are considering signing a power purchase agreement (PPA) with developers of SMRs. "I do think nuclear, especially advanced nuclear, is making a lot of progress," said Maud Texier, Google's global director of clean energy and

decarbonization development, in statements to *The Wall Street Journal*. Texier compared the cost of nuclear projects to where wind and solar were 15 years ago. "Cost decline is going to be a function of deployment," she said. Company sources did not confirm to EL PAÍS whether the nuclear route is an option for the future, although they did not deny it either. Google recently signed an agreement with Microsoft and Nucor to accelerate advanced clean energy technologies, including "advanced nuclear."

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In October 2023, Microsoft closed PPAs with the American company Helion Energy to have the latter supply it with energy obtained from nuclear fusion starting in 2028. This technique is still more theoretical than practical and, unlike fission, does not produce radioactive waste. Asked by this newspaper about its strategy in the nuclear field, Microsoft alluded to a policy brief from December titled *Accelerating a carbon-free future*, which makes it clear that advanced nuclear and fusion energy, as well as traditional reactors, are one of the pillars on which Microsoft's green policy will pivot, although there is no talk of deadlines or dates.

WS, Amazon's cloud computing division, has recently purchased a large data center in the United States located next to the country's sixth largest nuclear power plant, which supplies it with 100% of its energy at a fixed price. "To complement our wind and solar projects, which depend on weather conditions to generate energy, we are also exploring innovations and technologies and investing in other sources of clean, carbon-free energy. The agreement with Talen Energy [the company that owns the aforementioned US nuclear power plant] for carbon-free energy is a project that goes in that direction," company sources told EL PAÍS.

**Silicon Valley's Nuclear Flirtation:** The idea that

nuclear energy is AI's salvation is catching on among the Silicon Valley jet set. Sam Altman is one of its great supporters. He is so convinced about the good prospects of the proposal from Helion Energy, a pioneer of nuclear fusion, that he has invested \$375 million in the company.

Altman also chairs a startup, Oklo, that aims to design and manufacture nuclear fission reactors like those used today, but much smaller (the so-called SMRs, short for small modular reactors).

Bill Gates is another technology tycoons with

interests in SMRs. His company TerraPower is working on a sodium nuclear reactor, an experimental variant that, if successful, promises to be 25 times cheaper than nuclear fission. Meta's chief generative AI engineer, Sergey Edunov, said a few months ago that only two large nuclear reactors would be needed to cover the entire global energy demand projected for 2024 in terms of AI, including powering already operational models and training new ones.

**Does the nuclear route have a future? "There are no advances on the horizon that would allow for the immediate deployment of SMRs, which are currently in the initial prototyping phase in numerous countries. This option would only be viable if we are talking about a period of decades," says engineer Heidy Khlaaf.**

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Heidy Khlaaf, a specialist in evaluation, specification and verification of complex computer applications in safety-critical systems. Some countries, such as the United Kingdom, France, Canada and the United States, have plans to develop this type of facilities, but not before 20 years.

Khlaaf is especially concerned that Microsoft has put generative AI to work on streamlining the bureaucracy to achieve nuclear licenses, a process that can take years and cost millions of dollars. "This is not a box-ticking exercise, but a

process of self-assurance. Considering these regulatory processes as mere cumbersome paperwork says a lot about your understanding, or lack thereof, of nuclear safety,” he says.

Is it realistic to trust the future of AI to nuclear fusion? Helion Energy’s most optimistic estimates say that in 2029 it will be able to produce enough energy to supply 40,000 average homes in the United States. It is estimated that ChatGPT already consumes the equivalent of 33,000 homes today.

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**Why So Much Energy Consumption?** The emergence of AI has shaken the global energy scene. Most of the consumption associated with generative AI models occurs before they are used, during the training phase. This is a key process in the development of deep learning models that consists of showing the algorithm millions of examples that help it establish patterns with which to predict situations. In the case of large language models, such as ChatGPT, the system is expected to conclude that the series of words “the color of the sea is” has a high probability of being followed by the word “blue.”

Most data centers use advanced processors called GPUs to train AI models. GPUs require a lot of energy to operate, about five times more than CPUs (conventional processors). Training large language models requires tens of thousands of GPUs, which need to operate day and night for weeks or months. ...

**What is the Total Consumption of AI?** How much energy is dedicated to training and feeding the most commonly used models? Companies don’t publish that information, so all we have are estimates. For example, Google’s Gemini Ultra model, one of the most advanced today, required 50 billion petaFLOPs to train it, according to a

recent report from Stanford University. To achieve that kind of computing power with commercial computers (although supercomputers are used in these tasks) would require about 10,000,000,000,000,000 (10 to the power of 16) computers. The cost associated with this training was \$191 million, largely attributable to the energy it consumed. A single AI model can consume tens of thousands of kilowatt-hours. Generative AI models, such as ChatGPT,

can have 100 times greater consumption, according to estimates by the technology consulting firm IDC.

Apart from powering the systems themselves, energy also goes to the cooling systems of the processors. The most common techniques include electric ventilation and the use of water to cool the environment and the machines. This latter system is beginning to cause problems in places with water scarcity, although the most modern techniques involve the use of closed circuits that minimize losses of water resources.

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Source: <https://english.elpais.com/technology/2024-04-30/why-data-centers-want-to-have-their-own-nuclear-reactors.html>, 30 April 2024.

**OPINION – Sri Hastjarjo**

**To Go Nuclear, the Public Must be Onboard**

Surveys over the past decade show that nuclear energy as an energy option is being increasingly accepted in Indonesia. In a meeting with the Indonesian Nuclear New Energy Society (MEBNI) in January 2024, Indonesian Vice President Amien said public perception of safety was one of the main issues challenging the development of nuclear power in Indonesia. The meeting was one of the latest efforts by the proponents of nuclear power in Indonesia to encourage the government to ratify the Bill on New Energy and Renewable

Energy that was proposed in 2019.

The use of nuclear energy on a large scale in Indonesia cannot be implemented if the bill is not enacted. Like elsewhere in the world, public acceptance of nuclear power as an energy option is crucial if it is to be adopted. However, three big nuclear accidents since 1979, at Three Mile Island, Chernobyl and Fukushima, are still fresh in the memories of people, including those in Indonesia. The development of nuclear power plants requires significant investment and long-term operation. Public acceptance ensures that communities and other stakeholders are supportive of these projects. Public opinion often influences political decision-making and regulatory frameworks. If the public is not supportive of nuclear power, politicians may be less inclined to support policies that promote its development.

Research on public acceptance of nuclear power as an energy source has been conducted in various countries. Shortly after the Fukushima accident in 2011, a global survey of 24 countries conducted by IPSOS found that the average public acceptance of continuation using nuclear power was 31 percent. The more recent survey in 2023 by Radiant Energy Group found that across the 20 countries surveyed, 28 percent of respondents opposed the use of nuclear energy while 46 percent supported it. Support for nuclear power was three times higher in the world's two most populated countries, China and India.

According to the World Nuclear Industry's Status Report, there are 407 nuclear reactors in operation

in 31 countries around the world. Studies of public acceptance have been conducted in 29 countries that operate nuclear reactors. The average level of public acceptance in those countries was 38 percent, the lowest being 15.7 percent (Slovenia) with the highest at 63 percent (UAE). An interesting fact is that there are countries that operate nuclear power plants despite very low public acceptance. While Indonesia does not yet have a nuclear power plant, it has been operating three nuclear reactors for education and research purposes since 1965. The radiation they emit is considered too small to be dangerous to nearby communities.

In 2007, the Indonesian National Atomic Energy Agency (BATAN) made plans to build a nuclear power plant in Jepara, Central Java but was opposed by local communities and several NGOs including Nahdaul Ulama (NU), one of Indonesia's largest civil society organisations. Since then, BATAN has conducted several national surveys on public acceptance of nuclear power plants in Indonesia. The results from the 2011 to 2017 surveys show that public acceptance increased from 49.5 percent in 2011 to 77.53 percent as of 2017.

In 2019, an idea emerged to develop a Molten Salt Reactor (MSR) type nuclear power plant with thorium

as the main raw material as opposed to uranium. A private company proposed to build the plant in the Bangka-Belitung Islands province, which is known to have abundant thorium deposits. PT PAL Indonesia, a state-owned enterprise that manufactures ships for military and civilian use, signed a contract with the government to build

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A public acceptance survey involving 1,500 residents of Bangka Belitung was conducted in 2021, to measure public perception towards the proposed plant as well as public trust in the competence of nuclear power plant managers.

