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**OPINION – Mark Hibbs**

**KSA: Outliers and Firewalls**

The recent attention given to a US Congressional report, and especially its allegations of secrecy and potentially illegal actions concerning individuals close to President Donald Trump, raises the question whether advisers to the President could engineer the export of nuclear power reactors to the Kingdom of Saudi Arabia (KSA) or another foreign destination outside the requirements of US statutes and behind the backs of lawmakers.

Based on information brought to light in this affair so far, the answer in my view is almost certainly no. Individuals advocating exporting nuclear items to the KSA, whose activities are the focus of the Congressional report, could not have escaped the obligations of the US Atomic Energy Act (AEA). Moreover, they appear to have been outliers, having no business relationship with, or endorsement from, the private industry firms whose know-how would have to be the basis of any US nuclear power plant export to the KSA or elsewhere.

Two months ago Democrats on the US House of Representatives “Committee on Oversight and Reform” released an “interim report”

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documenting efforts by individuals close to the President to sell “sensitive nuclear technology” to the KSA. Having suggested that the activities it described were secret and may have been illegal, upon release the document captured the attention of the US major media. Thereafter, the report’s contents were boiled down in social media and the international press, where in some cases it was suggested that the United

States was about to embark upon clandestine and unlawful foreign nuclear cooperation.

The backbone of the Congressional narrative was not news; for two years it had already been established that two firms, ACU and IP3, had

successively made proposals to US officials and industry executives for exporting nuclear power plants to the Middle East. According to the linked ProPublica report, in both cases General Michael Flynn was involved. "IP3's idea was a variation of ACU's," it said; "IP3 swapped out" Russia as an international partner for China, and "then later shifted to an all-American approach."

Under US law, a foreign country that is the intended destination of a nuclear power plant exported by a commercial entity in the United States needs, as a prerequisite, an "agreement of cooperation," a so-called "123 Agreement" with the US. This is Section 123 of the US AEA as amended in 1954, pertaining to "Cooperation with Other Nations." Section 123 sets forth that such an agreement includes nine nonproliferation conditions that a foreign country must meet. Whether a country satisfies these is a judgment based on an internal US government assessment. So far, the KSA does not have such an agreement with the US.

**Congress and Technology:** The House report in several instances refers to the export of "nuclear technology" in a manner that inaccurately describes the scope of possible US nuclear exports to the KSA and, in light of information revealed after the release of the report, might also mislead lay readers about the extent of Congressional oversight concerning what US firms and US government agencies may and may not do in pursuit of nuclear trade opportunities with a foreign nuclear program.

In its attention-grabbing *mise en scène*, the House

report repeatedly refers to US entities possibly supplying "sensitive nuclear technology" to the KSA. That would be truly an alarming development because "sensitive nuclear technology" (SNT) in official US nuclear trade and nonproliferation parlance specifically refers to technology for uranium enrichment and separation of plutonium that can be used for the production of nuclear weapons. Deeper into the document, it becomes clear that what's at issue here is not assistance provided for enrichment or reprocessing but the sale of nuclear power plants to the KSA by US industry. That prospect has been under consideration by vendor firms and government agencies for several years including under the Obama Administration.

The House report in one instance does concern itself with sensitive nuclear technology (in fact without specifically referring to it as such), in the context of a possible future determination by the US government "permitting Saudi Arabia to enrich and reprocess as part of a deal that would allow Westinghouse and other American companies to build nuclear reactors" in the KSA. That formulation left out the critical distinction that a determination by the US, pursuant to a 123 Agreement, not to compel the KSA to forego its future options to enrich or reprocess would, under terms routinely governing US bilateral nuclear cooperation with foreign countries, for sure obligate the KSA to obtain the prior consent of the United States to enrich or reprocess any US-obligated nuclear materials. The language "permitting Saudi Arabia to enrich and reprocess" may suggest erroneously to lay readers that the US would be complicit in

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**KSA and Part 810:** In the wake of the release of the House document, it has become known through media reports that US companies pursuing nuclear power plant business in the KSA have been awarded seven authorizations by the US DoE under so-called 10 C.F.R. Part 810 regulations. These rules specifically govern export and re-export of unclassified nuclear technology and assistance to foreign countries. It is usual practice for companies embarking upon negotiations with a foreign nuclear program to request such authorizations to be able to share restricted information concerning the items that may be transferred.

There is an interagency process for the award of these authorizations, whereby DOE must consult with the Department of Commerce, the Department of Defense, and the Nuclear Regulatory Commission, and concur with the Department of State. It would appear that, contrary to hasty media reporting suggesting that DoE may not have consulted one or more of these agencies prior to the award of Part 810 authorizations to the KSA, in these cases the interagency consultative process was in fact followed.

Tracking headlines in media reports, some lawmakers accused DoE of having made "secret" authorizations and withholding cooperation with Congress. Lay readers of the House report may well have drawn that conclusion, having read that "Under Section 123 [of the AEA] the US may not transfer nuclear technology to a foreign country without the approval of the US Congress." With regard to DoE's actions, this statement does not apply and is potentially misleading because neither a 123 Agreement, nor Congressional

approval, are prerequisites for the award of a Part 810 authorization by DoE. Independently of these facts, on April 10, US lawmakers introduced legislation to amend the AEA to compel the Executive Branch to divulge to Congress details of Part 810 authorizations for transfers to foreign countries.

**What's the Danger?:** In December 2017, Mieke Eoyang and Laura Holgate, a former US ambassador to the IAEA and an Obama appointee, published this blog post to explain "Why Flynn's Nuclear Advocacy was so Dangerous." They gave three reasons: 1.) General Flynn, as former National Security Adviser, may have persuaded Trump to tilt US policy toward Russia in support of their private business interests; 2.) Flynn was advocating on behalf of foreign nuclear power industries; and 3.) While advocating nuclear trade with the KSA, Flynn was urging Trump to walk away from the JCPOA, a decision that would contribute to destabilizing the Middle East. These are all serious objections. It is notable that Eoyang and

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Holgate did not include in their list of "dangers" that Trump might open the road for nuclear commerce with the KSA by short-circuiting US law including the requirements under AEA Section 123.

Indeed, for anyone seeking to enlist the US President to export power reactors anywhere, Section 123 looks like a solid firewall. Whether or not the KSA's lobbyists and lawyers convince Trump and the Congress to conclude an agreement for peaceful nuclear cooperation with the KSA that would not deprive Riyadh of its future option to deploy reprocessing and enrichment technology, the result of bilateral atomic diplomacy will not be a "secret nuclear deal" between Trump and the KSA, since a negotiated 123 Agreement must be put before the Congress for its consideration.

That said, Trump could elect to suspend any of the nine nonproliferation conditions specified for 123 Agreements by the AEA, and/or include unique provisions. To date, with the singular exception of



India discussed below, the US has never concluded a 123 Agreement in which any of the nine nonproliferation conditions were suspended by the President. Were Trump to do this in the case of the KSA, the Congress would have to affirmatively approve it for the agreement to go into effect. With this in mind, lawmakers are currently considering increasing Congressional authority governing future approval of proposed 123 Agreements.

**IP3-Industry Disconnect:** In addition to a 123 Agreement, for a company like IP3 to make headway and participate in a nuclear power project in the KSA or elsewhere, it would also need the cooperation of US private industry exporting nuclear power plants.

Long before Trump's election, personalities that set up ACU, the forerunner of IP3, first flogged the idea in Washington that nuclear power vendor companies build scores of power reactors in the Middle East and take back the spent fuel. In the US they generated some interest from firms selling engineering, enrichment, and nuclear fuel-related services, but they got very limited traction in US government circles. After Trump's election, IP3 reached out to US industry concerning its ambition to sell American-design nuclear power plants to the KSA. Some nuclear firms in early 2017 told Saudi Crown Prince Mohammad Bin Salman they were interested in an IP3 scheme for a Middle East "Marshall Plan."

But what did IP3 and its advisers have to contribute to a nuclear power plant export project? The main focus in US industry for potential nuclear sales to the KSA is WEC, working with a consortium of dozens of firms. According to sources, WEC was enlisted by IP3 in late 2017 to include IP3 in its projects, but WEC management never endorsed IP3's nuclear export scheme and it never included IP3 in its business plans. IP3 persisted, and in

February 2019 set up a meeting—referred to in the House report—between Trump and nuclear power companies. According to sources, IP3 also offered to prepare a report after that meeting and then convene a follow-up meeting in about three months, assuring that it would remain in the picture for US industry doing nuclear business in the KSA.

Independent of IP3's own interests in getting involved in a nuclear power project in the KSA, executives from vendors in the power reactor sector accepted IP3's offer to convene a meeting with the President. In light of dim global prospects for nuclear power plant sales—and especially in the teeth of competition from state-owned

vendors in China and Russia—CEOs acted on wishful thinking that if they were to put their case for nuclear power sales to Trump in person, as one industry executive said, "they would get results." Ultimately, US private industry firms would have to carefully consider their shareholder obligations and potential liability in any case where impropriety

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allegations might be raised. Given that White House staffers had in this instance warned about potential conflicts of interest under US law, industry executives may have been deterred by risk considerations from including IP3 in their plans. WEC did not conclude that IP3 could add value to WEC's own efforts to sell power reactors to the KSA and according to sources, sometime after the February meeting, the IP3 effort was put to rest.

**The Example of India:** Executive Branch personnel in this case also expressly informed inexperienced would-be nuclear exporters about the requirements for a 123 Agreement. Similar advice was given by the State Department in a previous case. Not long after the November 2000 US election, aides of President-Elect George W. Bush prepared to set the stage for a plan to

upgrade US-India relations by exporting nuclear power plants to India. To move this project forward on short order, advocates briefed officials in the Department of State about their aims. According to sources, US diplomats explained right off the bat that because the US was a party to the NPT, US industry could not export nuclear power plants to India, an NPT non-party, without first changing US law. Until then, according to sources, some leading personalities in the Bush transition team were unaware that the NPT stood in the way of making a snap change of US policy in India's favor.

