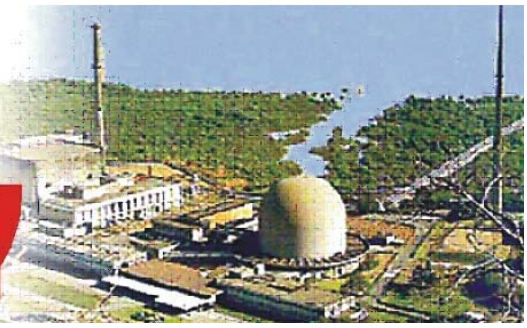
NUCLEAR SECURITY



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

Vol 12, No. 16, 15 JUNE 2018

CONTENTS

STATEMENT

Kim Jong-un and Donald Trump's Joint Statement, Singapore

President Donald J. Trump of the USA and Chairman Kim Jong Un of the State Affairs Commission of the DPRK held a first, historic summit in Singapore on June 12, 2018.

President Trump and Chairman Kim Jong Un conducted a comprehensive, in-depth, and sincere exchange of opinions on the issues related to the establishment of new US-DPRK relations and the building of a lasting and robust peace regime on the Korean Peninsula. President Trump committed to provide security guarantees to the DPRK, and Chairman Kim Jong Un reaffirmed his firm and unwavering commitment to complete denuclearization of the Korean Peninsula.

Convinced that the establishment of new US-DPRK relations will contribute to the peace and prosperity of the Korean Peninsula and of the world, and recognizing that mutual confidence building can promote the denuclearization of the Korean Peninsula, President Trump and Chairman Kim Jong Un state the following:

President Trump committed to provide security guarantees to the DPRK, and Chairman Kim Jong Un reaffirmed his firm and unwavering commitment to complete denuclearization of the Korean Peninsula. Convinced that the establishment of new US-DPRK relations will contribute to the peace and prosperity of the Korean Peninsula and of the world, and recognizing that mutual confidence building can promote the denuclearization of the Korean Peninsula.

1. The United States and the DPRK commit to establish new US-DPRK relations in accordance with the desire of the peoples of the two countries for peace and prosperity.

2. The United States and the DPRK will join their efforts to build a lasting and stable peace regime on the Korean Peninsula.

3. Reaffirming the April 27, 2018 Panmunjom Declaration, the DPRK commits to work toward complete denuclearization of the Korean Peninsula.

4. The United States and the DPRK commit to recovering POW/MIA remains, including the immediate repatriation of those already identified.

Having acknowledged that the US-DPRK summit — the first in history — was an epochal event of

great significance in overcoming decades of tensions and hostilities between the two countries and for the opening up of a new future, President Trump and Chairman Kim Jong Un commit to implement the stipulations in this joint statement fully and expeditiously. The United States and the DPRK commit to hold follow-on negotiations, led by the US Secretary of State, Mike Pompeo, and a relevant high-level DPRK official, at the earliest possible date, to implement the outcomes of the US-DPRK summit.

President Donald J. Trump of the United States of America and Chairman Kim Jong Un of the State Affairs Commission of the DPRK have committed to cooperate for the development of new US-DPRK relations and for the promotion of peace, prosperity, and security of the Korean Peninsula and of the world.

Source: https://www. aljazeera. com, 12 June 2016.

OPINION – Margaret Brennan

What would it Take to Get Rid of North Korea's Nuclear Weapons?

North Korea staged the destruction of its Punggye-Ri nuclear site last month for the cameras, but dismantling North Korea's entire nuclear program begins with verifying what they actually have in their arsenal.

US intelligence wants inspectors to access roughly 100 other sites, including Yongbyon, the nation's main atomic complex just 50 miles north of Pyongyang, as well as a factory in Chongsu, near the Chinese border, suspected of producing nuclear material. "The only way to know if North Korea's declarations are accurate is to verify them through on the ground presence," said David Albright, a former weapons inspector.

North Korea granted such access as part of a Clinton-era diplomatic deal and agreed to freeze its nuclear material production. But North Korea kicked out the inspectors after the Bush administration accused it of cheating.

This time, the Trump administration wants to destroy the weapons itself with assistance from other countries. Components would then be shipped to a research lab in Tennessee. Depending on how truthful Kim Jong Un is, that process could take anywhere from two to 10 years.

US intelligence wants inspectors to access roughly 100 other sites, including Yongbyon, the nation's main atomic complex just 50 miles north of Pyongyang, as well as a factory in Chongsu, near the Chinese border, suspected of producing nuclear material. "The only way to know if North Korea's declarations are accurate is to verify them through on the ground presence.

Another challenge is monitoring North Korea's nuclear scientists. "They could steal documents that are highly classified. You have to work with those people to make sure that they're not encouraged to go out and sell their skills to others," Albright said. In addition to giving up its nuclear weapons, the US also wants North Korea to end its ballistic missile program and get rid of all of its biological and chemical weapons.

Source: https://www.cbsnews.com, 11 June 2018.

OPINION – Hyung-jin Kim

Closing North Korea's Vast Nuclear Program a Challenge

The list of what it would take for the "complete denuclearization" of North Korea is long. North Korea has said it's willing to deal away its entire nuclear arsenal if the United States provides it with a reliable security assurance and other benefits.