A total of 73 percent of Bangka Belitung residents agreed with the plan to build the nuclear power plant in their area. Observers, however, say that historically, the population of Bangka Belitung have always been supportive of the government's stance, pro-nuclear or otherwise. In 2020, the proposal for developing nuclear power plants in Indonesia was supported by Prabowo Subiyanto who was then Indonesian minister of defence. With Prabowo's victory in the 2024 presidential election, it remains to be seen if the push for nuclear power generation will gain a new impetus.

Source: <https://en.tempco.co/read/1856777/to-go-nuclear-the-public-must-be-onboard>, 15 April 2024.

**OPINION – Jordan McGillis**

**Taiwan's Lai Needs to Rethink Nuclear Shutdown Plan**

Taiwan's energy politics need disruption, and President-elect Lai Ching-te is just the man for the job. Lai's Democratic Progressive Party (DPP), which has held control of the presidency and legislature for the past eight years, has overseen an impressive economic expansion. Since 2017, Taiwan has averaged real annual gross domestic product growth of more than 3%, largely thanks to

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**Blackouts have become all too common, and particularly widespread in recent years. A significant element of the problem is that the DPP is pushing reliable nuclear power out of the island's electricity mix, even as peak loads climb year after year. Outgoing President Tsai Ing-wen won in 2016 after campaigning on the promise of a "nuclear-free homeland" and the retirement of Taiwan's three operating nuclear power plants.**

economy stands out in the developed world as manufacturing still accounts for more than a third of the island's GDP, versus 25% for South Korea and less than 20% for Germany, Japan and the U.S.

All that manufacturing demands a whole lot of electricity. Industry took up 56% of Taiwan's power supply in 2022, the most recent year on record. Taiwan Semiconductor Manufacturing Co. (TSMC) alone sucked up an astonishing 6.4% of the total power output the previous year. While efficiency advances have lowered Taiwan's energy use per unit of economic output over time, total consumption has continued to rise, with the increase since 2001 exceeding 40%. Taiwan now tops Asia in electricity use per capita.

Rising power consumption is not a problem per se, but Taiwan's grid has not kept pace. Blackouts have become all too common, and particularly widespread in recent years. A significant element of the problem is that the DPP is pushing reliable nuclear power out of the island's electricity mix, even as peak loads climb year after year. Outgoing President Tsai Ing-wen won in 2016 after campaigning on the promise of a "nuclear-free homeland" and the retirement of Taiwan's three operating nuclear power plants.

The slogan reflected a perennial fault line in Taiwanese politics. When it got its start in the 1980s, the DPP staked out its ideological terrain in opposition to the then-ruling Kuomintang (KMT), which had led a massive nuclear buildout. When the DPP was born, Taiwan got half of its power from nuclear plants. Nuclear remained crucial to Taiwan's economy in the ensuing

decades, even as other sources of power, most prominently its semiconductor industry. Taiwan's

decades, even as other sources of power, most prominently, gas-fired power plants, were added

to the grid.

The DPP's anti-nuclear heritage was given new salience in the aftermath of the 2011 earthquake and tsunami that caused meltdowns at Japan's Fukushima Daiichi nuclear power plant. At that time, Taiwan still got 16% of its power from nuclear, but after the accident, the KMT government then in power halted the development of a fourth nuclear plant. Tsai's administration then moved forward with the premature retirement of reactors at two of the island's three operating plants. This reduced nuclear power generation from 42,000 gigawatt-hours in 2011 to 24,000 in 2022. That year, nuclear accounted for 8% of Taiwan's total generation.

In the years since Tsai's pledge, nuclear power has enjoyed a global redemption of sorts, particularly with the squeeze on energy supplies caused by the outbreak of the Ukraine war. Several Southeast Asian nations are moving forward with plans to build reactors. Japan has begun to restart closed plants and the gravest Fukushima contamination concerns have proved unwarranted. Nevertheless, despite a 2018 referendum in which Taiwan's public backed keeping the island's reactors running, Tsai and Lai, her vice president, have remained committed to a full shut down by 2025 even as touted wind and solar resources have failed to come online.

When Tsai first took office, hydropower, wind, solar and biomass generated a combined 4.8% of Taiwan's power. As of 2022, these sources still only matched nuclear's 8% share, putting the island far behind Tsai's original target of 20%

renewables by 2025. January's election results give Lai and the DPP reason for reflection. Though Lai won the presidency, he received 2 million fewer votes than Tsai garnered in her successful 2020 reelection. The party also lost its legislative majority as the KMT emerged with the largest number of seats and the upstart Taiwan People's Party (TPP) expanded its foothold.

During the campaign, the KMT and TPP candidates found common ground on energy, with both parties' presidential nominees voicing support for nuclear power to shore up Taiwan's ailing grid. Some scholars have cited energy worries as a key reason voters drifted away from the DPP. After he takes over from Tsai next month, Lai can move to address the DPP's slide by

stepping back from Tsai's 2016 pledge. Working with the KMT and TPP to launch a nuclear comeback would bolster the DPP politically, not harm it.

Some misguided environmental activists and old party hands who have not moved on from the 1980s might be alienated, but millions of voters who backed the KMT and TPP in January

would be gratified if Lai showed his party recognizes how important energy abundance is for a thriving Taiwan. Lai hinted at the possibility of pivot a year ago when he suggested that the island's nuclear plants could be kept available for emergency use, distancing himself slightly from Tsai.

While Taiwan is more vulnerable to geopolitical crises than any other key global economy, it can stave off an electricity emergency of its own making. Indeed, only Lai and the DPP can right Taiwan's energy policy. With its strong environmental credentials, the DPP is best positioned to make the case to the Taiwanese public

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Source: <https://asia.nikkei.com/Opinion/Taiwan-s-Lai-needs-to-rethink-nuclear-shutdown-plan>, 22 April 2024.

**NUCLEAR STRATEGY**

**FRANCE**

**France's Nuclear Weapons should be Part of European Defence Debate, Macron Says**

France's nuclear weapons should be part of the European defence debate, French President Emmanuel Macron told a group of regional newspapers on 28 April, in comments that drew fire from his political opponents ahead of EU elections in June. Macron has been more strident on defence issues recently, having called for stronger, more integrated European defences as he outlined his vision for a more assertive European Union on the global stage, saying "Europe could die".

In an interview set up by EBRA, a group of French eastern regional newspapers, he said a "credible European defence" should go beyond the protection already offered by NATO. "That may mean deploying anti-missile shields, but we need to be sure that they block all missiles and deter the use of nuclear weapons," he said.

Regarding nuclear weapons, while France's doctrine has so far been to use them when the country's vital interests are threatened, Macron said he was open to give a more "European dimension" to these interests. "I'm in favour of opening this debate, which must therefore include

missile defence, long-range weapons and nuclear weapons for those who have them or who have American nuclear weapons on their soil," he said. His comments drew criticism from opponents on the right and the left of the political spectrum. ...

Source: Mathieu Rosemain, <https://www.reuters.com/world/europe/frances-nuclear-weapons-should-be-part-european-defence-debate-macron-says-2024-04-28/>, 28 April 2024.

**IRAN**

**Iranian Commander Warns Tehran could Review its 'Nuclear Doctrine' Amid Israeli Threats**

Iran could review its "nuclear doctrine" amid Israeli threats, a senior Iranian Revolutionary Guards commander said, raising concerns about Tehran's nuclear program, which it has always said was strictly for peaceful purposes. "A review of our nuclear doctrine and politics, as well as considerations previously communicated, is entirely possible," Ahmad Haghtalab, the commander in charge of nuclear security, said, according to the semi-official Tasnim news agency

Iran's Supreme Leader Ayatollah Ali Khamenei has the last say on Tehran's nuclear program, which the West suspects has military purposes. Khamenei has said on numerous occasions that Tehran has never pursued building or using nuclear weapons,

which its religion forbids.

Source: <https://www.msn.com/en-nz/news/other/iranian-commander-warns-tehran-could-review-its-nuclear-doctrine-amid-israeli-threats/ar-AA1neQyG>, 18 April 2024.

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**Iran could review its "nuclear doctrine" amid Israeli threats, a senior Iranian Revolutionary Guards commander said, raising concerns about Tehran's nuclear program, which it has always said was strictly for peaceful purposes. "A review of our nuclear doctrine and politics, as well as considerations previously communicated, is entirely possible," Ahmad Haghtalab, the commander in charge of nuclear security, said, according to the semi-official Tasnim news agency.**

RUSSIA

Russia Vetoes a UN Resolution to Ban Space Nukes

Russia vetoed a UNSC resolution April 24 that would have reaffirmed a nearly 50-year-old ban on placing weapons of mass destruction into orbit, two months after reports Russia has plans to do just that. Russia's vote against the resolution was no surprise.