"Friends of India" in the incoming Bush administration had no choice but to comply with the requirements of US statutes in order to permit US industry to export nuclear equipment to India. After seven long years, they succeeded, having concluded a unique 123 Agreement with India, and having obtained the consent of world's nuclear exporters to make an exception to rules of the Nuclear Suppliers Group that virtually ban nuclear exports to the Subcontinent.

If there is to be nuclear cooperation between the United States and Saudi Arabia, it will likewise not come about as a consequence of a fast-track arrangement secured behind the scenes by people who claim to have access to President Trump. There will be a process that looks like what industry and government have followed in past cases. There will be Congressional involvement and interagency consultation. There will be requirements concerning US national security and nonproliferation. And in the case of the KSA to date, the deliberations of IP3 and its advisers, documented in the House report and elsewhere, appear rudimentary and unconnected with actions undertaken on a separate and parallel track by US technology holders in industry to organize a bona fide nuclear power plant export project.

Source: <https://www.armscontrolwonk.com/>, 16 April 2019.

**OPINION – Gitura Mwaura**

**Africa Ready for Nuclear Energy, Lower the Costs**

A fair number of African countries are at varying stages of acquiring nuclear energy, an indication they might be ready for it. Of the regional economic communities on the continent, East Africa leads with four countries – Tanzania, Rwanda, Kenya and Uganda – having expressed some interest.

Other countries, according to the IAEA, include Egypt, Ghana, Morocco, Niger, Nigeria and Sudan, which have already engaged with the organisation to assess their readiness to embark on a nuclear programme. Algeria, Tunisia and Zambia are also mulling the possibility of nuclear power. Most of these countries are also in various stages of liaison with one of the major nuclear energy development organisation in the world, the ROSATOM.

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Rwanda is among the latest in the group, having just entered into an agreement with Rosatom.

The agreement is comprehensive and includes the development of requisite infrastructure, construction of a Centre for Nuclear Science and Technology and nuclear power plants in Rwanda. It also covers fundamental and applied research, including development and cooperation in nuclear technology applicable in industry, medicine and agriculture, as well as in education, training and retraining of specialists for the nuclear industry.

Like all the countries with intent to go nuclear on the continent, one does not see doubt in Rwanda's bid. It should be expected all is going to pass as specified in the agreement. This is despite long-standing concerns, foremost amongst which is the costliness and often acknowledged difficulties to finance such projects, and environmental costs due to nuclear waste and should anything go

wrong. Thus there are issues of safety and, consequently, an apprehensive public whose acceptance must be secured.

There is also a time factor. If any of the countries were to commission the construction of the prevalent Third Generation nuclear plant today, it would take no less than ten years to complete – and more likely 15 years or more. As things stand, none of the East African countries, including some of the others on the continent, are ready just yet to commission such a plant. Operational nuclear plants are therefore a bit distant in the future. But there's a major electricity gap. Africa's population now stands at around 1.3 billion, with well more than half in Sub-Saharan Africa without access to electricity.

This means that ongoing efforts to increase uptake of the cheaper renewable energy options such as solar and wind technologies must continue. This is inevitable, combining it with a mix of energy options as is happening in India. Observe that, with a population almost similar to Africa's at 1.37 billion, India is set to achieve 100 per cent household electricity connection this year, according to the World Nuclear Association.

However, though the country's nuclear energy production may appear paltry at only 2.6 per cent, perhaps the bigger lesson is how the country applies nuclear technology in medicine and agriculture. In agriculture, nuclear applications are used to combat pests and diseases, increase crop production, protect land and water resources, ensure food safety and authenticity, and increase livestock production.

In medicine, it is widely used in diagnosis as well as treatment of chronic diseases such as cancer and cardiac disorders. This makes part of the case why African countries should go nuclear as agriculture remains the mainstay of many of the countries, and given their health burden that feeds medical tourism in India. There's possibly another urgent reason, as articulated by the director of

the Nuclear Power Institute at the Ghana Atomic Energy Commission.

"Energy is the backbone of any strong development," he was quoted saying in a UN analysis on Africa's readiness for nuclear energy. "And where do we get energy from? We have hydro, thermal, fossil fuels, and we have local gas—but these are dwindling. They are limited; fossil fuels could run out by 2030. And, the prices are volatile."

The majority of nuclear reactors currently in operation are Generations III and III+. Fourth Generation plants under development, and include SMRs that are much cheaper and take a much shorter time to install. They are also more flexible

to install according to growth in demand. Countries around the world, including in Africa, have their eye on the SMRs with China, Russia and Argentina expected to have commercially installed SMRs by 2020.

Crucially, principles guiding the development of Fourth Generation nuclear energy systems are aimed at addressing some of the key

concerns, particularly as they relate to sustainability and economy, as well as safety and reliability. This should lower the costs, environmental and economic. These issues continue to be discussed for safer more productive technology, such as at the XI International Forum on nuclear energy (Atomexpo 2019) concluded in Sochi, Russia.

Along with the above challenges and application in agriculture and medicine, ATOMEXPO 2019 dwelt on "global issues of carbon-free energy, responsible approach to the environment and natural resources, 'green' investments and international partnership for sustainable development." Though addressing all the issues will take a while, Africa is arguably ready for nuclear energy.

Source: <https://www.newtimes.co.rw/>, 20 April 2019.

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OPINION – Rich Moniak

**Doing Nuclear Energy Right Requires Global Paradigm Shift**

“The next generation of nuclear systems — known as advanced reactors” could help “feed the world’s appetite for energy with no emissions,” Sen. Lisa Murkowski claims in an opinion piece. Joshua S. Goldstein, Staffan A. Qvist and Steven Pinker think it can “save the world.” For them all to be right, we need a new model of cooperation between governments of the world, industry and the people both are supposed to serve.

First let me say Murkowski added another star to her independent streak. In a March 2019 opinion co-authored by Sen. Joe Manchin, a Democrat from West Virginia, she acknowledged there’s “no question that climate change is real or that human activities are driving much of it.” She said advanced nuclear energy systems are among the “game-changing” technologies to mitigate it.

Goldstein et al had their views published in *The New York Times* three weeks ago. They argue that by replacing most of their fossil-fueled power plants with nuclear, France and Sweden have already proven “rapid decarbonization with economic and energy growth” is possible. But the high cost of building new plants and “an irrational dread among the public and many activists” are preventing that from happening in America.

New technologies like advanced reactors might overcome that first hurdle. But the second is complicated by justifiable mistrust of government officials and power plant owners. Neither have had public health and safety at the very top of their agenda. The problem for the government stems from 20 years of nuclear weapons testing. About 100 atmospheric tests were conducted at the Nevada Proving Grounds. The Marshall

Islands were the site of another 23. Throughout the test period and for years afterwards, the US government denied that exposure to the radioactive fallout drastically increased the risks of cancer, leukemia and birth defects.

Similarly, people living in the vicinity of the Hanford, Washington nuclear weapons production site were never told of the risks from radiation exposure during routine operations, accidents and in some cases, intentional releases. Nuclear power plants are obviously becoming safer, but operators haven’t always been honest when accidents have occurred.

The most notable in America is the 1979 partial meltdown of the Three Mile Island plant in Pennsylvania. It was caused by a valve failure. When the plant owner notified state officials of the incident, they claimed no radiation had been released. Based on that, the governor’s office stated there was “no danger to public health or safety.” But the truth was offsite monitors had detected low levels of radiation. After more escaped from the plant two days later, the governor issued an advisory evacuation for pregnant women and young children. And it wasn’t until five weeks later that the Nuclear Regulatory Commission finally learned that at the time of the accident “operators had measured fuel temperatures near the melting point.”

According to a study published by the Union of Concerned Scientists, in 2010 alone there were at least 14 serious nuclear power plant incidents. Most of those “occurred because reactor owners, and often, the NRC tolerated known safety problems.” One they didn’t examine was a valve failure at the Browns Ferry plant in Alabama. It should have triggered the highest level public alert. But even the NRC wasn’t aware how serious it was until six months later.

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Another problem Murkowski didn't address was described by the *Los Angeles Times* in 2017 as "one of the biggest and longest running policy failures in federal government history." There's no safe and secure repository for the industry's nuclear waste. Between its birth and 1993, most was dumped in the ocean. And the international agreement outlawing that practice doesn't stop the United Kingdom, France and Russia from discharging some of theirs through pipelines to the bottom of the sea.

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Like climate change, the risks posed by nuclear accidents and waste management are global problems. They'll multiply dramatically if even a quarter of the countries without nuclear power choose that route — as will the risk of nuclear weapons proliferation. Doing nuclear energy right requires a global paradigm shift....

*Source: Rich Moniak is a Juneau resident and retired civil engineer with more than 25 years of experience working in the public sector, <https://www.juneauempire.com/>, 21 April 2019.*

## NUCLEAR STRATEGY

### CHINA

#### **China's First Nuclear Missile Suffered from Radiation Leaks, a Fire and might have Sank**

The single Xia-class submarine was not a military success. During the early 1980s, the PRC attempted to modernize its nuclear deterrent force. One concrete results of the effort was the construction of a single nuclear ballistic missile submarine, a "boomer" in arms-control parlance. Constructed at enormous cost, the Xia class of submarines was such a disappointment that a

follow-on class was not fielded for twenty years.

For a country with a population of more than a billion, the PRC has a remarkably small nuclear force—and a restrained nuclear policy. The country detonated its first nuclear device in 1957, and its first thermonuclear device in 1964. The country's nuclear weapons, under the control of the PLA Rocket Force, are estimated to total approximately 260 weapons, equipping both land-based intercontinental ballistic missiles and sea-based submarine-launched ballistic missiles.