But there is lingering skepticism ahead of summit between President Donald Trump and North Korean leader Kim Jong Un that Kim would fully give up the nuclear weapons he has pushed so hard to build. It wouldn't be hard to hide at least some of the warheads and radioactive materials in the country's vast complex of underground facilities. A look at the many pieces of a secrecy-clouded bomb program that has rattled the region for decades:

The Warheads: The size of North Korea's nuclear arsenal is a mystery, with estimates ranging from

10 bombs to as many as 60 to 70. How sophisticated they are is also unclear. It's one thing to conduct a nuclear test.... It's another thing to make the warheads small enough to be carried by a long-range missile that can strike the US mainland.

Kim said last November that his country had mastered that technology, and many foreign experts and governments believe North Korea is at least getting there. "They are close enough now in their capabilities that from a US policy perspective we ought to behave as if we are on the cusp of them achieving" the ability to strike the United States, then-CIA Director Mike Pompeo said in October.

The size of North Korea's nuclear arsenal is a mystery, with estimates ranging from 10 bombs to as many as 60 to 70. How sophisticated they are is also unclear. It's one thing to conduct a nuclear test.... It's another thing to make the warheads small enough to be carried by a long-range missile that can strike the US mainland.

Closer to home, many analysts believe North Korea is able to mount nuclear weapons on shorter-range missiles that could reach South Korea and Japan, where 80,000 American troops are stationed.

The Ingredients: Nuclear bombs can be made from plutonium or highly enriched uranium, and North Korea has both. A 2016 South Korean government report says that North Korea is believed to have produced 110 pounds of weaponized plutonium, enough for six to 10 bombs.

Last year, North Korea test-launched three ICBMs that it says are all nuclear-capable. Experts say, though, that North Korea has yet to demonstrate the technology needed to protect its bombs from the severe heat and pressure that a long-range missile is subjected to on returning to the Earth's atmosphere.

North Korea shut down the plutonium-producing factory at its main nuclear complex in Nyongbyon in 2007 as part a disarmament-for-aid deal, but the accord later fell apart, and satellite imagery indicates the North has resumed extracting plutonium in recent years.

Plutonium plants are generally large and generate much heat, making it easier for outsiders to detect. A uranium-enrichment plant is more compact and can be easily hidden from satellite cameras. The centrifuges to enrich uranium can be clandestinely operated underground.

Stanford University scholars, including nuclear physicist Siegfried Hecker who visited North Korea's centrifuge facility at Nyongbyon in 2010, recently wrote that North Korea is estimated to have a highly enriched uranium inventory of 550 to 1,100 pounds, sufficient for 25 to 30 nuclear devices.

South Korean and US experts speculate North Korea may be running several additional uranium-enrichment plants. It doesn't take much plutonium or highly enriched uranium to make a bomb, and North Korea could hide some of either or both in the more than 10,000 underground tunnels and structures it is reported to have.

About 13 to 18 pounds of plutonium is needed to make a bomb, which would be about the size of a softball, according to experts. For highly-enriched uranium, it's about 44 pounds for a bomb about as big as a 1-quart water bottle, says nuclear expert Whang Joo-ho of South Korea's Kyung Hee University.

The Missiles: The United States would want North Korea to include any intercontinental ballistic missiles in its disarmament steps as they are the delivery vehicles for nuclear weapons targeting the US mainland.

Last year, North Korea test-launched three ICBMs that it says are all nuclear-capable. Experts say, though, that North Korea has yet to demonstrate the technology needed to protect its bombs from the severe heat and pressure that a long-range missile is subjected to on returning to the Earth's atmosphere. Lee Choon Geun, a missile expert from South Korea's Science and Technology Policy Institute, says he believes that North Korea has

"several but less than 10 ICBMs."

Source: https://www.timesunion.com, 09 June 2018.

OPINION – Emily B. Landau

US-North Korea Summit: Crisis Management, Not Nuclear Resolution

Once the US-North Korean mutual deterrent rhetoric heated up to the levels we witnessed in late 2017 – culminating with the New Year's "greetings" – it was pretty clear that the degree of threatening exchanges could not be sustained for long. Either the two states might stumble into military action, or, more likely, they would move to calm the situation down. It is perhaps not surprising that it was Kim Jong-Un who took the first step in the direction of tension reduction.

Kim most likely understood that although he had demonstrated the capability to strike the US mainland with his long-range missiles, there was no symmetry between his country and the US, and North Korea would likely be obliterated if he ever thought to actually strike the United States. But what became a little more scary for Kim is that US officials back in the summer of 2017 started talking about the possible need for a preemptive military strike against North Korea. And it wasn't only Trump doing the talking – the statements came from others, like HR McMaster, the so-called "adult in the room."

Moreover, the harsh sanctions that had been slapped on North Korea for its increasingly defiant behavior started to bite, and Kim needed to ease the pressure on that front as well. Luckily for Kim, he had a willing partner in his desire to calm things down – the new president of South Korea who was eager to latch onto any sign that the two Koreas might move toward more peaceful relations. Kim Jong-Un's outreach was first to Moon Jae-in, who then helped facilitate the new chapter in US-North Korean relations.

While Kim's aims for seeking a meeting with Trump seem pretty clear, what could coax the US president to play along? Clearly, the only thing the North Korean leader had to offer Trump was a promise of nuclear dismantlement, and he thus made the necessary gestures in that direction.