As one of the five permanent members of the Security Council, Russia has veto power over any resolution that comes before the body. China abstained from the vote, and 13 other members of the Security Council voted in favor of the resolution.

If it passed, the resolution would have affirmed a binding obligation in Article IV of the 1967 Outer Space Treaty, which says nations are "not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction." Russia is one of 115 parties to the Outer Space Treaty. The Security Council vote Wednesday follows reports in February that Russia is developing a nuclear anti-satellite weapon.

The United States and Japan proposed the joint resolution, which also called on nations not to develop nuclear weapons or any other weapons of mass destruction designed to be placed into orbit around the

Earth. In a statement, US and Japanese diplomats highlighted the danger of a nuclear detonation in space. Such an event would have "grave implications for sustainable development, and other aspects of international peace and security," US officials said in a press release.

With its abstention from the vote, "China has shown that it would rather defend Russia as its

junior partner, than safeguard the global nonproliferation regime," said Linda Thomas-Greenfield, the US ambassador to the UN.

US government officials have not offered details about the exact nature of the anti-satellite weapon they say Russia is developing. A nuclear explosion in orbit would destroy numerous satellites—from many

countries—and endanger astronauts. Space debris created from a nuclear detonation could clutter orbital traffic lanes needed for future spacecraft.

Source: <https://www.wired.com/story/russia-un-resolution-space-nuclear-weapons-satellites/>, 27 April 2024.

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BALLISTIC MISSILE DEFENCE

INDIA

India Successfully Test Fires Medium-Range Ballistic Missile

India successfully test-fired a new variant of a medium-range ballistic missile on Tuesday. The launch, conducted by the Strategic Forces Command, demonstrated the missile's operational readiness and the effectiveness of its innovative technologies, according to a press release from the defence ministry. "A successful launch of the new variant of a medium-range ballistic missile was

carried out under the aegis of the Strategic Forces Command on April 23," the ministry said in the statement. The ministry further added, "The user launch has proven the operational capability of the Command and validated new technologies."

Source: <https://www.msn.com/en-in/news/India/india-successfully-test-fires-medium-range-ballistic-missile/ar-AA1nwjY>, 23 April 2024.

**The Russian-supplied VVER-1200 unit uses a double containment to maximise safety, with reinforced concrete protecting the plant from external hazards including natural disasters such as an earthquake, tsunami or hurricane. The lower tier of the internal containment steel dome at Tianwan 8 was hoisted into place on 13 March.**

**NUCLEAR ENERGY**

**CHINA**

**Inner Containment in Place at Tianwan 8**

The Russian-supplied VVER-1200 unit uses a double containment to maximise safety, with reinforced concrete protecting the plant from external hazards including natural disasters such as an earthquake, tsunami or hurricane. The lower tier of the internal containment steel dome at Tianwan 8 was hoisted into place on 13 March. The upper part of the inner containment dome - weighing 210 tonnes - was installed in the design position in the reactor building on 15 April, China National Nuclear Corporation (CNNC) announced. The total weight of the dome is over 600 tonnes, CNNC said, noting that it is “the heaviest thin-shell steel-lined dome in China”. Construction workers will now weld the metal structures of the lower and the upper tiers of the inner containment together. After the completion of installation works of the dome, they will continue concreting of the containment.

In June 2018, Russia and China signed four agreements, including for the construction of two VVER-1200 reactors as units 7 and 8 of the Tianwan plant. In addition, two further VVER-1200 units were to be constructed at the new Xudabao (also known as Xudapu) site in Liaoning province. Work on Tianwan 7 and 8 and Xudabao 3 and 4 was launched on 19 May 2021 at a ceremony attended via video-link by Chinese President Jinping and Russian President Putin. The ceremony included the pouring of first concrete for Tianwan 7. Construction of Tianwan 8 officially got under way on 25 February 2022 with the pouring of first concrete for the reactor’s nuclear island.

“Tianwan NPP unit 8 is being constructed strictly in accordance with the schedule,” said Alexey Bannik, vice president for projects in China and

advanced projects of Atomstroyexport, part of Russian state nuclear corporation Rosatom. “The Russian and the Chinese specialists are jointly implementing this project - the Russian party being responsible for design and supply of documentation and equipment for the nuclear island, or designing supervision, installation and adjustment supervision during the construction of units 7 and 8, and the Chinese customer for civil and erection, commissioning and other works during the units’ construction.” The two units are expected to be put into operation in 2026 and 2027, respectively.

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*Source: <https://www.world-nuclear-news.org/Articles/Inner-containment-in-place-at-Tianwan-8>, 17 April 2024.*

**GENERAL**

**IAEA Puts Case to G20 for Nuclear Energy’s Net Zero Role**

The G20 includes the world’s largest economies, with its member states meeting annually to discuss economic, political and social initiatives with the aim of bolstering international economic cooperation. Its members take it in turns to hold the presidency, with Brazil currently holding it. The IAEA is an invited participant to the Energy Transitions Working Group, which is one of 15 working groups in the policy-making process - the Sherpa Track - ahead of the next G20 leaders’ summit, in Rio de Janeiro in November, when Brazil’s priorities are “the fight against hunger, poverty and inequality, the three dimensions of sustainable development (economic, social and environmental) and the reform of global governance”.

In the past the IAEA has presented to the G20 on the use of nuclear technologies in tackling plastic pollution but had not done so on issues related to nuclear power until this year. In this case it has given an overview of nuclear power “in the clean energy mix, underscoring the need to speed up nuclear investments to meet net zero goals,

especially in emerging markets and developing economies”. The agency aims to continue to contribute to the working group. Fourteen of the G20 countries operate nuclear power plants, and six of them joined the pledge to triple nuclear capacity by 2050 made at the UN’s COP28 climate change summit in Dubai last year.

IAEA Director General Rafael Mariano Grossi said: “The global clean energy transition requires nuclear energy - that is absolutely clear. In the past month the world has embraced that fact in several milestones, including nuclear’s inclusion in the first Global Stocktake at COP28; in the pledge by more than 20 countries to triple nuclear capacity, and also in our landmark *Nuclear Energy Summit* last month. Through the leadership of the Brazilian Presidency of the G20, the IAEA is helping to further build on this momentum.”

In a 17-page document, *Nuclear Energy for Net Zero: Accelerating Investment in the Clean Energy Transitions*, the IAEA “calls for a combination of a supportive policy environment and improved access to finance to scale up investments in nuclear energy, particularly in developing economies. Investments in nuclear power will need to more than double from current levels to more than USD100 billion annually if the world is to reach net zero”. The IAEA says it plans to release another report, *Climate Change and Nuclear Power 2024: Financing Nuclear Energy in Low Carbon Transitions*, in October in the run-up to the G20 Summit and COP29. Thiago Barral, Secretary of Planning and Energy Transition of the Ministry of Mines of Brazil, said the IAEA’s work “tells a very important story around the scientific consensus on the role of nuclear energy to reach

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**But nuclear’s revival might be dead in the water with lenders balking at financing what they consider a high-risk sector. Last month, the IAEA convened the first ever nuclear summit in Brussels. Unfortunately, bankers appeared unwilling to finance the \$5 trillion the IAEA estimates the global nuclear industry needs for development until 2050.**

net zero, highlighting the acknowledgement of the role of nuclear in climate agreements and the recognition by the IPCC and climate experts that nuclear is needed to achieve net zero”.

Source: <https://world-nuclear-news.org/Articles/IAEA-puts-case-to-G20-for-nuclear-energy-s-net-zer>, 23 April 2024.

**Banks Unwilling to Finance \$5 Trillion Global Nuclear Development**

After decades of being treated as the black sheep of the energy universe, nuclear energy is enjoying a renaissance in the U.S. and many Western countries thanks to the global energy crisis. Back in December, at the COP28 summit, 22 countries including the US, Canada, the UK, and France pledged to triple nuclear power capacity by 2050 (from 2020 levels). Last month, 34 nations, including the United States, China, France, Britain, and Saudi Arabia, committed “to work to fully unlock the potential of nuclear energy by taking measures such as enabling conditions to support and competitively finance the lifetime extension of existing nuclear reactors, the construction of new nuclear power plants and the early deployment of advanced reactors.”

The world is begrudgingly beginning to accept that technological bottlenecks limit solar and wind energy as large-scale substitutes for fossil fuel energy. Further, we are unable to develop clean energy resources fast enough to meet the world’s climate goals while the war in Ukraine has laid bare Europe’s dependence on Russian energy. But nuclear’s revival might be dead in the water with lenders balking at financing what they consider a high-risk sector. Last month, the IAEA convened the first ever nuclear summit in Brussels. Unfortunately,

bankers appeared unwilling to finance the \$5 trillion the IAEA estimates the global nuclear industry needs for development until 2050.