China's nuclear policy is a pragmatic one, largely anchored in the country's former poverty. Rather than pursue a first-strike capability and thousands of nuclear weapons, something it could not afford during the Cold War, the country largely pursues a countervalue strategy that places an emphasis upon survivable weapons that can

stage devastating revenge attacks against enemy cities. As a result, land-based missiles dominated the PLA during the early years.

Upon coming to power in 1978, Chinese leader Deng Xiaoping cut military research and development spending, concentrating what was left on the "Three Grasps"—the development of an intercontinental ballistic missile, a submarine-launched ballistic missile and a communications satellite. Sea-based nukes, which are much more difficult to locate and destroy than other basing strategies, were more in line with China's countervalue strategy. This made a ballistic-missile submarine a national priority, and construction began that same year.

The Type 092 was designed by the Nuclear Powered Submarine Overall Design Section of the Seventh Academy, with Chief Designer Huang Xuhua overseeing the project. Despite most of China's submarines using a traditional World War II-derived



submarine hull, Huang pressed for a teardrop hull, the kind pioneered by the U.S. Navy with great success in the experimental sub USS Albacore. The first draft of the submarine plans was finished in October 1967. China's nuclear-submarine development effort, code-named Type 09, would produce two ships: the Type 091 attack submarine and Type 092.

The priority given to the Three Grasps accelerated the Type 092's developmental pace, which had been stalled by political maneuvering and even the carnage of the Cultural Revolution. The first submarine of the so-called Xia class was launched in 1981, and went to sea for the first time in 1983.

The Xia class was designed to carry twelve Julang ("Great Wave") JL-1 ballistic missiles. The JL-1 was a solid fueled design with a range of just 1,770 kilometers and a 250-kiloton warhead. The JL-1 was first test-fired from a modified Golf-class submarine in September 1982. The missile's range was disappointing: fired from the Yellow Sea, it could barely hit the northern half of Japan, and while it could hit the Soviet city of Vladivostok, it could not range as far as the important military hub of Khabarovsk. Indeed, a PLA boomer would have to be parked in the Baltic Sea to place Moscow at risk.

The single Xia-class submarine was not a military success. Ship construction was notoriously difficult and likely strained the limits of China's submarine building abilities. The ship became operational in 1983, but faced enduring problems with reliability and radiation leakage from its onboard reactor. The ship is also allegedly the noisiest of all U.S., Russian and Chinese ballistic missile submarines underwater, making it easy to detect and track.

The sub undertook a single patrol and then never sailed again, staying pierside for so long there were rumors it had caught fire and sank in 1985. It has allegedly never sailed beyond Chinese waters. The Xia-class boat was thought to have gone into refit

in 1995, and was not seen for years. It surfaced briefly in 2000 at a military exercise, but then resumed its fairly indolent career. It went back to drydock at the Jianggezhuang Submarine Base between 2005 and 2007.

While China's first ballistic-missile submarine was meant to be a real, operational submarine and part of China's nuclear deterrent, the obstacles encountered during construction forced lower expectations. The boat was more of a test bed, allowing China to test new underwater technologies as it gradually placed more emphasis on naval forces in general.

Today the ship has been replaced by the Type 094 Jin-class submarines. Although by no means perfect (the subs have their own noise issues) the four Jin submarines are closer to China's original vision of a sea-based nuclear deterrent

capability, and they almost certainly owe their existence to the groundbreaking Type 092.

*Source: Kyle Mizokami, <https://nationalinterest.org>, 26 April 2019.*

## **RUSSIA**

### **Russia Floats out First Nuclear Sub that will Carry Poseidon Strategic Underwater Drones**

The Project 09852 special-purpose nuclear-powered submarine Belgorod that will be the first carrier of Poseidon strategic underwater drones was floated out at the Sevmash Shipyard in north Russia..., TASS reports from the scene.

Key facts about Russia's special-purpose nuclear-powered submarine Belgorod. Sevmash Head Mikhail Budnichenko said during the ceremony of floating out the submarine from the slipway, "the enterprise's shipbuilders will fulfill all the tasks of building ships within the established timeframe and with high quality."...The submarine's construction will be completed afloat. A source in the defense industry earlier told TASS that the tests of the submarine's nuclear reactor and its dockside

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trials are scheduled for this year. The Belgorod will undertake shipbuilders' sea and state trials in 2020, after which it will be delivered to the Navy by the end of that year, the source noted. Another source in the defense industry told TASS that the new submarine would be able to carry six strategic underwater drones.

The nuclear-powered submarine Belgorod was initially being built under Project 949A 'Antey.' The submarine was laid out at the Sevmash Shipyard on 24 July 1992. On 20 December 2012, it was laid down again under Project 09852. The exact operational characteristics of the special-purpose submarine have been classified and are unknown today. Russia's Defense Ministry reported in November 2018 that the Belgorod sub's crew had been formed.

The underwater drone later named Poseidon was unveiled by Russian President Vladimir Putin in his State-of-the-Nation Address to the Federal Assembly on 01 March 2018. The Russian leader said that Russia had already developed drones capable of moving at very large depths and to an intercontinental distance at a speed multiply exceeding the speed of submarines, the most advanced torpedoes and all types of surface ships. As the Russian president said, these drones can be armed with conventional or nuclear munitions, which will allow them to strike a broad range of targets. The Poseidon drone will feature an unlimited operating range and an operational depth of over 1 km.

Source: <http://tass.com/defense/>, 23 April 2019.

## **RUSSIA-USA**

### **Kremlin Wants to Know Details of Trump's Arms-Control Initiative**

Russia is interested in the details of a potential U.S. plan to push for new arms-control agreements, Dmitry Peskov, spokesman for

Russian President Vladimir Putin, told reporters in Beijing. US President Donald Trump has questioned the cost of maintaining a nuclear arsenal and has asked administration officials to prepare options for potential new arms-control agreements with Russia and China, the *Washington Post* reported April 25, citing an unidentified senior administration official.

Peskov said while it would be ideal to rid the world of nuclear weapons, such a move would also remove the "restraining parity" that guarantees that no nuclear power makes a "monstrous mistake." There had been no contacts with Russian experts on the issue, he said.

The US and Moscow are at loggerheads on nuclear weapons after Trump announced in February that he's pulling out of a landmark Cold War-era treaty banning short- and medium-range missiles.

The U.S. withdrawal from the 1987 INF treaty, after accusing Russia of violating the pact, has raised the threat of a renewed missile build-up in Europe. Russia has warned that time is also running out to begin talks on extending the other key nuclear weapons accord between Russia and the U.S., the New START treaty, before it expires in 2021.

Source: *Olga Tanas, Bloomberg, 27 April 2019.*

## **USA**

### **US Halts Recent Practice of Disclosing Nuclear Weapon Total**

The Trump administration has halted, without explanation, the recent US government practice of disclosing the current size of the nuclear weapons stockpile. The decision was revealed in a recent Department of Energy letter to the Federation of American Scientists, a private group that studies nuclear weapons issues and advocates for government openness on national security issues.

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The Obama administration, in May 2010, had declassified for the first time the full history of the US nuclear weapons stockpile from its beginning in 1945. It revealed that the warhead total stood at 5,113 as of 30 September 2009, approximately the number that private experts had estimated and about 84 percent below the official peak number of 31,255 warheads in 1967.

As recently as last year, the Trump administration had disclosed that the stockpile consisted of 3,822 nuclear warheads as of 30 September 2017 down 196 warheads from the year before. The 2017 figure was made public in response to a request by the scientists group, which asked for a 2018 update last October.

"After careful consideration ... it was determined that the requested information cannot be declassified at this time," the Energy Department wrote in an April 5 letter responding to the federation's request. The department provided no explanation for the decision, which it said was made by the Formerly Restricted Data Declassification Working Group, consisting of officials from the departments of Defense and Energy.

...The decision walks back nearly a decade of US nuclear weapons transparency policy — in fact, longer if including stockpile transparency initiatives in the late-1990s," Kristensen wrote. "With this decision," he added, "the Trump administration surrenders any pressure on other nuclear-armed states to be more transparent about the size of their nuclear weapon stockpiles. This is curious since the Trump administration had repeatedly complained about secrecy in the Russian and Chinese arsenals. Instead, it now appears to endorse their secrecy."

Source: <https://www.militarytimes.com/>, 17 April 2019.

## BALLISTIC MISSILE DEFENCE

### INDIA

#### India Completes Phase One of BMD Programme, Nod for Missiles Awaited

In a boost to India's deterrence capabilities, the phase one of the ambitious BMD programme has been completed and a formal nod for the deployment of active missiles is expected soon, top sources told *The Print*. Phase one of the programme will cover Delhi and Mumbai, and guard them against incoming ballistic missiles. "The phase one of the Ballistic Missile Defence programme has been completed. We have deployed two indigenous long-range radars as part of the programme. As and when we get an all-clear from the government, the specific missiles will be deployed," a top source in the defence establishment told *The Print*.

**The Trump administration had disclosed that the stockpile consisted of 3,822 nuclear warheads as of 30 September 2017 down 196 warheads from the year before. The 2017 figure was made public in response to a request by the scientists group, which asked for a 2018 update last October.**

Sources also said adequate arrangements have been made to ensure that missiles were produced in the required manner. Asked by when the permission for the deployment of missiles is expected, another top source said, "soon" without getting into any time line.

...It was in the mid-2000s that India got Swordfish from Israel. The Swordfish is an active electronically scanned array (AESA) long-range tracking radar, specifically built to counter ballistic missile threat.