But can Kim Jong-Un seriously be expected to give up the nuclear capability that his father and he worked so hard to achieve? Is there a realistic chance that North Korea will denuclearize – completely, verifiably, and irreversibly – or any way else? Not much. North Korea wants lowered tensions and economic assistance. Those are its goals. And if the past is any guide, the North Koreans have no problem promising denuclearization if it helps achieve those goals. But to actually deliver? Hard to imagine.

Is there a realistic chance that North Korea will denuclearize – completely, verifiably, and irreversibly – or any way else? Not much. North Korea wants lowered tensions and economic assistance. Those are its goals. And if the past is any guide, the North Koreans have no problem promising denuclearization if it helps achieve those goals.

Nuclear weapons for North Korea not only ensure regime survival – which is of course an important goal – but they are also extremely important as a prestige enhancer for the regime. With nuclear weapons North Korea must be reckoned with, it cannot be ignored. Throughout this millennium the North Koreans have been seeking bilateral negotiations with the US. But they want to talk at eye level: "nuclear state to nuclear state."

North Korea has insisted that it will not be dictated to in the nuclear realm; if the Americans want to talk about their nuclear capabilities, they must recognize that North Korea is equal to the US, and should be respected as such. Bush refused to acquiesce to this framing and created the Six Party format for negotiations, hoping to increase the regional negotiators' collective leverage on North Korea; and Obama ended up stuck in "strategic patience" for eight years, not doing anything to advance negotiations.

Now President Trump came to a high-level bilateral summit with Kim Jong-Un, which is a huge

win for North Korea. But the only reason the North Korean leader was granted this special audience with the president is the fact that his country has nuclear weapons. Giving them up means not only exposing North Korea to possible moves toward unification on the Korean peninsula that would spell the end of North Korea, but a significant loss of international status, even if based on negative attention. So Kim's promises need to be taken with not a small measure of skepticism.

The Singapore summit could nevertheless prove valuable, as an opening to an altered bilateral relationship. Tension-reduction is a mutually beneficial goal, and Trump was correct to agree to meet Kim and work to calm the situation down. If expectations remain singularly focused on denuclearization, the president is probably in for a rude awakening. But Trump might understand this, as reflected in his recent statements that the summit is only the beginning of "a process."

The only reason the North Korean leader was granted this special audience with the president is the fact that his country has nuclear weapons. Giving them up means not only exposing North Korea to possible moves toward unification on the Korean peninsula that would spell the end of North Korea, but a significant loss of international status.

At the end of the day, decades of failed diplomacy with North Korea led to the sad result that it is a nuclear state, and at this late stage that situation is unlikely to be reversed. But a change of context – re US-North Korean relations – could also change the threat value of Kim's nuclear arsenal.

The US wants to see "complete, verifiable and irreversible denuclearization" of the Korean Peninsula. Known in the arms-control world as "CVID," this would involve dismantling North Korea's nuclear program and stripping Kim of the ability to make nuclear bombs in the future.

Meanwhile, in the process that ensues, the US would be well advised to use this opportunity to put a stop to an equally worrisome aspect of North Korea's nuclear activities: the fact that it will sell nuclear knowhow, technologies, and components to whoever will pay in hard cash. North Korea can and must be pressed to end these activities, first and foremost the dangerous cooperation with Iran in the missile and nuclear realms.

Source: Emily B. Landau is a senior research fellow at INSS and head of the Arms Control and Regional Security Program. https://www.jpost.com, 12 June 2018.

OPINION – David Tweed, Kanga Kong

How Kim Jong Un and Trump Differ on Denuclearization

Donald Trump and Kim Jong Un's meeting in Singapore June 12, 2018 seemed an unthinkable prospect just a year ago when the leaders of the US and North Korea were exchanging insults and threats. The main topic will be denuclearization, but they appear to have different ideas of what that means and how long it might take. Overcoming those differences will be key to reaching a historic outcome.

1. What is the US Stance on Denuclearization? The US wants to see "complete, verifiable and irreversible denuclearization" of the Korean Peninsula. Known in the arms-control world as "CVID," this would involve dismantling North Korea's nuclear program and stripping Kim of the ability to make nuclear bombs in the future.

2. What does Denuclearization Mean for North Korea? North Korea in April 2018 committed to work toward "complete denuclearization," without elaborating on what that meant. In 2016, a government spokesman called for "the denuclearization of the whole Korean peninsula and this includes the dismantlement of nukes in South Korea and its vicinity." More recently, North Korea has framed its willingness to get rid of nuclear weapons in more of a global

context, implying that it will do so in concert with established nuclear powers like the US, China and Russia.

3. Does the US have Nuclear Weapons on the Peninsula? The US hasn't stationed them in South Korea since 1992, but it does provide a so-called nuclear umbrella that guarantees the safety of allies South Korea and Japan. Kim may ask the US to remove the nuclear bombers it has stationed in Guam and cease patrols by its nuclear-armed submarines. The US would be unlikely to agree to any measures that would leave its allies vulnerable.