“If the bankers are uniformly pessimistic, it’s a self-fulfilling prophecy,” former U.S. Energy Secretary Ernest Moniz said after listening to a panel of international lenders. “The project risks, as we have seen in reality, seem to be very high,” said European Investment Bank Vice President Thomas Ostros, adding that countries need to focus more on renewables and energy efficiency. Ines Rocha, a director at the European Bank of Reconstruction and Development, and Fernando Cubillos, a banker at the Development Bank of Latin America, concurred, saying their lending priorities lean toward renewables and transmission grids. “Nuclear comes last,” Cubillos said. “We need state involvement, I don’t see any other model. Probably we need quite heavy state involvement to make projects bankable,” Ostros said.

**State Involvement:** As Ostros has noted, at this juncture, the nuclear sector probably requires considerable government support if it’s to really take off. In the past, the U.S. government has been involved in nuclear

energy mainly through safety and environmental regulations as well as R&D funding in enrichment of uranium projects like HALEU. However, lately, the federal government is becoming more heavily involved in the nuclear energy sector.

Over the past several years, billions of federal dollars have gone into the development and demonstration of next-generation SMRs and advanced fuel cycle reactors. U.S. EXIM has been providing financing for overseas nuclear projects for more than a half-century. EXIM has issued

Letters of Interest for up to \$3 billion for nuclear exports to Poland and Romania. Established in 1934, the Export-Import Bank of the United States

(Ex-Im Bank), operates as an independent agency of the U.S. Government under the authority of the Export-Import Bank Act of 1945. Similarly, USTDA has committed funding for the export of nuclear power technologies to Poland and Romania, Ukraine and Indonesia. Much of the funding is for technical

activities, and includes a significant focus on the potential export of small modular reactors.

Last month, the U.S. federal government agreed to provide a \$1.5 billion loan to restart a nuclear power plant in southwestern Michigan, abandoning earlier plans to decommission it. The Michigan plant will become the first ever nuclear plant in the U.S. to be revived after abandonment. Privately-owned Holtec International acquired the 800-megawatt Palisades plant in 2022 with plans

to dismantle it. But now the plant will be able to contribute to Michigan’s power grid if it’s able to pass inspections and testing by the U.S. Nuclear Regulatory Commission, known as the NRC.

Michigan governor Gretchen Whitmer has welcomed the move. “Nuclear power is our

single largest source of carbon-free electricity, directly supporting 100,000 jobs across the country and hundreds of thousands more indirectly,” Energy Secretary Jennifer Granholm, a former Michigan governor, has said. “The repowering of Palisades will restore safe, around-the-clock generation to hundreds of thousands of households, businesses and manufacturers,” Kris Singh, Holtec president and chief executive, has declared. Meanwhile, California regulators have given the greenlight for the Diablo Canyon plant to operate through 2030 instead of 2025 as the state transitions toward

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renewable power sources. Pacific Gas & Electric, the plant's owner, says it has received assistance from the federal government to repay a state loan.

*Source: Alex Kimani, <https://oilprice.com/Alternative-Energy/Nuclear-Power/Banks-Unwilling-To-Finance-5-Trillion-Global-Nuclear-Development.html>, 14 April 2024.*

## **SUDAN**

### **Sudan to Pursue Nuclear Energy**

In a bid to boost the country's development, Sudan has consolidated its energy and mining ministries, and is pursuing nuclear power as a source of electricity, a senior official said at the World Economic Forum here on Monday. Speaking to Arab News, Minister of Energy and Petroleum Moheiddin Naeem Mohamed Saeed said the merging of the ministries is aimed at capitalizing on the nation's gold resources. Pursuing nuclear energy would boost the war-torn country's development, he added. "Sudan's significant gold production will be leveraged to drive development in other sectors," the minister said.

**Energy Minister Herman Halushchenko said: "This is a major geopolitical project of common interest for Ukraine and the US. The technologies that we will build and develop together will push Russians out of the European nuclear energy market ... through cooperation in the construction of a new type of reactor for Europe."**

Meanwhile, Saeed said that he found the discussions on nuclear energy during the WEF event beneficial, adding that his country has begun the process of developing its nuclear-power sector. "Having completed the initial two steps, it is now high time to seriously consider nuclear energy, given it is safe. This action will accelerate Sudan's industrial and developmental progress, potentially spearheading reforms in the energy sector, which is a key indicator of a country's level of development," Saeed said.

He said that discussions around energy were critical for all nations. "Energy is no longer a private matter; it is a concern that resonates worldwide. Access to energy is a fundamental right for people everywhere. With the evolving quality of life, energy has become indispensable. From household appliances to industrial machinery, our modern way of life relies heavily

on energy," he said. Saeed added that the WEF special meeting provides a platform for participants to discuss different energy sources and strategies for investing in them optimally, while keeping costs as low as possible, and developing industry standards.

*Source: Mohammed Al-Kinani, <https://www.arabnews.com/node/2501911/business-economy>, 30 April 2024.*

## **UKRAINE**

### **Work Under Way for First Westinghouse AP1000 in Ukraine**

They oversaw the first bit of concrete being laid as part of concreting of the drainage channel. The new unit will be the first of a planned fleet of Westinghouse AP1000 reactors in Ukraine. Energy

Minister Herman Halushchenko said: "This is a major geopolitical project of common interest for Ukraine and the US. The technologies that we will build and develop together will push Russians out of the European nuclear energy market ... through cooperation in the

construction of a new type of reactor for Europe." Energoatom CEO Petro Kotin said: "Westinghouse is our reliable strategic partner: both in the development and loading of alternative fuel into the VVER reactors, and in the creation of a fuel production line in Ukraine and in the construction of new power units ... during the war, we have not stopped, but on the contrary deepened and accelerated our cooperation."

He said that once the two new units - 5 and 6 - at Khmel'nitsky were built, and units 3 and 4 commissioned, the plant's power capacity would exceed that of the six-unit Zaporizhzhia nuclear power plant and "will be the largest nuclear power plant in Europe". Westinghouse Electric Company's President and CEO Patrick Fragman said: "We are opening a new stage, a new milestone in the cooperation between Westinghouse and Energoatom .... Ukraine will get energy that is

clean, affordable and with the use of economically feasible technologies. This project will also create many jobs during construction, operation, repairs and maintenance.” US Ambassador to Ukraine Bridget Brink said Ukraine needed more power facilities, especially with its current infrastructure being targeted by regular shelling...

**Ukraine has 15 nuclear units which could generate about half of its electricity, including the six at the Zaporizhzhia nuclear power plant which has been under Russian military control since early March 2022. Khmelniysky's first reactor was connected to the grid in 1987, but work on three other reactors was halted in 1990, at a time when unit 3 was 75% complete.**

Ukraine has 15 nuclear units which could generate about half of its electricity, including the six at the Zaporizhzhia nuclear power plant which has been under Russian military control since early March 2022. Khmelniysky's first reactor was connected to the grid in 1987, but work on three other reactors was halted in 1990, at a time when unit 3 was 75% complete. Work on the second reactor restarted and it was connected to the grid in 2004 but units 3 and 4 remain uncompleted. Last week, the Ukrainian Cabinet put forward a draft law on the construction/completion of units 3 and 4. Halushchenko said earlier this year that unit 3 could come into operation in as little as two and a half years.

Source: <https://www.world-nuclear-news.org/Articles/Work-under-way-for-first-Westinghouse-AP1000-in-Uk>, 15 April 2024.

**SMALL MODULAR REACTORS**

**CANADA**

**Ontario Welcomes \$80 Million Nuclear Manufacturing Investment in Cambridge**

The Ontario government is welcoming a \$80 million investment by BWX Technologies, Inc. (BWXT) to expand their Cambridge nuclear manufacturing plant. Their investment will create more than 250 new skilled, unionized jobs in Cambridge and support Ontario's expansion of reliable, affordable

and clean nuclear energy to power our growing economy. “With shovels in the ground today on new nuclear generation, including the first small modular reactor in the G7, I'm so pleased to see global nuclear manufacturers like BWXT expanding their operations in Cambridge and hiring

more Ontario workers,” said Todd Smith, Minister of Energy. “The benefits of Ontario's nuclear industry reaches far beyond the stations at Darlington, Pickering and Bruce, and this \$80 million investment shows how all communities can help meet Ontario's growing demand for clean energy, while also securing local investments and creating even more good-paying jobs.”