This radar is a derivative of the Israeli Green Pine long-range radar, which is the critical component of its arrow missile defence system. However, Swordfish uses a number of indigenous systems....India's Ballistic Missile Defence programme was launched in 1999 in the wake of Pakistan's maiden nuclear test in 1998 and China's leaps in this sphere. BMD works on two levels — endo-atmospheric (within Earth's atmosphere) and exo-atmospheric (the space stretching beyond the Earth's atmosphere). While phase one deals with destroying incoming missiles at endo-

atmospheric level, phase two deals with the same in exo-atmospheric level.

India's BMD arsenal consists of a Prithvi Air Defence (PAD) missile to take out incoming missiles at a range of about 80 km in altitude and an AAD missile for altitudes of 15-25 km. In 2017, India had tested a new exo-atmospheric interceptor missile named the Prithvi Defence Vehicle (PDV), which reportedly intercepted a missile at an altitude of 100 km during trials. The first missile test for a BMD system was conducted in November 2006, when a Prithvi-II missile was successfully intercepted by the PAD in the endo-atmospheric level at an altitude of about 48 km.

Source: <https://theprint.in/defence/>, 23 April 2019.

## USA

### The Cost of a New ICBM is Going Up. Here's Why the US Air Force isn't Concerned

The Air Force expects the price of its next-generation intercontinental ballistic missile to increase in the short term to pay for improved infrastructure, such as an overhaul of the existing silos.... But ultimately, the service projects that the total cost estimate for the Ground Based Strategic Deterrent program will come back down after the Air Force makes a source selection decision, in which competitors Boeing and Northrop Grumman will duke it out over which company can offer the best price, Gen. Timothy Ray told reporters during a roundtable event.

Why the fluctuation in cost? GBSD will reuse much of the infrastructure where the existing Minuteman III missiles are housed, and by making certain investments into those facilities up front,

the Air Force will be able to maintain the new missiles more easily and more cheaply over the life of the program, Ray said. Boeing and Northrop Grumman are the two companies who will move on to the next phase of the Air Force's intercontinental ballistic missile replacement program...after awarding two contracts, each with a \$359 million price ceiling.

**GBSD will reuse much of the infrastructure where the existing Minuteman III missiles are housed, and by making certain investments into those facilities up front, the Air Force will be able to maintain the new missiles more easily and more cheaply over the life of the program.**

...Smith is skeptical of the Defense Department's plans to overhaul its nuclear enterprise over the next several decades and has called for a less expensive blueprint. In March 2019, he set off alarms by saying that the Pentagon could cut the ICBM leg of the nuclear triad. He later softened those comments by remarking that it might be enough to scale back the number of warheads rather than reduce the types of systems used to deliver nuclear weapons.

...If Congress curtails GBSD, that could mean billions of dollars in lost profits for the two competitors. The Pentagon's Cost Assessment and Program Evaluation office previously estimated the total cost of the program as anywhere from \$85 billion to \$100 billion. It intends to put out a revised cost estimate for GBSD in June, reported Inside the Air Force on 12 April 2019.

**The Air Force will pick one vendor to move onto the engineering and manufacturing development phase in 2020. That company will eventually produce the new ICBMs and associated operating systems, which will become operational in the late 2020s.**

In 2017, Boeing and Northrop Grumman beat out Lockheed Martin for contracts to continue developing their versions of GBSD, each earning awards of up to \$359 million for technology and risk reduction efforts over a 36-month period. The Air Force will pick one vendor to move onto the engineering and manufacturing development phase in 2020. That company will eventually produce the new ICBMs and associated operating systems, which will become operational in the late 2020s. Despite the potential change in cost, Ray said that GBSD is a model program, noting that the use of digital



modeling and engineering has enabled both Northrop and Boeing to expedite their design process.

Source: <https://www.defensenews.com/>, 17 April 2019.

## **NUCLEAR ENERGY**

### **CHINA**

#### **Report: China No.3 in Online Nuclear Reactors**

A Japanese nuclear industry association report shows China had the third-largest number of reactors in operation as of January 2019. It also points to a change in the global nuclear power landscape. The report, published by the Japan Atomic Industrial Forum, says China has 44 reactors online, an increase of seven from a year earlier. That follows the United States, which has 98 reactors up and running, and France, with 58. The report says China is building or has plans to build 38 more reactors as it expands its nuclear-generation capacity to meet growing electricity demand and deal with air pollution. This contrasts with moves in some other countries prompted by rising costs and safety concerns after the 2011 Fukushima nuclear accident in Japan. Germany is phasing out nuclear power, and France has announced it will reduce its dependence on atomic power.

Source: <https://www3.nhk.or.jp>, 21 April 2019.

### **GENERAL**

#### **Artificial Intelligence could Solve Nuclear Fusion's Biggest Problem**

The predictive powers of artificial intelligence could help scientists bring nuclear fusion closer to actually working, researchers from Princeton and Harvard working with the Department of Energy hope. The team, working at the DoE's Princeton Plasma Physics Laboratory, says they

have applied deep learning techniques to computers in order to be able to forecast sudden outages in the reactors used for nuclear fusion that can halt the energy-generating reaction.

The implications of a success here could be major: nuclear fusion can theoretically supply emissions-free electric power indefinitely. However, making the leap from theoretical to practical has proved challenging.

Nuclear fusion, unlike fission, which is what takes place in traditional reactors, involves smashing particles together and turning them into plasma to generate energy. This takes place in what is called a magnetic fusion machine, or a tokamak. The tokamak produces magnetic fields that keep the superhot plasma inside and keep it moving—and hot—but controlling it forever-longer periods of time and making it move faster to produce more energy has been a challenge.

Many believe we will never be able to make nuclear

fusion happen, but researchers are not giving up. Computer technology is a natural ally to scientists in this quest for infinite clean power, but the presence of data to feed into the computers has proved crucial. The Princeton and Harvard scientists used data from two fusion reactors: the Department of Energy's DIII-D National Fusion Facility in California, operated by General Atomics, and the Joint European Torus tokamak in the UK. What the team learns about predicting outages will be applied to the largest tokamak that is currently in construction in the ITER project in Europe. It may just help solve fusion's biggest problem: why the particle smashing sometimes stops. If this problem is solved, the world could see a working nuclear reactor in less than 20 years, although many scientists and observers remain skeptical.

Source: Irina Slav, <https://oilprice.com>, 18 April 2019.

## **INDIA**

### **12 More Nuclear Power Plants in India Soon, Says DAE Chief**

12 more nuclear power plants in India soon, says DAE chief Mumbai: India will soon have 12 more nuclear plants soon to improve the power situation and ensure there is a free flow of uninterrupted power supply for both industries and residential use, a statement issued .... "Nuclear technology helps in betterment of lives through varied usages and is an irreplaceable source of clean, pollution-free energy," the statement quoted Vyas, who is also the Atomic Energy Commission of India's Chairman, as saying at the 11th International Forum AtomExpo 2019, sponsored by Rosatom State Atomic Energy Corporation, held in Sochi, Russia, recently.

Citing the record run of Kaiga Nuclear Power Station, he said a small unit of indigenously-developed

220-250MW reaction has completed 962 days of uninterrupted run at about 99.3 per cent capacity and the amount of electricity it has generated is "tremendous". Vyas said the first stage of India's indigenous nuclear power programme has now attained maturity with 18 operating PHWRs. The AtomExpo was held in Sochi with the motto this year being 'Nuclear for better life', with over 3,600 participants from 74 countries in attendance, including new ones like Qatar, Bahrain and Nicaragua.

... In a message, Russian President Vladimir Putin lauded the AtomExpo in advancing the stature of the country in the field of nuclear technology. Vyas added that the government of Prime Minister Narendra Modi has sanctioned 10 PHWRs in fleet mode, besides plans afoot for constructing two light water reactors. Indian industry has gained a lot through the process, nuclear energy and instruments require a guided and systematic way of manufacturing and quality assurance which

raises the standard of industry participating in the manufacturing of equipment, he added. ...

*Source: <https://energy.economictimes.indiatimes.com/>, 22 April 2019.*

## **JAPAN**

### **Japan's Nuclear Reactors Face New Near-Total Shutdown**

Japan is heading towards another near-total shutdown of its nuclear reactors after regulators refused to extend deadlines for completing antiterrorism measures. The Nuclear Regulation Authority said it would enforce deadlines that

expired next summer for many operating reactors. Electricity companies have said there was almost no chance they would be ready on time.

The regulator's stance is a fresh blow to a nuclear power sector that has never recovered from the Fukushima Daiichi disaster in 2011, when three reactors

melted down after a tsunami knocked out their cooling systems. It is likely to result in a surge in Japanese demand for coal, oil and liquid natural gas as alternatives if most of the operating nuclear reactors have to go offline.

"[The companies] say there is a change of circumstances but I am not satisfied of that," said Toyoshi Fuketa, chairman of the NRA, in comments that signalled a loss of patience with the electric operators that run the reactors. "They haven't notified us of a change in plans. There may be various issues such as hard bedrock but that's not a change of circumstances — they have to notify us as soon as there's a change in the designs."

All of Japan's reactors were shut down after Fukushima while regulators drew up a strict set of new rules. One of those requires operators to have off-site control rooms that let them manage a reactor remotely in the event of a terrorist attack. Each restarting reactor has its own deadline and

**India will soon have 12 more nuclear plants soon to improve the power situation and ensure there is a free flow of uninterrupted power supply for both industries and residential use, a statement issued .... "Nuclear technology helps in betterment of lives through varied usages and is an irreplaceable source of clean, pollution-free energy.**

a number of them expire next year — but none of the operators are likely to be ready in time. They will therefore have to shut the reactors down. For example, anti-terror work at the Sendai No 1 and No 2 reactors, run by Kyushu Electric, and the Takahama No 3 and No 4 reactors, run by Kansai Electric, must be completed next year.