4. What about the Time Frame for Removing Nuclear Weapons? Speed is crucial for the US to avoid a lengthy process that provides sanctions relief for North Korea as well as time to advance its nuclear program even further. Even so, North Korea has made it clear it will not accept the so-called Libya model proposed by US National Security Adviser John Bolton under which the regime ships its nuclear arsenal out of the country in return for security guarantees and sanctions relief. Libyan dictator Qaddafi, who gave up his weapons of mass destruction in exchange for an easing of sanctions in 2003, was subsequently killed at the hands of US-backed rebels.

Kim's regime is looking for a reduction in US troops, the curtailment of the US-South Korean military drills, a peace treaty to formally end the Korean War, US diplomatic recognition and the easing of sanctions that are starting to hit its economy.

5. Has any Progress been Made in this Area? A spat over the sequencing for denuclearization underpinned Trump's decision last month to cancel the summit. North Korea then softened its tone by pushing for a "phased" approach to giving up its nuclear program. Trump has indicated flexibility, saying on June 01, 2018 that denuclearization is "going to be a process." US Secretary of Defense James Mattis said afterward that North Korea would receive relief "when it demonstrates verifiable and irreversible steps to denuclearization."

6. What Might those Steps Look Like? They could include extending a moratorium on missile and nuclear testing, limiting and eventually eliminating North Korea's stockpiles of fissile material, and closing its main nuclear facility, the Yongbyon nuclear plant. North Korea may also cap production and eventually eliminate its two classes of intercontinental ballistic missiles — the Hwasong-14 and the larger and more developed Hwasong-15 — as well as shorter-range missiles that would be used in an attack on Japan or South Korea. In addition, it could agree to allow independent inspectors into the country to verify all of its commitments.

7. What will North Korea Seek in the Negotiations? Kim's regime is looking for a reduction in US troops, the curtailment of the US-South Korean military drills, a peace treaty to formally end the Korean War, US diplomatic recognition and the easing of sanctions that are starting to hit its economy. Most importantly, Kim's regime wants its security guaranteed. After meeting Kim for the second time last month, South Korean President Moon Jae-in said the North Korean leader was uncertain if he could "trust the US saying that it'll end hostile relations and guarantee the security of his regime after his denuclearization."

8. Why does North Korea Worry about its Security? The 1950s conflict between North Korea — backed by China and the Soviet Union — and US-led forces supporting South Korea ended without a peace treaty. As such, the US and North Korea are technically still at war. Kim, like his father and grandfather, views the US — which stations some 28,500 troops in South Korea and conducts drills with its military — as an existential threat. Recent American military campaigns in Afghanistan, Iraq and Libya have only reinforced his view that nuclear weapons are necessary to deter a US invasion.

9. Why does the US Worry about North Korea? The US has long been concerned that North Korea was developing a nuclear program that would threaten its allies in the region and eventually America itself. That worry turned into reality after

Kim accelerated North Korea's missile testing program and detonated a nuclear device 17 times more powerful than the bomb the US dropped on Hiroshima. Late last year, Kim announced North Korea had completed its nuclear deterrent – in other words, it had an intercontinental ballistic missile that was capable of delivering a nuclear warhead to the continental US

Source: https:// www.bloomberg.com, 04 June 2018.

OPINION – Steve Kidd

The Renaissance – What Happened?

Following a period of rapid growth in the 1970s and early 1980s, nuclear power experienced a marked slowdown from the late 1980s onwards. New reactors coming online began to be balanced by closures, so nuclear generation began to level-off. The reasons for the slowdown are many and it was not just due to the lingering impact of the accidents at Three Mile Island (1979) and Chernobyl (1986). There were a mix of economic, political and technical factors that lay behind nuclear power going out of fashion.

I joined the industry in 1995 and there was certainly an air of gloom at key meetings. One reason was the rising tide of electricity liberalisation that threatened to expose many operating reactors to the harsh winds of competition from other power generation options. Things took a turn for the better in the early years of the new century. The earliest I can recall hearing the term "nuclear renaissance" was in about 2001, referring to a possible industry revival in the established nuclear countries over the next decades. The reasons for this included unwelcome volatility in fossil fuel prices, new Generation III reactor designs (designed with better safety and economy in mind) and the new concerns about greenhouse gas emissions. One practical factor was that in many countries where operating performance of reactors had been relatively poor, power sector liberalisation seemed to have pushed reactor capacity factors sharply upwards. The USA was a good example of this: fleet capacity factors initially at 60-70% improved until most of the fleet was achieving over 90%.

There were signs of the renaissance in the USA. Between 2007 and 2009, 13 companies applied to the US Nuclear Regulatory Commission for construction and operating licences to build 31 new nuclear power reactors. The Energy Policy Act of 2005 offered the nuclear power industry financial incentives and economic subsidies such as loan guarantees, cost-overrun support totalling up to $2 billion across the industry and the extension of the Price-Anderson Nuclear Industries Indemnity Act through to 2025. On the regulatory side, early site permitting and combined construction and operating licences made things easier for new projects.

It is clear 15 years on, however, that the revival has not happened. Although the number of reactors under construction around the world is higher than it was then, this is largely down to China and India, plus a revival in Russia after the former Soviet Union fell apart. The USA provided the only solid example of a rise in reactor orders, but of the 31 only four began construction and only the two units at Vogtle in Georgia are still actively at work. Even they are much delayed.