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This investment builds on BWXT's existing operations in Ontario, which already employs 1200 people, and supports the ongoing operations of Ontario's existing nuclear stations at Darlington, Bruce and Pickering. As Ontario takes a global leadership position on new nuclear technologies,

including Ontario Power Generation's Darlington New Nuclear Project for four small modular reactors and the first large-scale new nuclear build in a generation at the Bruce site, BWXT is expanding their operations and hiring more Ontario workers to be able to meet the growing demand here in Ontario, across Canada and beyond.

...The province's build-out of nuclear generation – supported by BWXT's expanded facility - will provide families and industries with the reliable, low-cost, and clean energy needed to power the future, with growing electricity demands as a result of increasing electrification and strong economic growth in the province.

Source: <https://news.ontario.ca/en/release/1004463/ontario-welcomes-80-million-nuclear-manufacturing-investment-in-cambridge>, 19 April 2024.

**GENERAL**

**SMR Market Expected to Reach \$295bn by 2043 Shows Report**

Market analyst IDTechEx expects the installation rate of SMRs to grow significantly from the end of the decade, contributing significantly to solving the climate crisis. The flexibility of these reactors beyond supplying electricity to the grid is a significant reason that their expected impact is so broad. These were findings in the latest report released by IDTechEx titled *Nuclear Small Modular Reactors (SMRs) 2023-2043*, which shows the global market for SMRs is expected to reach \$72.4 billion by 2033 and \$295 billion by 2043, representing a CAGR of 30% in this period.

The report outlines the level of potential of SMRs, with twenty-year forecasting outlining the expected rise of SMRs as tools for decarbonisation. It identifies additional business models to grid power supply as important motivators for uptake – in 2024, the ongoing AI boom is intensifying demand here. Nuclear SMRs aim to take advantage of assembly line production to reduce cost and construction time compared to the large reactors that form the bulk of today’s nuclear fleet. Their smaller size and frequent use of advanced fourth generation reactor designs also make them more flexible than today’s reactors, opening uses beyond supplying power to the grid directly.

**SMRs Offer a Solution to the Data Centre Energy Crisis:** According to the International Energy

Agency, annual energy consumption from data centres could double between 2024 and 2026 to

exceed 1,000TWh. The widening rollout of advanced AI models is the major reason for this astounding increase. SMRs typically have electrical capacities of less than 300MW, closely matching the demands of many data centres, and promise to provide reliable baseload capacity

without the need for energy storage. It is no surprise that the data centre and AI industries are showing increasing interest in SMRs to provide on-site power.

OpenAI’s Sam Altman has chaired the board of SMR firm Oklo Energy since 2015 and the company says it has signed letters of intent for powering data centre locations by the end of the decade. Last December, Microsoft hired the former director of nuclear strategy & programmes at SMR firm

Ultra Safe Nuclear Corporation as a director in its nuclear programme, which may have links to the massive AI acceleration centres it is expected to construct for its partner, OpenAI. In March, Amazon Web Services acquired a data centre drawing 475MW of power from a co-located large nuclear power plant in Pennsylvania, proving the utility of this concept. The increased

flexibility and lower predicted cost of SMRs are only expected to increase viability here.

**SMRs could Power the Hydrogen Economy and Decarbonise Critical Industries:** SMRs offer an excellent complement to renewable energy in the production of green hydrogen that could reduce reliance on costly energy storage systems. With an SMR supplying baseload capacity on a local

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grid alongside variable renewables like solar and wind energy, electricity overcapacity in the network at times of peak production could be diverted to water electrolyzers located at the SMR facility, producing carbon-free pink hydrogen. Since SMRs will be located next to abundant water supplies and have their own water treatment facilities, this part of their infrastructure could pull double duty, reducing overall capital costs. Rolls-Royce SMR has suggested this form of hydrogen production could make up a significant part of the business model for some of its sites.

There is also the potential to use Gen IV reactor design-based SMRs to directly supply process heat to hard to decarbonise industries without needing to go through the proxy of generating electricity. Compared to most existing reactors, the higher operating temperatures of Gen IV designs massively expands their compatibility with industrial processes, even those as demanding as steelmaking. The Japan Atomic Energy Agency recently outlined its ongoing project to retrofit its existing demonstration HTGR (High Temperature Gas-cooled Reactor) to steam reform methane for hydrogen production to IDTechEx, demonstrating the potential here.

Canadian startup Terrestrial Energy's SMR design uses a molten salt reactor (MSRs), which allows it to supply process heat at extremely high temperatures, even for a Gen IV reactor. These reactors are aimed specifically at installation in industrial zones, where they could co-generate heat and electricity. The safety benefits of Gen IV designs make this co-location more attractive: in the case of MSRs, core melts are effectively

impossible since the fuel is already molten in the coolant salt, and low operating pressures reduce the risk of coolant leaks.

Source: <https://www.powerengineeringint.com/nuclear/smr-market-expected-to-reach-295bn-by-2043-shows-report/>, 24 April 2024.

#### **UKRAINE-USA**

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#### **Energatom and Holtec Sign Agreement to Produce Components of Small Modular Reactors in Ukraine**

NNEGC Energatom and the American company Holtec International signed an agreement on the production of small modular reactor components. According to the Agreement, Ukraine will create facilities for the production and manufacture of nuclear systems, structures and components for small modular reactors, storage and transportation systems for spent nuclear fuel. At the same time, the document covers other needs for the use of nuclear energy in Ukraine and other countries of the region.

In the past, Energatom and Holtec International have already had successful cooperation experience. Thanks to their cooperation, the Centralized Spent Fuel Storage Facility (CSFSF) was built and commissioned in Ukraine, which allows saving about \$200 million annually. This also made it possible to completely abandon the export of spent nuclear fuel to Russia. In addition, in November 2023, during the visit of the Minister of Energy of Ukraine Herman Halushchenko to Washington, Energatom and Holtec International signed an agreement to establish a plant in

Ukraine to produce spent nuclear fuel storage containers for the Centralized SFSF. Previously, they were manufactured in the US. Energoatom and Holtec International also signed an agreement on cooperation in deploying Holtec small modular reactors in Ukraine.

Source: <https://itc.ua/en/news/energoatom-and-holtec-sign-agreement-to-produce-components-of-small-modular-reactors-in-ukraine/>, 17 April 2024.

**USA**

**Small Nuclear Reactor Prototype Displayed in DC**

DC-based energy startup Last Energy is making a pitch that small nuclear reactors are the answer to future energy concerns. Last Energy builds so-called SMRs. These reactors can create enough energy to power neighborhoods. One of Last Energy's target audiences with the SMR technology is data centers. "In a world driven by data, reliable and scalable energy solutions are paramount to meet evolving energy requirements and sustainability commitments," the company's website says.

Last Energy officials were in D.C. Monday showing off the prototype of the SMR. It uses an easy-to-assemble steel structure to house a 20-megawatt light-water reactor, which is partially buried underground. The founder and CEO Bret Kugelmass is now on a tour to convince the public that smaller scale nuclear plants are a good idea. A spokesperson for Last Energy said while this prototype is currently sitting in a northwest DC neighborhood, the real SMRs would not be built there.

They would be set up in industrial zones — near manufacturing parks or data centers. The team is presenting its vision for nuclear energy at the Data Center World Conference in DC this week, which is why it suspended a 22-ton prototype from a crane in front of the Convention Center Monday afternoon.

While Last Energy sees these small reactors as the next big thing in energy, others are urging caution. The watchdog group Union of Concerned Scientists has been raising the alarm for years. In a 2013 report titled "Small Isn't Always Beautiful," Edwin Lyman says many of the risk surrounding nuclear power, including waste concerns, and vulnerability to terrorist attacks, still exist with SMRs.

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... In April of this year, the group penned a letter to the US Senate, urging caution on a bill that the House of Representatives passed in February. They fear that H.R.6544 could undermine the Nuclear Regulatory Commission, which is the body charged with protecting public health, worker safety, and the environment as it relates to civilian nuclear power. As the Senate reviews it, the Union of Concerned Scientists is making the following recommendations: Reject language that undermines the NRC's independence and core mission; Reject attempts to micromanage how the NRC conducts its safety and security oversight; Reject foreign ownership, control or domination of domestic nuclear facilities. Cost is often also top of mind for taxpayers. Last Energy said this would not be funded by the government. ...

Source: <https://www.msn.com/en-us/money/companies/small-nuclear-reactor-prototype-displayed-in-dc/ar-BB1IHIfA>, 15 April 2024.