Kyushu Electric said it would “continue making the maximum effort to complete the work at the earliest possible moment”. The utilities lose millions of dollars for every day the reactors are offline and they are forced to burn fossil fuels instead. Shares in Kyushu Electric, Kansai Electric and Shikoku Electric, which operates the Ikata No 3 power station, extended losses and have shed around 18 per cent of their value so far in 2019.

Japan has struggled to restart its reactors in the face of strong public opposition and many are still offline. As of March 15, nine out of Japan's 57 reactors had restarted. Several others have restarted only to shut down again because of injunctions issued by local courts.

The national energy strategy calls on Japan to use nuclear power for the foreseeable future given the low cost of running existing reactors, the need to reduce carbon emissions and the country's dependence on imported energy. However, the national government has not pushed for restarts, leaving it in the hands of regulators, utilities, courts and local politicians. The long-term future of the sector is therefore in doubt.

*Source: Robin Harding, <https://www.ft.com>, 25 April 2019.*

## **SOUTH KOREA**

### **South Korea Starts Up Second APR-1400**

Korea Hydro and Nuclear Power has started up its new Shin Kori 4 reactor and plans to connect it to the electricity grid at the end of this April 2019. It is the second APR-1400 design unit to start up of a

planned global fleet of at least 10. KHNP said the unit had achieved criticality and that it would gradually increase its power level during the commissioning process. By the end of this month (April) it hopes to connect the reactor to the grid, after which the power level can begin to approach its full 1340 MWe output. After a successful full-power run, the unit will be ready to begin commercial operation. KHNP expects this at the end of August 2019.

Construction of two further APR1400 pressurised water reactors at Shin Kori - units 5 and 6 - began in April 2017 and September 2018 respectively. Unit 5 is scheduled to begin commercial operation in March 2022, with unit 6 following one year later. Two further APR-1400 units are under construction in South Korea as units 1 and 2 of the Shin Hanul site. A further four APR-1400s are under construction at Barakah in the United Arab Emirates, while KHNP and Kepco are hopeful of further orders in other countries.

The APR-1400 is a pressurised water reactor designed by Kepco that KHNP said features improvements in operation, safety, maintenance and affordability based on accumulated experience as well as technological development. It supersedes the standardised 995 MWe OPR-1400 design, of which South Korea built 12.

The brief announcement of the criticality on KHNP's website is dated 11 April, but has only just been uploaded there. Kepco has not yet released a statement. Both companies are owned by the government of President Moon Jae-in, who wishes to close down the nuclear sector and find other sources for the one-third of national electricity it currently provides.

*Source: World Nuclear News, 18 April 2019.*

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**NUCLEAR COOPERATION**

**CHINA-BANGLADESH**

**China Keen on Second Nuclear Plant in Bangladesh**

Chinese companies have expressed great interest in bidding for Bangladesh's proposed second nuclear power plant. Two Chinese companies – Dongfang Electric Corporation and China State Construction Engineering Corporation – have started huge lobbying with the Bangladesh Atomic Energy Commission to bag the deal.

They said that the government conceived the second nuclear power plant in 2014, but was yet to seek any expression of interest from foreign companies or finalise a site. The country's first nuclear power plant is under construction at Rooppur in Pabna with over \$12 billion in financial and technical assistance from Russia. The first of the two reactors is expected to be commissioned in 202.

...Top Bangladesh officials said that some other Chinese companies, including Guangdong Nuclear Power Group, were making queries about the second nuclear power plant, though its site was yet to be finalized.

Science and technology secretary Anwar Hossain said that they were considering extending the duration of the site selection programme by six months. Bangladesh Atomic Energy Commission chairman Mahbubul Hoq has admitted to local mediapersons here that Dongfang Electric Corporation officials met him about two months ago and expressed their interest in the proposed nuclear power plant.... He said that they were considering finalising the site from one of the four

locations — Gangamati in Patuakhali, Mazher Char in Barguna, Boyar Char in Noakhali and Muhurir Char in Feni.

Gangamati may finally be picked up over the three other sites following the government's plan to modernise Patuakhali's coastal zone by a deep sea port and a naval base. On April 7, China State Construction Engineering Corporation submitted a written proposal to the commission expressing its willingness to 'undertake the 2nd NPP in Bangladesh'. Mahbubul Hoq said that they were yet to respond to the proposal made by the Chinese company which had been responsible for the construction of the first Chinese nuclear power plant, Daya Bay, in 1987.

Officials said that the Chinese corporation promised 'timely commencement and completion' of the project against the backdrop of criticism that many projects, including Padma Multipurpose Bridge, implemented by Chinese companies in Bangladesh, have been hit by delays causing time and cost overruns. Anu Muhammad, who heads the National committee to protect oil, gas, mineral resources, power and ports, told journalists that the government's lack of transparency has encouraged the Chinese companies to bid for the second NPP project.

...'May be the atomic energy commission is waiting' until the project gets a concrete shape, he said. Officials said that the government wanted to construct the second nuclear power plant in the coastal region to ensure availability of water. For the first nuclear power plant at Rooppur, nearly 1,750 cubic metre of water would be fetched

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**For the first nuclear power plant at Rooppur, nearly 1,750 cubic metre of water would be fetched everyday from the nearby Padma River to cool the reactors, The atomic energy commission has also invited Japan Atomic Energy Agency to explore the possibility of building the proposed nuclear power plant with 2,000 MW power generation capacity.**



everyday from the nearby Padma River to cool the reactors, they said. The atomic energy commission has also invited Japan Atomic Energy Agency to explore the possibility of building the proposed nuclear power plant with 2,000 MW power generation capacity. Bangladesh's rapid industrialization has made it desperate to augment power generation and the nuclear option was one under active consideration.

Source: <https://nenow.in/>, 22 April 2019.

## **RUSSIA-ETHIOPIA**

### **Ethiopia and Russia Sign Three-Year Nuclear Power Plan**

Russia and Ethiopia have signed an agreement setting out a three-year plan to lay the ground for the construction of a centre for nuclear science and technology and a nuclear power plant, Russian State Atomic Energy Corporation said ....

Rosatom said in a statement: "The roadmap determines specific steps in strengthening bilateral cooperation in the field of peaceful use of atomic energy. The parties have identified joint actions within the framework of a nuclear power plant construction and centre for nuclear science construction projects. "Thus, a foundation is laid for training personnel and raising public awareness about atomic energy."

The signing follows an earlier memorandum of understanding, signed in June 2017, that established a legal framework for nuclear cooperation. The day after agreeing the Ethiopian roadmap, Rosatom signed another with the Democratic Republic of Congo. This is a two-year deal that also envisages the construction of a nuclear science centre and the training of Congolese technicians. Rosatom says it has six reactor projects under way inside Russia and 36 outside. Its 11th Atomexpo forum, brought together over 1,500 foreign participants from 74 countries.

Source: <http://www.globalconstructionreview.com/>, 17 April 2019.

## **USA-SAUDI ARABIA**

### **US Nuclear Firms' New Plan to Cash in on Saudi Deal**

American companies have to deal with all kinds of cumbersome regulations if they want to sell nuclear gear to the Saudis. So they're eyeing a new partner to help out. Executives in the industry and American officials told The Daily Beast that despite the Trump administration pushing for a deal with Riyadh, the US nuclear energy sector is behind its competitors, notably Russia and China, when it comes to developing and exporting technology for major international projects.

To get ahead, US companies are mulling over whether to turn a consortium of companies—which some have dubbed "Team USA"—into one that includes foreigners, namely state-run energy firms from South Korea, in an attempt to strengthen its bid in Saudi Arabia.

If the plan comes to fruition, experts say it could offer US companies a greater chance of securing contracts in Saudi Arabia and beating out Russia and China—one of the administration's main economic goals. But the possibility of such a deal has raised concerns among officials in the Trump administration that it may also limit the US government's ability to ensure Saudi Arabia adheres to certain nuclear safeguards.

The Trump administration, whose officials have publicly said they are pushing Saudi Arabia to commit to the highest standards of inspection and verification—also known as the "gold standard"—have raised the question of whether the partnership with South Korea might help American companies clinch a deal without the US signing a formal cooperation deal with Saudi known as a "123 Agreement."

The US Atomic Energy Act requires the US sign the 123 Agreement with countries it plans to cooperate with on nuclear energy and sets forth conditions and controls to govern nuclear commercial transactions. "Engaging in nuclear cooperation with a country, such as Saudi Arabia, that has threatened to leave the NPT to build nuclear weapons, carries extreme risks," said

Daryl Kimball, executive director at the Arms Control Association. "If US companies are considering a business partnership with Korean nuclear companies, such an arrangement increases the burden on the administration to ensure that the Saudis accept rigorous inspections and a commitment never to acquire or seek to acquire...nuclear weapons."

**If US companies are considering a business partnership with Korean nuclear companies, such an arrangement increases the burden on the administration to ensure that the Saudis accept rigorous inspections and a commitment never to acquire...nuclear weapons.**

There is no indication that American companies have followed through with such a plan, but two officials in the Department of Energy told The Daily Beast the Saudis and the South Koreans have offered it up as a winning strategy. The argument from the Saudi and South Koreans, experts say, is that the nuclear technology that would eventually find its way to Riyadh would be of South Korean origin, not American. Therefore, the US and Saudi Arabia would not need a 123 Agreement. The US companies would only provide other services such as technical expertise, security and staffing.

But there is considerable pushback against that argument in the Department of Energy, current and former officials say. Combustion Engineering, a company that was absorbed by Westinghouse in 2010, transferred its technology to Seoul to aid in the joint development of a reactor that South Korea then sold across the globe. Since then, South Korea has developed its own technology to manufacture reactors.