The decision in 2017 by two utilities to scrap the expansion at the Summer station in South Carolina can be viewed as the end of the renaissance dream. But as recently as five years ago, then-energy secretary Steven Chu visited Vogtle and declared the project the start of "the resurgence of America's nuclear industry" and a critical part of President Obama's energy strategy. The obvious question is "what went wrong"?

There was a degree of industry hype about the renaissance. It was talked up by an insular industry with its back against the wall. It also never spread very far beyond the USA, with European countries markedly less confident from the start. Some of the claims made for the Generation III reactors, particularly the costs, look laughable in retrospect. But the industry can at least claim there have been three significant events about which it could do very little and which have adversely affected its prospects.

1. ***Low Gas Prices:*** The first of these is much cheaper natural gas prices, initially in North America but increasingly in other countries as the gas market becomes, like the oil market, much more globalised. The economic exploitation of shale gas deposits has transformed the economics of gas-powered generating stations and threatened the survival of US nuclear plants.

The first of these is much cheaper natural gas prices, initially in North America but increasingly in other countries as the gas market becomes, like the oil market, much more globalised. The economic exploitation of shale gas deposits has transformed the economics of gas-powered generating stations and threatened the survival of US nuclear plants.

It was always thought that once the heavy capital investment and interest due had been paid, nuclear plants would always have operating costs (including fuel) at the low end of the spectrum. Even substantial capital investment to replace key components such as steam generators and turbines could be covered. Now the position is different. US plants in competitive power markets (many, particularly in the south, are still in regulated markets) are finding it difficult to compete with gas plants. Some have already closed and perhaps another 25-30 are threatened by 2030. Cheaper gas has not yet become a big factor in Europe or Asia, but it is only a matter of time before some impact will be felt. It certainly makes new plants hard to justify economically.

2. Renewable Energy: The second factor is the rise of renewable energy. With the benefit of widespread public subsidies to promote clean energy, the cost of wind and solar power has tumbled. They have both begun to push down wholesale power prices when they are operating and displace other modes of generation, including nuclear. Competition from renewables has been a factor more in Europe than the USA, and it has largely been wind power to the fore. But renewables have now begun to play a more substantial role in many US power markets, particularly in the sunny south west.

The second factor is the rise of renewable energy. With the benefit of widespread public subsidies to promote clean energy, the cost of wind and solar power has tumbled. They have both begun to push down wholesale power prices when they are operating and displace other modes of generation, including nuclear.

As shares of intermittent renewables rise, it gets increasingly difficult to integrate them in traditional power markets. Gas-fired generation has advantages over nuclear in matching the peaks and troughs of wind and solar supply. Load following with nuclear is technically possible but economically less than optimum for high-capital-cost investments that should to operate continuously to pay back investment. It may be claimed that the nuclear sector has supported renewable power by proposing "balanced energy strategies" in the context of battling carbon emissions – but with strong public support measures, it was going to boom anyway.

3. Fukushima Effect: The final issue is of course the accident at the Fukushima plant in Japan in 2011. This clearly had a detrimental impact on public and political confidence in the industry, while encouraging additional regulatory activity which has increased the costs of building and operating plants. Confirmation of a German nuclear phaseout immediately after the accident was an extreme reaction but the accident seemed to confirm in many people's minds all the scare stories they had learned about nuclear. Hence it has been profoundly unhelpful to the nuclear cause in prospective nuclear countries and those with mature reactors battling to carry on operating for another 10 or 20 years.

Whether the accident and its aftermath can be seen as wholly out of the industry's control is debatable. The earthquake and tsunami were clearly exceptional events but the plant had not been well maintained by Tepco, its owner-operator. There were some seemingly quite obvious safety flaws in the design, notably the siting of the backup diesel generators in an earthquake/tsunami

prone zone. Similarly, the reaction to the accident by Tepco and the Japanese authorities has been inept, especially the unnecessary evacuation of thousands of people.

Nuclear's Position Today: All these events could have been managed a lot better if the industry had put its own house in order. There were mistakes in new plant construction (combined with wider questions over economics) and a flawed communications strategy based on the climate change argument.

The industry now has to answer basic questions such as how it will fix construction cost problems of current reactors; how it will deliver a new generation of cheap, failsafe designs, and how nuclear fits in a grid dominated by cheap, variable renewables.

The industry now has to answer basic questions such as how it will fix construction cost problems of current reactors; how it will deliver a new generation of cheap, failsafe designs, and how nuclear fits in a grid dominated by cheap, variable renewables.

Construction experience with the Generation III designs in the western world has been frankly disastrous. The industry has seemingly forgotten how to manage large projects during the long fallow years. Olkiluoto, Flamanville and Vogtle are all long delayed and way over budget. The industry's economic problems have been much discussed in these columns and the answer would seem to lie in building fleets of standardised large reactors, as the French did in the 1970s and 1980s and the Chinese are working towards today. This is the opposite of what the UK is doing with its current new-build programme.

The environmental case for nuclear is better rooted in its potential to clean up the air in Chinese and Indian cities and its good stewardship of the Earth's resources, and in saving valuable hydrocarbons, which have important alternative uses.