**NUCLEAR SAFETY**

**GENERAL**

**New IAEA Publication: Radiation Safety in the Use of Radiation Sources in Research and Education**

The IAEA has published a safety guide to protect students and researchers who use radioactive material or radiation in learning or research. Students and researchers who work with radiation sources are integral to shaping a strong safety culture in tomorrow's nuclear workforce. To provide guidance, the IAEA has published the

tailored guide with recommendations for the safe use of radioactive material in research and educational establishments, entitled/ Radiation Safety in the Use of Radiation Sources in Research and Education.

“The use of radiation sources and radioactive material in academic and research programmes is increasing globally,” said Haridasan Pappinisseri Puthanveedu, IAEA Senior Safety Officer, who coordinated the development of the publication, adding that “a harmonized effort is necessary to protect students and teachers in institutions worldwide as well as the general public.” A wide variety of

radiation sources are used in research and education, from teaching basic science principles in secondary schools to scientific research projects. These sources include sealed radioactive sources, unsealed radioactive material, and radiation generators such as X ray units, accelerators and neutron generators, which can be used for testing radiation monitoring instruments in laboratories and in secondary school demonstrations.

The recommendations in this publication are aimed primarily at academic and research institutions that are authorized to use sealed radiation sources in their programme. They may also

be of interest to individuals working for regulatory bodies and other organizations involved in the design, manufacture, supply and service of sealed radiation sources and associated equipment for research and education.

... The guidance covers the basic principles of radiation protection, information about different types of radiation sources, the duties and responsibilities of operating organizations, recommendations for the design of facilities,

laboratories and equipment and advice on conducting safety assessments. As the use of radioactive sources can lead to the generation of radioactive waste, the guide also covers the safe transportation, storage and disposal of radioactive material and waste.

...The information sets out concrete measures for controlling exposure to radiation, including recommendations for the prevention of accidents and the protection of members of the public who might inadvertently be exposed to radiation, as well as guidance for emergency exposure situations. In addition, practical guidance is provided on the use of

radiation sources with regard to the age of students, starting from secondary school, as well as case studies related to radiation protection of students in medical education. ... This safety guide forms part of the IAEA's Safety Standards, which provide the fundamental principles, requirements and recommendations to ensure nuclear safety. The series serves as a global

reference for protecting people and the environment and contributes to a harmonized high level of safety worldwide.

Source: <https://www.iaea.org/newscenter/news/new-iaea-publication-radiation-safety-in-the-use-of-radiation-sources-in-research-and-education>, 23 April 2024.

### JAPAN

#### IAEA Assesses Operation of Japanese Reactor for 60 Years

Under revised regulations which came into force in July 2013, Japanese reactors have a nominal operating period of 40 years. Extensions can be granted once only and limited to a maximum of

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20 years, contingent on exacting safety requirements. In November 2016, Japan's Nuclear Regulation Authority (NRA) approved an extension to the operating period for Kansai's Mihama unit 3, a 780 MWe pressurised water reactor that entered commercial operation in 1976. The NRA's decision cleared the unit to operate until 2036.

Mihama 3 was the third Japanese unit to be granted a licence extension enabling it to operate beyond 40 years under the revised regulations, following Kansai's Takahama 1 and 2 which received NRA approval in June 2016. Mihama 3 was restarted in June 2021 after having been idle since May 2011 following the accident at the Fukushima Daiichi plant two months earlier. It became the first Japanese power reactor to operate beyond 40 years. The IAEA has now completed a ten-day Safety Aspects of Long-Term Operation (SALTO) mission to Mihama 3, carried out at Kansai's request.

A SALTO peer review is a comprehensive safety review addressing strategy and key elements for the safe long-term operation of nuclear power plants. SALTO missions complement IAEA Operational Safety Review Team (OSART) missions which are designed as a review of programmes and activities essential to operational safety. SALTO peer reviews can be carried out at any time during the lifetime of a nuclear power plant, although according to the IAEA the most suitable time lies within the last ten years of the plant's originally foreseen operating period. SALTO and OSART reviews are carried out at the request of the IAEA member

country in which the review is to take place.

The team reviewed Mahama 3's preparedness, organisation and programmes for safe LTO. The mission was conducted by an 11-person team comprising experts from the Czech Republic, France, Sweden, the UK and the USA, as well as three observers from Finland and South Korea, and two IAEA staff members. The team identified good performances, including that the plant has developed and effectively implemented a comprehensive methodology for identification and management of design obsolescence. The plant has also participated in benchmarking efforts related to ageing management of the steel containment and containment pressure testing and uses these benchmarking efforts to enhance the ageing management activities of the civil structures. In addition, it has put in place an effective mentoring programme using retired staff as mentors for new and current staff to develop their competencies and skills.

The team also provided recommendations and suggestions, including that the plant should further develop and implement its LTO programme and should fully develop and complete the ageing management review process for mechanical, electrical, and instrumentation and control components and civil structures. It also said the plant should improve its so-called equipment qualification programme, designed to confirm the resistance of components to harsh conditions. "The team observed that Kansai is implementing measures for safe LTO in a timely manner and the staff at the plant are professional, open and receptive to proposals for improvement," said

**Mihama 3 was restarted in June 2021 after having been idle since May 2011 following the accident at the Fukushima Daiichi plant two months earlier. It became the first Japanese power reactor to operate beyond 40 years. The IAEA has now completed a ten-day Safety Aspects of Long-Term Operation (SALTO) mission to Mihama 3, carried out at Kansai's request.**

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team leader and IAEA Nuclear Safety Officer Martin Marchena. "Some ageing management and LTO activities already meet IAEA safety standards. We encourage the plant to address the review findings and implement all remaining activities for safe LTO as planned."

The team provided a draft report to the plant management and to the NRA at the end of the mission. The plant management and the NRA will have an opportunity to make factual comments on

the draft. A final report will be submitted to the plant management, the NRA and the Japanese government after comments are addressed.

*Source: <https://www.world-nuclear-news.org/Articles/IAEA-assesses-operation-of-Japanese-reactor-for-60>, 25 April 2024.*

## **NETHERLANDS**

### **IAEA Finds Improved Safety at Dutch Research Reactor**

The previous Integrated Safety Assessment for Research Reactors (INSARR) found that the Reactor Institute Delft (RID) at the Delft University of Technology had prioritised safety during implementation of significant refurbishment and modernisation of the facility. The team also found areas requiring further enhancements, including

the organisational structure and safety procedures and documentation. An INSARR mission is conducted at the request of an IAEA Member State. It is a peer review service that assesses and evaluates the safety of research reactors based on IAEA safety standards. The follow-up

**The previous Integrated Safety Assessment for Research Reactors (INSARR) found that the Reactor Institute Delft (RID) at the Delft University of Technology had prioritised safety during implementation of significant refurbishment and modernisation of the facility. The team also found areas requiring further enhancements, including the organisational structure and safety procedures and documentation.**

INSARR mission to the Hoger Onderwijs reactor was requested by the Dutch regulatory body, the Authority for Nuclear Safety and Radiation Protection.

A team has now completed the follow-up INSARR mission. While it concluded that safety had since been enhanced through the implementation of the previous recommendations, the team found there is the need to address recommendations related to operational radiation protection and commissioning, following

major modifications to the research reactor. Earlier this month, the 3 MWt pool-type research reactor ended a six-month shutdown for the installation of a cold neutron source, which uses very low energy neutrons to study materials with large dimensions. It has since resumed operation to complete the commissioning of the cold neutron source.

The team assessed that RID has strengthened the organisational effectiveness and operational

programmes through: completion of an analysis for RID organisational restructuring options and clarification of roles and responsibilities; revision of operational limits and conditions, with clear distinctions between safety limits and safety system settings; development of an asset management database for the reactor operating programmes and technical modifications;

and improvement of emergency preparedness by conducting drills. The findings from the mission indicate the need for continued safety enhancements in areas that are related to: reassessment and development of a specific set of operational limits and conditions associated

**The findings from the mission indicate the need for continued safety enhancements in areas that are related to: reassessment and development of a specific set of operational limits and conditions associated with the commissioning stages of testing the new installation of the cold neutron source; and revision of the area classification and zoning systems for radiological protection, considering the laboratories located within the reactor site.**

with the commissioning stages of testing the new installation of the cold neutron source; and revision of the area classification and zoning systems for radiological protection, considering the laboratories located within the reactor site.

...The Hoger Onderwijs reactor is mainly used for research in nuclear science and engineering, neutron activation analysis and in the development of new radioisotopes and production methods. ...It was temporarily shut down in 2019 for the modification programme of its systems and components, including cooling circuits and the containment dome.

Source: <https://www.world-nuclear-news.org/Articles/IAEA-finds-improved-safety-at-Dutch-research-react,23April2024>.