But some officials in the Trump administration told The Daily Beast they believe that the South Korean reactors, even if newly developed, are still based on American technology and would therefore require the US and Saudi to sign a 123 Agreement for an American-South Korean consortium to work.

American companies—along with companies from Russia, China, and South Korea—are already

involved in extensive conversations with Saudi Arabia about the possibility of working to transfer nuclear technology to the kingdom for its plan to reduce their dependence on oil, known as "Vision 2030."

The Department of Energy has doled out seven authorizations to US companies seeking to conduct nuclear-related work in Saudi Arabia. The authorizations, known as

part 810s, allow for the transfer of US nuclear technology to the country, though a separate authorization is needed for companies to actually export that technology.

But experts say some of the companies involved in conversations about a US consortium bidding in Saudi Arabia are behind in developing the technology Riyadh would look for in a bid...Officials from South Korea and Saudi Arabia have met over the past two years in an attempt

to broker a relationship that fosters cooperation on nuclear energy. And in January, an executive from one of the country's energy firms, Kepco, said he believed the company "left a good impression" in Saudi Arabia after it had detailed its plans for Riyadh's nuclear bid.

**American companies—along with companies from Russia, China, and South Korea—are already involved in extensive conversations with Saudi Arabia about the possibility of working to transfer nuclear technology to the kingdom for its plan to reduce their dependence on oil, known as "Vision 2030."**

...South Korea could be an attractive option for Saudi Arabia, experts say, because it does not demand the same rigorous standards for inspection and verification as other countries such as the US. South Korea does not require that a bilateral cooperation agreement be approved by parliament. It also does not require its clients sign on to the IAEA's additional protocol—a safeguard agreement that allows the IAEA to conduct rigorous inspections to ensure countries are using nuclear material for peaceful means.

"If the US encourages the IAEA to take a dive, or if the IAEA allows Saudi Arabia to sign a watered

down additional protocol, all four parties benefit." The signing of a protocol is not a requirement; however, most countries around the world have signed on to it, even countries that do not have nuclear power. The protocol is a safeguard agreement that in particular allows the IAEA to conduct rigorous inspections to ensure countries are using nuclear material for peaceful means.

..."I have heard Saudi Arabia thinks [the US partnering with South Korea] is a loophole," said Robert Kelley, the former director of the IAEA. "If the US encourages the IAEA to take a dive, or if the IAEA allows Saudi Arabia to sign a watered down additional protocol, all four parties benefit." Officials in the Trump administration, particularly in the Department of Energy, are trying to persuade South Korea to uphold the "gold standard" of inspections and the IAEA additional protocol with Saudi Arabia, according to one official with direct knowledge of those conversations. The IAEA, too, has asked Saudi to agree to the additional protocol. ...

Source: <https://www.thedailybeast.com/>, 15 April 2019.

## **NUCLEAR NON-PROLIFERATION**

### **IRAN**

#### **Dispute Flares among US Officials over Trump Administration Iran Arms Control Report**

A new Trump administration report on international compliance with arms control accords provoked a dispute with US intelligence agencies and some State Department officials concerned that the document politicizes and slants assessments about Iran, five sources with knowledge of the matter said.

US President Donald Trump is intensifying a drive to contain Iran's power in the Middle East, which

has raised fears that his administration wants to topple the Tehran government or lay the groundwork to justify military action. The administration says it is trying to halt Iranian "malign behavior" in its support for Islamist militants in the region and denies seeking the overthrow of the Islamic republic's government.

...Washington also has piled on tough economic sanctions following Trump's withdrawal from the 2015 nuclear deal between Iran and world powers. The administration also is waging a propaganda campaign, including over social media, aimed at fueling popular anger against Iran's government.

Several sources said the report, which reappeared without explanation...made them wonder if the

administration was painting Iran in the darkest light possible, much as the George W. Bush administration used bogus and exaggerated intelligence to justify its 2003 invasion of Iraq. A State Department spokeswoman defended the judgment on Iran, saying in an email that it was "informed by careful assessment of all relevant information."

The report was published to meet a mandatory April 15 deadline by which it had to go to Congress, the department said. A more comprehensive unclassified version will be provided after the completion of a review of what information in the classified report can be made public, the spokeswoman said. The department did not address the internal dispute over the report or concerns of politicization.

The unclassified "Adherence to and compliance with arms control, nonproliferation and disarmament agreements and commitments" report omitted assessments of Russian. ...The report also failed to include detailed assessments published in previous years of whether Iran, Myanmar, North Korea, Syria and other nations

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complied with the NPT. Instead, the report replaced those assessments with a five paragraph section entitled "country concerns."

...The section made no mention of judgments by US intelligence agencies and the IAEA that Iran ended a nuclear weapons program in 2003 and has complied with the 2015 deal that imposed restrictions on its civilian nuclear program. Instead, it said Iran's retention of a nuclear archive disclosed last year by Israel raised questions about whether Tehran might have plans to resume a nuclear weapons program.

It added that any such effort would violate the NPT, as would any Iranian retention of undeclared nuclear material, though it offered no evidence that Iran had done either. "It's piling inference upon inference here to try to create a scary picture," said a congressional aide, who requested anonymity to discuss the issue, as did the other sources. The aide added that by stripping out much of the report's normal content, the documents largely had become about Iran.

"There is significant concern that the entire sort of purpose ... was to help build a case for military intervention in Iran in a way that seems very familiar," the source said, referring to the Bush administration's use of erroneous intelligence before the invasion of Iraq 16 years ago that ousted President Saddam Hussein.

The 12-page report, down from last year's 45-page document, reflected a disagreement between Assistant Secretary of State Yleem Poblete, whose office is charged with its drafting, and her boss, Undersecretary of State Andrea Thompson, three of the sources said. Two sources said Poblete had sought to include information such as news stories and opinion pieces in the report, which traditionally is based on legal analyses of US intelligence reports.

The State Department did not comment on

Poblete's role. "And it had other obvious errors," said a former US official familiar with matter. A draft of the unclassified version had included classified information, the official said. "It's been described to me as just a big food fight within the department over an initially inadequate draft."

A second former US official said he believed that the report was being used to advance the Trump administration's views on Iran rather than to reflect information gathered by intelligence agencies and assessments of that information by State Department experts. "This 'trends' section is adding a political tinge or politicizing the report," said the fourth source on condition of

**North Korea said it test-fired a new type of "tactical guided weapon," in what appeared to be a warning from Kim Jong-un to President Trump that unless once-promising negotiations with Washington resume, the two countries could again be on a collision course.**

anonymity, saying the administration seemed to be using a once objective report "to back up subjective assertions." While saying they did not know why the report had been so abbreviated, removed and then restored from the website, analysts

asked if there was an effort underway to demonize Iran. ...

*Source: Jonathan Landay and Arshad Mohammed, <https://www.reuters.com/>, 17 April 2019.*

## **NUCLEAR PROLIFERATION**

### **NORTH KOREA**

#### **North Korea Tests New Weapon**

North Korea said it test-fired a new type of "tactical guided weapon," in what appeared to be a warning from Kim Jong-un to President Trump that unless once-promising negotiations with Washington resume, the two countries could again be on a collision course.

The North's official Korean Central News Agency did not specify what type of weapon was involved in the test. But there was no evidence the test involved a nuclear detonation or an intercontinental ballistic missile. The North has observed a voluntary moratorium of those tests since November 2017, and President Trump has



repeatedly said that the North's self-imposed suspension of nuclear and long-range missile tests was one of his administration's biggest achievements, crediting himself with averting war by first threatening the North with "fire and fury" and then holding two face-to-face meetings with Mr. Kim.

But at the latest of those meetings, in Hanoi in February 2019, the two leaders failed to reach an agreement, after Mr. Trump rejected, at the insistence of his top advisers, Mr. Kim's proposal to lift the harshest sanctions on the North in return for suspending operations at North Korea's largest nuclear facility. Since then, there has been virtually no communication, much less negotiation, between the two countries.

Experts said it was likely that the test announced...was a demonstration of a conventional weapons system, perhaps artillery or anti-aircraft. If so, that would amount to signal-sending by Mr. Kim, who North Korea media said witnessed the test.

...In recent days the North Korean leader has said he would give the United States until the end of the year to come up with concrete proposals that would lift sanctions on the North — an implicit warning that, after that deadline, it might resume the nuclear and intercontinental missile testing that had appeared, in the summer of 2017, to be leading to conflict.

Shortly after announcing the weapons test, the North Koreans threw in a new condition to any continued talks: Secretary of State Mike Pompeo, considered a hard-liner who helped persuade Mr. Trump to reject North Korea's proposed terms for an agreement, could not be part of future negotiations. In a statement, a foreign ministry official, Kwon Jong-gun, accused Mr. Pompeo of "letting loose reckless remarks and sophism of all kinds against us every day."

The test announced...suggested that Mr. Kim was willing to consider gradually raising the stakes sooner, and making Mr. Trump fear that his signature foreign policy initiative could collapse before the 2020 elections. Mr. Kim has also been under pressure at home, where many expected him to return from Hanoi celebrating a lifting of the sanctions that have weighed heavily on the North Korean economy.

...But the test also revealed Mr. Kim's growing desperation, said Woo Jung-yeop, a North Korea expert at the Sejong Institute in South Korea.... The test of the weapon, which was conducted by the North's Academy of Defense Science, Mr. Kim said its development "serves as an event of very weighty significance in increasing the combat power of the People's Army," the North Korean news agency said. The test was the first since last November 2018 when the country said Mr.

Kim had attended the test of an unidentified "newly developed ultramodern tactical weapon."

After that test, the South Korean news media, quoting government sources, said that North Korea appeared to have tested multiple-rocket launchers, not missiles. Besides the North's

nuclear weapons and missiles, which are probably capable of reaching the continental United States, such rockets are considered one of the greatest military threats to South Korea, because the North deploys them near the countries' border to target the South's capital, Seoul, a city of 10 million people.