It will be difficult for the industry to move to the next generation of reactors, such as small modular reactors without investing in a programme of today's designs first. The question on renewables will perhaps sort itself out once policy makers realise that it should be the intermittent renewable power generators who fit in with the grid, rather than vice versa. They should be forced to guarantee power despatch by providing backup power, whether from large batteries or insurance policies with peaking power plants. Then the full costs of renewables will become transparent.

The flaws in the industry's public communications have also been much discussed in these columns, notably the climate change message. The nuclear renaissance in the early years of this century was hijacked by individuals more concerned about going down in human history as saviours of the world, without any deep knowledge or concern about nuclear. Many nuclear bodies, and various national associations, suffered in this way. Even today, we have many former environmentalists who have embraced nuclear as some kind of "last resort". Fervent belief is all they bring, as these people have little understanding of the commercial realities of nuclear power.

The whole climate change process has become an international bureaucratic nonsense and it seems unlikely that nuclear will gain much from any measures in response. The environmental case for nuclear is better rooted in its potential to clean up the air in Chinese and Indian cities and its good stewardship of the Earth's resources, and in saving valuable hydrocarbons, which have important alternative uses.

Nuclear's biggest selling point remains that it can produce huge quantities of power reliably and cheaply, if it is done properly. It should avoid getting caught in anything involving more costs, government intervention, taxes and similar, which is where the climate change argument inevitably ends up.

Source: https://www. neimagazine. com, 06 June 2018.

OPINION – Michael Koziol

TerraPower's Nuclear Reactor Could Power the 21st Century

Sodium-cooled nuclear reactors have a history of lackluster performance, but TerraPower believes it can build one that will work. Testing the flow of molten sodium through the reactor assembly is crucial. Water shares many of the same flow characteristics as the toxic metal and is a viable substitute for tests.

Sodium-cooled nuclear reactors have a history of lackluster performance, but TerraPower believes it can build one that will work. Testing the flow of molten sodium through the reactor assembly is crucial. Water shares many of the same flow characteristics as the toxic metal and is a viable substitute for tests.

The engineers at TerraPower, a startup that has designed an advanced nuclear power reactor, use a pressurized-air cannon to demonstrate that very point to visitors. The stunt vividly illustrates a key concept in nuclear fission: Small objects traveling at high speed can have a big impact when they hit something seemingly immovable. And perhaps there is a larger point being made here, too—one about a small and fast-moving startup having a big impact on the electric-power industry, which for many years also seemed immovable.

In a world defined by climate change, many experts hope that the electricity grid of the future will be powered entirely by solar, wind, and hydropower. Yet few expect that clean energy grid to manifest soon enough to bring about significant cuts in greenhouse gases within the next few decades. Solar- and wind-generated electricity are growing faster than any other category; nevertheless, together they accounted for less than 2 percent of the world's primary energy consumption in 2015, according to the Renewable Energy Policy Network for the 21st Century. To build a bridge to that clean green grid of the future, many experts say we must depend on fission power. Among carbon-free power sources, only nuclear fission reactors have a track record of providing high levels of power, consistently and reliably, independent of weather and regardless of location.

Yet commercial nuclear reactors have barely changed since the first plants were commissioned halfway through the 20th century. Now, a significant fraction of the world's 447 operable power reactors are showing their age and shortcomings, and after the Fukushima Daiichi disaster in Japan seven years ago, nuclear energy is in a precarious position. Between 2005 and 2015, the world share of nuclear in energy consumption fell from 5.73 to 4.44 percent. The abandonment of two giant reactor projects in South Carolina in the United States and the spiraling costs of completing the Hinkley Point C reactor in the United Kingdom, now projected to cost an eye-watering £20.3 billion (US $27.4 billion), have added to the malaise.

Elsewhere, there is some nuclear enthusiasm: China's 38 reactors have a total of 33 gigawatts of nuclear capacity, and the country has plans to add an additional 58 GW by 2024. At the moment, some 50 power reactors are under construction worldwide. These reactors, plus an additional 110 that are planned, would contribute some 160 GW to the world's grids, and avoid the emission of some 500 million metric tons of carbon dioxide every year. To get that kind of cut in greenhouse gases in the transportation sector, you'd have to junk more than 100 million cars, or roughly all the passenger cars in France, Germany, and the United Kingdom.

At the moment, some 50 power reactors are under construction worldwide. These reactors, plus an additional 110 that are planned, would contribute some 160 GW to the world's grids, and avoid the emission of some 500 million metric tons of carbon dioxide every year.

Against this backdrop, several US startups are pushing new reactor designs they say will address

nuclear's major shortcomings. In Cambridge, Mass., a startup called Transatomic Power is developing a reactor that runs on a liquid uranium fluoride–lithium fluoride mixture. In Denver, Gen4 Energy is designing a smaller, modular reactor that could be deployed quickly in remote sites. In this cluster of nuclear startups, TerraPower, based in Bellevue, Wash., stands out because it has deep pockets and a connection to nuclear-hungry China. Development of the reactor is being funded in part by Bill Gates, who serves as the company's chairman. And to prove that its design is viable, TerraPower is poised to break ground on a test reactor next year in cooperation with the China National Nuclear Corp.

In Cambridge, Mass., a startup called Transatomic Power is developing a reactor that runs on a liquid uranium fluoride–lithium fluoride mixture. In Denver, Gen4 Energy is designing a smaller, modular reactor that could be deployed quickly in remote sites.