**The team reviewed the status of 19 nuclear infrastructure issues using the IAEA evaluation methodology for Phase 2 of the Milestones Approach, which evaluates the readiness of a country to invite bids or negotiate a contract for the first nuclear power plant.**

### POLAND

#### IAEA Reviews Poland's Nuclear Power Infrastructure Development

Poland is making progress towards adding nuclear power to its energy mix, including in developing the necessary infrastructure for a safe and sustainable nuclear power programme, according to an IAEA review mission.

An IAEA team of experts today concluded an 11-day mission to Poland to review its infrastructure development for the Polish Nuclear Power Programme (PNPP). The PNPP was approved in January 2014 by the Polish Council of Ministers. The establishment of nuclear power is an objective of the Energy Policy of Poland until 2040, which sets the framework for the country's energy transition to strengthen energy security and to reduce reliance on coal power plants to meet climate goals. In 2022, the Polish Government announced that the country's first nuclear power plant will be comprised of three Westinghouse AP1000 reactors, and it expects the first unit to be commissioned in 2033.

The Phase 2 Integrated Nuclear Infrastructure Review (INIR) was carried out from 15 to 25 April,

at the invitation of the Government of Poland, and hosted by the Ministry of Climate and Environment. The team reviewed the status of 19 nuclear infrastructure issues using the IAEA evaluation methodology for Phase 2 of the Milestones Approach, which evaluates the readiness of a country to invite bids or negotiate a contract for the first nuclear power plant.

Prior to the Phase 2 INIR mission, Poland prepared a self-evaluation report covering all 19 nuclear power infrastructure issues and submitted the report and supporting documents to the IAEA. The team comprised of three experts from Brazil, the United Kingdom and the United States of America, as well as seven IAEA staff.

The team identified good practices that would benefit other countries developing nuclear power in the areas of contracting approach, strategic approach to funding, early authorization of technical support organizations to support the nuclear regulator, engagement with the electrical grid operator, stakeholder involvement and industrial involvement.

...The team also made recommendations and suggestions aimed at assisting Poland in making further progress in the development of its nuclear infrastructure and its readiness to build the first nuclear power plant in the country. The team highlighted areas where further actions would benefit Poland, including the need to further review its legal and regulatory framework, and finalize the preparatory work required for the contracting and construction stages. ...Based on the outcomes of the INIR mission, the IAEA and Poland will update their Integrated Workplan to continue providing coordinated support in line with the future development of the country's nuclear power programme.

Source: <https://www.iaea.org/newscenter/pressreleases/iaea-reviews-polands-nuclear-power-infrastructure-development,25April2024>.

**UKRAINE**

**China Supports Strengthened Nuclear Safety Measures in Ukraine, Lauds IAEA's Role**

China on Monday voiced support for the IAEA efforts to enhance nuclear safety in Ukraine. During a United Nations Security Council briefing on the safety of nuclear facilities in Ukraine, Geng Shuang, China's deputy permanent representative to the United Nations (UN), highlighted the significant challenges and threats posed to Ukrainian nuclear facilities by the ongoing crisis.

"The prolonged crisis in Ukraine poses a serious challenge and a grave threat to the safety and security of Ukrainian nuclear facilities," Geng said, pointing out recent drone attacks and shelling around the Zaporizhzhia nuclear power plant as particularly concerning. Geng praised the proactive steps taken by IAEA Director-General Rafael Grossi, who in May "proposed the five principles on the safety and security of the Zaporizhzhia nuclear power plant and has been actively using his good offices to promote the safety and security of nuclear facilities". China fully supports these efforts and "appreciates all his efforts", he said.

Geng reiterated China's call for calm and restraint from all involved parties. "We once again call on the parties concerned to strictly comply with the Convention on Nuclear Safety and other relevant international laws, refrain from any action that could endanger nuclear facilities, and work resolutely to prevent man-made nuclear accidents," he said. Discussing the broader

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implications of the conflict, Geng stressed that the safety issues at the Zaporizhzhia nuclear power plant are part of the larger Ukraine crisis, which requires a political resolution.

"We call on all parties to uphold the principle of indivisible security, focus on achieving peace and stability, start engagement without delay, gradually build consensus, and resume peace talks at an early date," he said, highlighting the need for conditions that foster the resolution of issues

including nuclear safety. Concluding his remarks, Geng affirmed China's commitment to promoting peace and dialogue and its intention to play a constructive role in achieving a political settlement of the Ukraine crisis.

*Source: <https://www.chinadaily.com.cn/a/202404/16/WS661e2b3fa31082fc043c242d.html>, 16 April 2024.*

**NUCLEAR COOPERATION**

**CHINA-GHANA**

**Ghana and China to Cooperate on HPR 1000 Nuclear Project**

Nuclear Power Ghana (NPG) and China National Nuclear Corporation (CNNC) Overseas Limited signed a cooperation and framework agreement on the margins of the 26th World Energy Congress in Rotterdam for the construction of a HPR-1000 (Hualong One) Nuclear Power Project and the upgrade of Ghana's grid. Ghana restructured its nuclear programme in 2008 to meet the expected increase in energy demand. Nuclear Power Ghana was established in 2018 as the

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Owner/Operator of Ghana's first proposed NPP. Based on support from the IAEA, several countries have expressed interest in assisting Ghana in the development of its nuclear power programme, including China which has long-standing cooperation with Ghana in the fields of energy and commerce.

Speaking at a pre-agreement signing ceremony, Energy Minister, Dr Matthew Opoku Prempeh said the agreement represents a profound commitment to advancing Ghana's energy sector, ensuring sustainable development, and meeting the growing demand for electricity. ...CNNC President Yu Jianfeng commended the Minister for his leadership in the collaboration. ...NPG said the Government of Ghana continue to support the Ghana Nuclear Power Programme, which is under the Power Directorate at the Ministry of Energy by its active participation and funding. Yu and Prempeh previously met during in December 2023 during the COP28 in Dubai. The two then reviewed successful experiences of collaboration in microreactor projects and the conversion of miniature neutron source reactors. They also discussed their shared vision for further nuclear cooperation.

Source: <https://www.neimagazine.com/news/newsghana-and-china-to-co-operate-on-hpr-1000-nuclear-project-11712852>, 25 April 2024.

**SOUTH KOREA–ROMANIA**

**Romania, South Korea Sign MoU on Nuclear Energy Bilateral Cooperation**

Romania and South Korea signed a Memorandum of Understanding on nuclear energy cooperation, which covers the improvement of nuclear equipment, safety and nuclear fuel equipment,

SMR, and radioactive waste management. "On the occasion of the state visit to South Korea undertaken together with President of Romania Klaus Iohannis, Energy Minister Sebastian Burduja had a bilateral meeting with Korean Minister of Trade, Industry and Energy Ahn Duk-geun, with the sides signing a Memorandum of Understanding on nuclear energy cooperation, in the presence of the presidents of the two countries. The

Memorandum provides for nuclear cooperation, including on the improvement of nuclear equipment, safety and nuclear fuel equipment, SMRs, and radioactive waste management," the Energy Ministry said in a release.

The two Energy ministers discussed energy policies and decided to expand cooperation for the development of the Cernavoda nuclear power plant and of the fuel supply chain. The Republic of Korea intends to strongly support the nuclear power plant industry in terms of refurbishment, nuclear fuel supply, maintenance and management services. The construction and operation of small modular reactors will ensure clean, emission-free energy, the document states.

"This memorandum strengthens the partnership between Romania and the Republic of Korea. Energy is the main dimension of this collaboration, through several projects such as: the refurbishment of Unit 1 of the Cernavoda Nuclear Power Plant, and the construction of Europe's

first and the world's third tritium-removal facility, which will give Romania the chance to become a European center for the production and export of tritium, a candidate fuel for future nuclear fusion reactors. Through this partnership, the Korean partners offer us the experience acquired in the

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nuclear energy field, their seriousness and competence,” Energy Minister Sebastian Burduja said, as cited in the statement.

The Romania–South Korea nuclear energy cooperation has developed a lot in recent years, mainly due to the Korean interest in Romania’s national nuclear projects. The Republic of Korea is among the states that have expressed their interest in financing the Doicesti small modular reactor project. ...

Source: <https://abnase.com/romania-south-korea-sign-mou-on-nuclear-energy-bilateral-cooperation/>, 24 April 2024.

**SOUTH KOREA–USA**

**S. Korea, U.S. Hold Consultations on Nuclear Energy, Nonproliferation**

South Korea and the US held consultations to discuss bilateral cooperation in nuclear disarmament and nonproliferation, the foreign ministry said Tuesday. At the meeting held in Seoul the previous day, Kweon Ki-hwan, the deputy foreign minister for multilateral and global affairs, and Jill Hruby, under-secretary for nuclear security of the U.S. Department of Energy, stressed that nuclear cooperation is an “important pillar” of the South Korea-U.S. alliance. They also agreed to bolster ties in the supply of nuclear fuel, management of spent nuclear fuel and joint research on nuclear nonproliferation, according to the ministry.