*Source: New York Times, 17 April 2019.*

### **Russia Inserts Itself in North Korea's Denuclearisation Talks: Says Kim Needs 'Security Guarantees'**

After the first meeting between Russian President Vladimir Putin and North Korea's leader Kim Jong-Un, the message for the US was clear – that Pyongyang has inserted other countries into the

**In recent days the North Korean leader has said he would give the United States until the end of the year to come up with concrete proposals that would lift sanctions on the North — an implicit warning that, after that deadline, it might resume the nuclear and intercontinental missile testing that had appeared, in the summer of 2017, to be leading to conflict.**

denuclearisation talks and it will not give up its nuclear weapons without considerable returns.

Putin said after his meeting with Kim Jong-Un...North Korea would need security guarantees before it could pursue nuclear disarmament. Putin added that those guarantees, if they are to work, would need to be offered within a multi-national framework. The Russian president said he was asked to pass on the message to the US. "There are no secrets here, no conspiracies.... Chairman Kim himself asked us to inform the American side of his position," Putin said.

He said Russia certainly supported the US call for complete denuclearisation of the Korean Peninsula. "This is certainly a common priority," he added. After the meeting, Putin also said that he was willing to look at the de-nuclearisation conditions that the US has proposed with North Korea. This is a move that will not be welcomed by anyone in the US but is exactly where Pyongyang wants itself to be – being backed by an American challenger. "We need to restore the power of international law, to return to a state where international law, not the law of the strongest, determines the situation in the world," Putin said after meeting Kim.

Kim Jong-Un's outreach to Russia comes after talks with the US have stalled following the failed Hanoi Summit. North Korea has accused the US of adopting a gangster-like stance during the denuclearisation negotiations.

Meanwhile, Kim's appreciation for Putin's support was highlighted in his effusive praise of the two country's historical ties and the importance of the relationship saying both nations had overcome

"every hardship thrown to them by history". "The people of the two countries ... understand [that the] North Korea-Russia tie not only serves our mutual interests but is also indispensable for

securing the region's peace and stability," Kim said.

Putin is the sixth world leader to meet Kim Jong-un since the North Korean leader took it upon himself to end the country's isolation due to its nuclear activities. Besides Putin and Trump, Kim Jong-un has met Chinese President Xi Jinping, South Korean President Moon Jae-in,

Singapore's Prime Minister Lee Hsien Loong and Vietnamese President Nguyen Phu Trong.

Source: <https://www.latestly.com/>, 25 April 2019.

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## NUCLEAR SAFETY

### CHINA

#### How Safe are China's Nuclear Power Plants?

Safety levels at China's nuclear power plants are now the highest in the world, Xue Xiaogang, president of the China Institute of Atomic Energy, told CGTN in an exclusive interview. After a three-year hiatus, China will resume approving new nuclear power projects this year, according to Liu Hua, deputy minister of ecology and environment and head of the National Nuclear Safety Administration.

**There are two major aspects with regard to the safety of a nuclear power plant. One is how to avoid nuclear meltdown, which requires robust and efficient cooling of the reactor, and the other is how to prevent the release of radioactive material into the environment.**

It has been taken as a positive signal for the country's nuclear power industry, which has slowed down since the catastrophic Fukushima nuclear accident in 2011. But safety is always the No.1 issue. According to the expert, there are two major aspects with regard to the safety of a nuclear power plant. One is how to avoid nuclear meltdown, which requires robust and efficient cooling of the reactor, and the other is how to

prevent the release of radioactive material into the environment.

In both aspects, the safety level (measured by various quantitative indexes) of all of China's nuclear power reactors in operation is above the world average, and 70 percent of them rank at the front, according to data from the World Nuclear Association. The country's homegrown third-generation nuclear power technology Hualong One (also known as HPR1000), with the world's most advanced designs and extra safety measures, meets the highest international safety standards.

Reactors built with Hualong One designs also adopt a double-layer safety shell that can withstand the impact of a Boeing 737 airplane. "It is almost impossible that a Fukushima-style accident will happen in China," Xue said. At the Japanese plant, tsunami waves swamped the backup generators needed to keep coolant pumps running, and the loss of coolant caused three of the plant's six reactors to melt down. The Hualong One design stores water above the reactor that can be gravity-fed to keep it cool. Like its major competitors, China is now developing the fourth generation of nuclear power technology, which could further minimize the likelihood of accidents, and has better economic performance and less nuclear waste, Xue said.

...China has seen the most rapid development of nuclear power technology since the early 1990s, with no suspension of nuclear power construction or operation over the years. Plus, a world-class talent pool has been cultivated. Compared with other carbon-free energy such as wind and solar power, which are inherently seasonal and weather-dependent, nuclear power still has some advantages. It's more stable and allows large-scale power supply, Xue said. China's overall appetite for energy will remain relatively high, as

the country maintains middle-to-high-speed economic growth. Meanwhile, China is transforming to green development, with higher environmental protection requirements. Currently, coal-fired electricity still accounts for about 70 percent of China's total power. In order to meet the still robust energy demand while lowering harm to the environment, the country needs to further adjust its energy structure.

*Source: <https://news.cgtn.com/>, 21 April 2019.*

## **JAPAN**

### **Japan to Shut Down Nuclear Plants if Counterterrorism Steps not Taken in Time**

**Japan's nuclear regulator decided not to let power companies operate reactors if they fail to install sufficient counterterrorism measures by specified deadlines. The decision by the Nuclear Regulation Authority came after three utilities that operate five nuclear plants in western and southwestern Japan requested that their deadlines be extended as they expect delays in completing counterterrorism steps required under stricter regulations introduced in 2013.**

Japan's nuclear regulator decided not to let power companies operate reactors if they fail to install sufficient counterterrorism measures by specified deadlines. The decision by the Nuclear Regulation Authority came after three utilities that operate five nuclear plants in western and southwestern Japan requested that their deadlines be extended as they expect delays in

completing counterterrorism steps required under stricter regulations introduced in 2013 following the Fukushima nuclear crisis. Kyushu Electric Power Co., Kansai Electric Power Co. and Shikoku Electric Power Co. had sought to postpone their five-year deadlines by one to three years, citing reasons such as the need to carry out massive construction work.

The three companies told the NRA that the measures would not be on time at 10 of their reactors, according to documents published on the regulator's website. But the regulator has declined their requests for extensions.

The power plant operators are required to build facilities that can keep reactors cool via remote control and prevent the massive release of radioactive materials if the units are the target of

a terrorist attack, such as from planes being flown into them. Nuclear plant operators need to set up such facilities within five years of the nuclear safety watchdog approving detailed construction plans for the plants.

But several firms have warned they will not meet these criteria. The NRA said after a meeting earlier it would no longer push back the deadline as it has done in the past. "There is no need to extend the deadline, and nuclear facilities have to stop operations if the operators fail to meet it," an NRA official said. He added that several other reactors were also at risk of being shut down.

A reactor at the Sendai power plant in Kyushu could be the first to be suspended if Kyushu Electric Power fails to finish work by the deadline next March 2020. Following the No. 1 reactor at the Sendai plant, the No. 2 reactor at the complex is facing a deadline in May 2020. The deadline for the No. 3 reactor at the Takahama plant in Fukui Prefecture operated by Kansai Electric is August 2020. ... "We cannot overlook the operations of nuclear facilities when they become incompatible with meeting standards," NRA Chairman Toyoshi Fuketa said.

*Source: Japan Times, 24 April 2019.*

**UK**

**The Royal Navy can't seem to figure out how to Dispose of Old Nuclear Submarines**

Britain has retired twenty nuclear submarines since 1980. None have been disposed of, and nine still contain radioactive fuel in their reactors, according to an audit by Britain's National Audit Office. These subs spent an average of twenty-six years on active service—and nineteen years out of service.

"Because of this, the Department [Ministry of Defense] now stores twice as many submarines as it operates, with seven of them having been in

storage for longer than they were in service," the audit states.

Even worse is the price tag. Britain has spent 500 million pounds (\$646.4 million) maintaining those decommissioned subs between 1980 and 2017. Full disposal of a nuclear sub would cost 96 million pounds (\$112.1 million). As a result, the total cost for disposing of the Royal Navy's ten active subs and twenty retired vessels would be 7.5 billion pounds (\$9.7 billion), NAO calculated.

Dismantling and disposing of a nuclear sub is a complex process. The nuclear fuel must be carefully removed from the reactor using special facilities. Then the submarine itself must be dismantled, again with extra care paid to removing the radioactive parts of the vessel. Just one contractor—Babcock International Group PLC—is "currently the Department's sole supplier capable of undertaking most of the Department's defueling and dismantling requirements," noted NAO. "It owns the nuclear-licensed dockyards and facilities in both Devonport and Rosyth, and also provides aspects of the related projects."

Fuel removal ceased in 2004 after British nuclear regulators found the removal facilities didn't meet standards. Yet the Ministry of Defense still lacks a fully-funded plan for defueling.

All of this is taking a toll on a Royal Navy already underfunded and struggling to fund new ships. "The Department pays an estimated £12 million [\$15.5 million] a year to maintain and store the nine fueled submarines currently stored in Devonport," NAO found. "Maintaining fueled, rather than unfueled, submarines also presents additional technical uncertainties and affects dock availability. This has contributed to space pressures in Devonport, with the Department at risk of not meeting its commitment to inspect, clean and repaint stored submarines at least every

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15 years, and not having space to prepare [the submarine] Torbay, which left service in 2017, for long-term storage. Until submarines are prepared, the Department must keep them partially crewed, potentially affecting the Department's ability to redeploy its personnel."