To reduce its coal dependence, China is racing to add over 250 GW of capacity by 2020 from renewables and nuclear. TerraPower's president, Chris Levesque, sees an opening there for a nuclear reactor that is safer and more fuel efficient. He says the reactor's fuel can't easily be used for weapons, and the company claims that its reactor will generate very little waste. What's more, TerraPower says that even if the reactor were left unattended, it wouldn't suffer a calamitous mishap. For Levesque, it's the perfect reactor to address the world's woes. "We can't seriously mitigate carbon and bring 1 billion people out of energy poverty without nuclear," he says.

The reactor's fuel can't easily be used for weapons, and the company claims that its reactor will generate very little waste. What's more, TerraPower says that even if the reactor were left unattended, it wouldn't suffer a calamitous mishap. For Levesque, it's the perfect reactor to address the world's woes.

The TerraPower reactor is a new variation on a design that was conceived some 60 years ago by a now-forgotten Russian physicist, Feinberg. Following World War II, as the United States and the Soviet Union stockpiled nuclear weapons, some thinkers were wondering if atomic energy could be something other than a weapon of war.

In 1958, during the Second International Conference on Peaceful Uses of Atomic Energy, held in Geneva, Feinberg suggested that it would be possible to construct a reactor that produced its own fuel.

Feinberg imagined what we now call a breed-and-burn reactor. Early proposals featured a slowly advancing wave of nuclear fission through a fuel source, like a cigar that takes decades to burn, creating and consuming its fuel as the reaction travels through the core. But Feinberg's design couldn't compete during the bustling heyday of atomic energy. Uranium was plentiful, other reactors were cheaper and easier to build, and the difficult task of radioactive-waste disposal was still decades away.

The breed-and-burn concept languished until Edward Teller, the driving force behind the hydrogen bomb, and astrophysicist Wood revived it in the 1990s. In 2006, Wood became an adviser to Intellectual Ventures, the intellectual property and investment firm that is TerraPower's parent company. At the time, Intellectual Ventures was exploring everything—fission, fusion, renewables—as potential solutions to cutting carbon. So Wood suggested the traveling-wave reactor (TWR), a subtype of the breed-and-burn reactor design. ...

That's not to say the reactor that Wood and Teller designed was perfect. "The one they came up with in the '90s was very elegant, but not practical," says Gilleland. But it gave TerraPower engineers somewhere to start, and the hope that if they could get the reactor design to work, it might address all of fission's current shortcomings.

... The TerraPower team, led by Wood and Gilleland, first tackled these challenges using

computer models. In 2009, they began building the Advanced Reactor Modeling Interface (ARMI), a digital toolbox for simulating deeply customizable reactors. With ARMI, the team could specify the size, shape, and material of every reactor component, and then run extensive tests. In the end, they came away with what they believe is a practical model of a breed-and-burn TWR first proposed by Feinberg six decades ago. As Levesque recalls, he joined TerraPower when the team approached him with remarkable news: "Hey, we think we can do the TWR now."

The reactor breeds the highly fissile plutonium fuel it needs right before it burns it, just as Feinberg imagined so many decades ago. Yet the "traveling wave" label refers to something slightly different from the slowly burning, cigar-style reactor. In the TWR, an overhead crane system will maintain a reaction within a ringed portion of the core.

To understand why the TWR stymied physicists for decades, first consider that today's reactors rely on enriched uranium, which has a much higher ratio of the fissile isotope of uranium (U-235) to its more stable counterpart (U-‘ 238) than does a natural sample of uranium. When a passing neutron strikes a U-235 atom, it's enough to split the atom into barium and krypton isotopes with three neutrons left over (like that high-speed ping-pong ball punching through a sturdy paddle). Criticality occurs when enough neutrons hit enough other fissile uranium atoms to create a self-sustaining nuclear reaction. In today's reactors, the only way to achieve criticality is to have a healthy abundance of U-235 atoms in the fuel.

Among other things, the team has been testing how molten sodium will flow through the reactor's pipes, how it will corrode those pipes, even the inevitable expansion of all of the core's components as they are subjected to decades of heat—all problems that have plagued sodium-cooled reactors in the past.

In contrast, the TWR will be able to use depleted uranium, which has far less U-235 and cannot reach criticality unassisted. TerraPower's solution is to arrange 169 solid uranium fuel pins into a hexagon. When the reaction begins, the U-238 atoms absorb spare neutrons to become U-239, which decays in a matter of minutes to neptunium-239, and then decays again to plutonium-‘ 239. When struck by a neutron, Pu-239 releases two or three more neutrons, enough to sustain a chain reaction. It also releases plenty of energy; after all, Pu-239 is the primary isotope used in modern nuclear weapons. But Levesque says the creation of Pu-239 doesn't make the reactor a nuclear-proliferation danger—just the opposite. Pu-239 won't accumulate in the TWR; instead, stray neutrons will split the Pu-239 into a cascade of fission products almost immediately.

In other words, the reactor breeds the highly fissile plutonium fuel it needs right before it burns it, just as Feinberg imagined so many decades ago. Yet the "traveling wave" label refers to something slightly different from the slowly burning, cigar-style reactor. In the TWR, an overhead crane system will maintain a reaction within a ringed portion of the core by moving pins into and out of that zone from elsewhere in the core, like a very large, precise arcade claw machine.