Source: <https://en.yna.co.kr/view/AEN20240423004100315?section=national/diplomacy>, 23 April 2024.

**NUCLEAR DISARMAMENT**

**JAPAN**

**New Group Sets 2030 Deadline for Japan to Join Nuke Ban Treaty**

An anti-nuclear group set up in Japan this month said it will work to get the government to sign and ratify the Treaty on the Prohibition of nuclear

weapons by 2030 at the latest. Japan Campaign to Abolish nuclear weapons was formed by the Japan NGO Network for Nuclear Weapons Abolition, a group of about 30 organizations and individuals. The treaty, which took effect in 2021, bans the possession, use and development of nuclear weapons. Japan has not joined the pact or sent an observer to two meetings of states parties. “Let us join forces across party lines and regardless of ideology or belief toward the goal of eliminating nuclear weapons,” Terumi Tanaka, who was appointed representative director of the campaign, said in a speech at an inaugural symposium in Tokyo on April 20.

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Tanaka, a hibakusha atomic bomb survivor, co-chair the Japan Federation of A- and H-Bomb Sufferers Organization (Nihon Hidankyo), a member of the NGO network. About 130 people took part in the symposium. Setsuko Thurlow, a high-profile hibakusha from Hiroshima who now lives in Canada, sent a video message of encouragement, as did U.N.

Under-Secretary-General Izumi Nakamitsu, who serves as high representative for disarmament affairs. The campaign aims to forge a cross-party and cross-generational alliance to build momentum for abolishing nuclear weapons. It plans to visit Diet members of all political parties, organize study sessions for citizens and hold international conferences. ...

Source: <https://www.asahi.com/ajw/articles/15240368>, 21 April 2024.

**NUCLEAR WASTE MANAGEMENT**

**CANADA**

**Nuclear Waste Referendum Date Set for October**

Residents in the Municipality of South Bruce will decide whether they want to host Canada’s first permanent nuclear waste storage facility this October. South Bruce Council has set a date for a long-awaited referendum on the proposed project

of Oct. 28, 2024. Eligible voters will be asked, “Are you in favour of the Municipality of South Bruce declaring South Bruce to be a willing host for the Nuclear Waste Management Organization’s proposed deep geological repository?”

If 50 per cent of voters turn out and more than 50 per cent vote “yes,” South Bruce will declare itself a willing host for the project. If 50 per cent of voters turn out and 50 per cent vote “no,” South Bruce will no longer be in the running for the project. However, if fewer than 50 per cent of voters end up voting in the referendum, South Bruce Council will decide whether the community will move forward in the process or not.

For the past 25 years, the Nuclear Waste Management Organization has been looking for a community willing to host Canada’s 5.6 million radioactive used nuclear fuel bundles in a massive underground facility. The only two communities left in the running for the project are the Municipality of South Bruce, north of Wingham, and the community of Ignace in northern Ontario. The \$26 billion project would mean thousands of jobs for the host community over the 170 year lifespan of the proposed facility. It would also mean housing Canada’s most radioactive waste forever. South Bruce Council said there will seven days of advance voting ahead of the referendum date.

*Source: <https://london.ctvnews.ca/nuclear-waste-referendum-date-set-for-october-1.6860582>, 25 April 2024.*

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**A special committee of a Saga Prefecture town assembly is expected to approve a petition to accept a “literature survey” for a possible final disposal site for high-level radioactive waste from nuclear plants. At the Genkai assembly, the committee on nuclear energy issues, consisting of all assembly members, began its second discussion on the petition, submitted by local business groups.**

## **JAPAN**

### **Saga Town Committee to OK Petition to Accept Nuclear Waste Survey**

A special committee of a Saga Prefecture town assembly is expected to approve a petition to accept a “literature survey” for a possible final disposal site for high-level radioactive waste from nuclear plants. At the Genkai assembly, the committee on nuclear energy issues, consisting of all assembly members, began its second discussion on the petition, submitted by local business groups.

In the previous discussion, the committee received explanations from officials from related organizations including the Agency for Natural Resources and Energy and the Nuclear Waste Management Organization of Japan, or NUMO, which conducts the survey. If the petition is approved by the special committee and then the full assembly, the Genkai mayor will need to make the final decision on whether to accept the survey. The mayor, Shintaro Wakiyama, has taken a cautious stance on the issue.

The literature survey, which looks into papers and data, is the first of the three stages in the process of selecting a final disposal site. Municipalities can decide whether to apply for the survey, and those that accept can receive up to ¥2 billion in state subsidies over two years. Once an area is found suitable for a disposal site, it moves on to the second stage after the consent of the prefectural governor. Saga Gov. Yoshinori Yamaguchi opposes

the idea of hosting such a site, making it unclear whether Genkai will be able to move forward in the selection process.

Source: <https://www.japantimes.co.jp/news/2024/04/25/japan/japan-nuclear-waste-disposal-site/>, 25 April 2024.

**UK**

**Hunterston A Achieves Major Milestone in Waste Storage**

The UK Nuclear Restoration Services (NRS) says 2,100 tonnes of solid radioactive waste have been retrieved and safely stored at the Hunterston A Magnox NPP in Scotland. NRS are a leading organisation in the UK responsible for the active decommissioning and restoring of Government nuclear sites, to ensure all our futures are more safe, secure and sustainable. Hunterston A's two 180 MWe Magnox reactors operated from 1964 to 1990. The nuclear decommissioning site holds the largest inventory of solid ILW across all the NRS sites. This waste comprises contaminated metallic components, debris removed from used fuel elements and 30,000 fuel element graphite sleeves.

Mark Blackley, Hunterston A Site Director, said: "This is a fantastic achievement which has safely and compliantly reduced one of the most significant hazards on site. Over 85% of the intermediate level waste (ILW) inventory has now been retrieved. This is a tremendous testament to everyone who has been involved in or who has supported this project. The remaining 15% of ILW inventory are residual sludges from the spent fuel storage ponds and acids. These are in the process of being recovered and treated."

Gareth Taylor, Group Performance Improvement

Director at the Nuclear Decommissioning Authority, described the operation as "a significant milestone in our mission to safely and securely decommission our legacy nuclear sites." He added: "It's a collective achievement that the whole team are rightfully proud of, and we will be looking to take forward the lessons learned and apply them across our other sites." The waste was transported via underground tunnels and stored in one of five above-ground concrete bunkers that

were constructed on site between the 1960s and 1980s. The Solid Active Waste Bunker Retrieval (SAWBR) project was established to remove the waste and empty the five bunkers in sequence by breaking through the walls one by one. The initial breakthrough at bunker five

was conducted manually in 2014 using core drills and wire saws to remove an 800mm deep concrete slab. Then a remotely operated vehicle broke through the remaining 400mm depth to create the first full opening.

Remotely operated vehicles were used to recover the waste to a purpose-built facility built on the side elevation of bunker five. The waste was then loaded in to three metre cube size stainless steel boxes. The filled boxes were transported to the site's ILW store pending future encapsulation at the solid intermediate level waste encapsulation (SILWE)

facility before being returned to the ILW store for long term storage in line with the Scottish Government's higher activity waste policy. ILW becomes a site's highest radiological hazard after all the used fuel has been removed and is often located in hard-to-reach areas. This complicates the task of retrieving the waste requiring, in some cases, many years of engineering work before retrieval can begin. Stuart Blair, Waste Operations

**Hunterston A's two 180 MWe Magnox reactors operated from 1964 to 1990. The nuclear decommissioning site holds the largest inventory of solid ILW across all the NRS sites. This waste comprises contaminated metallic components, debris removed from used fuel elements and 30,000 fuel element graphite sleeves.**

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Manager at Hunterston A, commented: “The process to empty the bunkers has not been without its challenges. The team has overcome many technical challenges throughout, employing operational experience and innovation to progress the waste recoveries safely and efficiently.”

He added: “Most of the team that has completed this work has been involved since day one of retrievals which makes the achievement

especially satisfying. With safe and sustainable decommissioning, the process takes decades to complete, so I am also mindful of former colleagues who have contributed significantly over the course of the 20 years since the recovery concept was born.”

*Source: <https://www.neimagazine.com/news/newshunterston-a-achieves-major-milestone-in-waste-storage-11688849>, 17 April 2024.*



Centre for Air Power Studies

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

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