The plan is to begin defueling subs, beginning with HMS Swiftsure, in 2023. But even then, the Ministry of Defense will have to deal with different subs that have different disposal requirements. "At present, the Department does not have a fully developed plan to dispose of Vanguard, Astute and Dreadnought-class submarines, which have different types of nuclear reactor," NAO pointed out. "For the Vanguard and Astute-class it has identified suitable dock space which, if used, will need to be maintained."

Interestingly, the British military gets an exemption when it comes to nuclear waste. "Within the civil nuclear sector, organizations must consider nuclear waste disposal during the design stage of power stations and nuclear infrastructure. The Department does not have a similar obligation."

Britain isn't the only nation that has problems disposing of nuclear warships. The Soviet Union sank nineteen nuclear vessels, and fourteen shipborne nuclear reactors, at sea, sparking fears of an environmental catastrophe. Even the U.S. Navy is struggling with how to dispose of nuclear subs and aircraft carriers, such as the decommissioned carrier USS Enterprise.

Source: Michael Peck, <https://nationalinterest.org>, 27 April 2019.

## NUCLEAR WASTE MANAGEMENT

### FRANCE

#### France Debates what to Do with its Nuclear Waste

France launched a national debate on how to treat its 1.6 million cubic meters of nuclear waste as part of the country's National Plan for the Management of Radioactive Waste takes place under the auspices of Andra, the national agency responsible for its management. Currently, Cigéo, the €35 billion Industrial Centre for Geological Storage, is being built in Bure, in eastern France, a region

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with no seismic activity and thick layers of slate that keep water out.

The idea is to create chambers 500 meters below the surface and seal the waste inside galleries. However, the emission of hydrogen from the waste could lead to explosions, so the waste needs to be ventilated, which suggests maintenance work for a few million years.

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The question is whether this solution will be able to maintain the waste "safely" for a few million years. Neptunium 237 requires 2.1 million years to be half as dangerous as it is today; iodine 129 will take 16 million years and chlorine 36 merely 300,000 years.

French physicist Bernard Laponche argues for an end to all talk about burying, which is irreversible and, therefore, "the worst of all options," as the leak of a single container would suffice to spell disaster.

An alternative approach would require authorities to wait for science to create a more efficient solution, with experiments focusing on neutron

bombardment to reduce the radioactivity of plutonium. Laponche argues that capital should be diverted from storage to research, to develop a more efficient solution.

Source: <https://www.neweurope.eu/>, 23 April 2019.

## JAPAN

### Removing Fuel Rods, Japan Hits Milestone in Fukushima Nuclear Cleanup

The operator of Japan's ruined Fukushima nuclear power plant began removing radioactive fuel rods at one of three reactors that melted down after an earthquake and a tsunami in 2011, a major milestone in the long-delayed cleanup effort. Thousands of former residents have been barred from the area around the plant for years as crews carried out a large-scale radioactive waste cleanup in the aftermath of the worst nuclear disaster since Chernobyl. The process of removing the fuel rods from a storage pool had been delayed since 2014 amid technical mishaps and high radiation levels.

The plant operator, Tokyo Electric Power, said in a statement that workers began removing the first of 566 spent and unspent fuel rods stored in a pool at the plant's third reactor. A radiation-hardened robot had first located the melted uranium fuel inside the reactor in 2017. "Thanks to their training, the work has been going smoothly," Tomohiko Isogai, the director of the nuclear plant, was quoted as saying by the Japanese broadcaster NHK, referring to workers involved in the fuel cleanup. He added that plant officials were "very sorry" over the delays in the process.

There are 1,573 fuel rods still inside the storage pools of the three reactors that melted down in 2011, the Kyodo News agency reported. Tokyo Electric said that the cleanup at the third reactor

would take just under two years, and that it planned to eventually remove uranium from all three reactors. Workers at the third reactor are using a remotely operated crane to remove the fuel rods, in a process that occurs underwater to prevent radiation leaks. The rods are dangerous partly because the pools are not enclosed, and they could be vulnerable in the event of another major earthquake.

Source: Mike Ives, <https://www.nytimes.com>, 15 April 2019.

## UK

### How Do You Scrap a Nuclear Submarine?

The UK defence department has not scrapped any of its 20 defunct nuclear submarines in more than three decades, according to a recent public spending report. Storing the vessels has already cost the government around £500 million. But why has the UK left these submarines in dockyards for so long – and

how difficult is it to dismantle them?

**What is a Nuclear Submarine?:** A 'nuclear' submarine can refer to a submarine that carries nuclear warheads, one that is powered using nuclear energy, or both. In the UK, the Vanguard, Astute and Trafalgar class submarines are all powered using a nuclear reactor, but only the four Vanguard class submarines carry nuclear warheads – Astute and Trafalgar submarines are 'hunter-killers' designed to sink other ships.

The UK's current fleet relies on a reactor typically seen in power stations across the world – the pressurised water reactor (PWR). These compact power plants produce vast amounts of heat through the splitting of uranium-235 (235U). This fissile isotope exists in very small quantities (less than 1%) in natural uranium, which mainly consists of uranium-238 (238U).

To use it as fuel, the 235U is increased relative to the 238U in a process known as enrichment. In

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the PWR, waste fission products are made, such as caesium, xenon and krypton, as neutrons split the <sup>235</sup>U fuel, with <sup>238</sup>U also absorbing neutrons to form plutonium. These fission products can damage the ceramic fuel and reduce the reactor's efficiency. The vessel that contains this whole process is also bombarded with high levels of radiation over its operational life.

**What Happens to a Nuclear Submarine Once it is Removed from Service?:** Once a nuclear-powered submarine is decommissioned, it is placed into long-term storage. Only after monitoring the vessel will engineers begin to defuel and dismantle it. However, over the past four decades, this second part hasn't happened in the UK. Since 1980, the UK Ministry of Defence has taken 20 nuclear-powered submarines out of service. Of these 20 subs, the UK has not fully disposed any of them and nine still contain highly radioactive nuclear fuel. The vessels have languished at dockyards in Plymouth and Rosyth.

This is not a sustainable solution, but it is in stark contrast with other countries' past policies. During the Cold War, the Soviet Union dumped 19 ships containing nuclear waste in the Kara Sea, as well as 14 reactors and the K-27 nuclear submarine. With such vessels continuing to rust on the seabed, there are concerns these sites could harbour a potential environmental crisis. However, the subs stored in the UK are constantly monitored in a controlled environment. Although a far cry from the Arctic submarine graveyards, the UK fleet still lies exposed to salty water, with the vessels rusting in the dockyards.

**Why are the Submarines Still in Storage?:** It is an incredibly complex situation, but the government stopped defueling its disbanded fleet back in 2004. The UK's nuclear regulator deemed that the facilities were not up to standards, and the UK has been working to improve them ever since.

Mired in delays and inflating budgets, the defueling may not restart until 2023 – the original start date was 2012. Even when the subs are ready for their next voyage through the disposal process, it is a journey fraught with complexity.

**What is the Plan for the Nuclear Waste?:** Once defueling starts, the sub will be moved to a 'reactor access house' on rails. In this facility, engineers will remove the spent nuclear fuel from the sub, which contains various actinides and radionuclides. The fuel is highly radioactive and generates heat, so needs to be cooled in water before any further work can begin.

To cool the fuel rods, the waste is sent to a specialised plant at Sellafield, where it is stored in vast water ponds. The water acts as both an efficient coolant and radiation barrier. Historically, this spent fuel would have then been recycled to form new nuclear fuel. During reprocessing, the fissile uranium and plutonium is separated through solvent extraction, before converting the remaining liquid waste into a glass for long-term storage. However, it is now unclear whether this will still happen. It is more likely that the spent nuclear fuel will be stored indefinitely after cooling.

The current UK strategy is to bury this waste in a highly-engineered geological disposal facility, which would see more than 650,000m<sup>3</sup> of waste stored in an underground cavern, according to recent government estimates. But plans are still ongoing and a facility is yet to be built.

**What Happens to the Submarine after Defueling?:** After defueling, the sub will return to the 'wet' dock for another period of storage and monitoring. Following this, the submarine is dismantled. Components such as pipes and pumps exposed to radiation are taken away and the reactor vessel removed.

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However, engineers do not simply remove the reactor. In many countries, the reactor is lifted out with the two empty compartments either side of it and then sealed off to minimise the risk of exposure. After removing this 'three-compartment unit', the submarine is cast off for its final voyage to a commercial shipyard for recycling. But it will be a costly endeavour. The UK may face costs of up to £7.5bn if it wants to take the entire fleet through this voyage of defueling and disposal. It remains unclear whether the plans will stay on course, but the defence department has committed to dismantling the fleet 'as soon as reasonably practicable'.

Source: Matthew Gunther, <https://www.chemistryworld.com>, 22 April 2019.

### USA

#### Burgum Signs Nuclear Waste Storage Bill

Gov. Doug Burgum has signed a bill that sets up a framework for permitting and regulating high-level radioactive waste. Burgum signed Senate Bill 2037...a bill related to nuclear waste disposal and

storage that resulted from an interim legislative study and input from a group of concerned Pierce County residents.

The bill includes a statement that the "placement, storage, treatment, exploration, testing or disposal of high-level radioactive waste" is prohibited in North Dakota. But if that provision is superseded by the federal government, the bill outlines a process for the state to respond and a permitting process.

The North Dakota Community Alliance advocated for provisions that were included in the bill to better protect the public, such as increased bond requirements and landowner notification. The legislation also establishes a high-level radioactive waste advisory council that includes state officials, legislators and representatives from city and county governments.... North Dakota residents concerned about nuclear waste storage say they're "gratified" that state legislators included their suggestions....

Source: <https://bismarcktribune.com/>, 24 April 2019.

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