To generate electricity, the TWR uses a more complicated system than today's reactors, which use the core's immense heat to boil water and drive a steam turbine to generate usable electricity. In the TWR, the heat will be absorbed by a looping stream of liquid sodium, which leaves the reactor core and then boils water to drive the steam turbine. But therein lies a major problem, says Makhijani. Molten sodium can move more heat out of the core than water, and it's actually less corrosive to metal pipes than hot water is. But it's a highly toxic metal, and it's violently flammable when it encounters oxygen. "The problem around the sodium cooling, it's proved the Achilles' heel," he says.

... Today, TerraPower's lab is filled with bits of fuel pins and reactor components. Among other things, the team has been testing how molten sodium

will flow through the reactor's pipes, how it will corrode those pipes, even the inevitable expansion of all of the core's components as they are subjected to decades of heat—all problems that have plagued sodium-cooled reactors in the past. TerraPower's engineers will use what they learn from the results when building their test reactor—and they'll find out if their design really works.

The safety of the TerraPower reactor stems in part from inherent design factors. Of course, all power reactors are designed with safety systems. Each one has a coping time, which indicates how long a stricken reactor can go on without human intervention before catastrophe occurs. Ideas for so-called inherently safe reactors have been touted since the 1980s, but the goal for TerraPower is a reactor that relies on fundamental physics to provide unlimited coping time.

Because the TWR burns its fuel more efficiently, the TerraPower team also claims it will produce less waste. The company says a 1,200-MW reactor will generate only 5 metric megatons of waste per gigawatt-year, whereas a typical reactor today produces 21 metric megatons per gigawatt-year.

The TWR's design features some of the same safety systems standard to nuclear reactors. In the case of an accident in any reactor, control rods crafted from neutron-absorbing materials like cadmium plummet into the core and halt a runaway chain reaction that could otherwise lead to a core meltdown. Such a shutdown is called a scram. Scramming a reactor cuts its fission rate to almost zero in a very short time, though residual heat can still cause a disaster. At Chernobyl, some of the fuel rods fractured during the scram, allowing the reactor to continue to a meltdown. At Fukushima Daiichi, a broken coolant system failed to transfer heat away from the core quickly enough. That's why the TerraPower team wanted to find a reactor that could naturally wind down, even if its safety systems failed.

TerraPower's reactor stays cool because its pure uranium fuel pins move heat out of the core much more effectively than the fuel rods in today's typical reactors. If even that isn't enough to prevent a meltdown, the company has an ace up its sleeve. As Gilleland explains, the fuel pins will expand when they get too hot—just enough so that neutrons can slip past the fuel pins without hitting more Pu-239, thereby slowing the reaction and cooling the core automatically.

Because the TWR burns its fuel more efficiently, the TerraPower team also claims it will produce less waste. The company says a 1,200-MW reactor will generate only 5 metric megatons of waste per gigawatt-year, whereas a typical reactor today produces 21 metric megatons per gigawatt-year. If that number is right, the reactor could address the ongoing storage problem by drastically reducing the amount of generated waste, which remains highly radioactive for thousands of years. More than 60 years into the nuclear age, only Finland and Sweden have made serious progress in building deep, permanent repositories, and even those won't be ready until the 2020s.

TerraPower plans to break ground on its test reactor next year in China. If all goes well, this reactor will be operational by the mid-2020s. But even if TerraPower's reactor succeeds wildly, it will take 20 years or more for the company to deploy large numbers of TWRs. Thus for the next couple of decades, the world's utilities will have no choice but to rely on fossil fuels and conventional nuclear reactors for reliable, round-the-clock electricity. …

Source: *https://www. spectrum.ieee.org, 01 June 2018.*

NUCLEAR STRATEGY

USA

The US still Keeps Hundreds of Nuclear Weapons on Hair-Trigger Alert

At a highly anticipated summit in Singapore, US President Donald Trump and North Korean leader Kim Jong Un discussed the future of the two nations' nuclear arsenal programs. They ultimately agreed to work toward the complete denuclearization of the Korean Peninsula.

Leading up to the summit, Trump argued that North Korea's highly-secretive nuclear program threatens American security. After the meeting, a joint statement said the two countries would "join their efforts to build a lasting and stable peace regime." While the meeting seemed optimistic, global security experts say there is another domestic nuclear policy that the Trump administration reportedly did not address - and one just as dangerous as North Korea initiating nuclear war with the US.

Since the end of the Cold War, the US has had 450 land-based missiles and hundreds more missiles undetectable submarines that are all on "hair-trigger alert" – a policy that allows for the launch of nuclear weapons in 10 minutes. Only the president's permission is required to launch these weapons, according to the Department of Defense.

Since the end of the Cold War, the US has had 450 land-based missiles and hundreds more missiles undetectable submarines that are all on "hair-trigger alert" – a policy that allows for the launch of nuclear weapons in 10 minutes. Only the president's permission is required to launch these weapons, according to the Department of Defense.

But a growing number of experts believe the US should consider retiring this policy. The Union of Concerned Scientists (UCS), an advocacy group comprised of hundreds of scientists, engineers, and economists, published a report in 2016 on the dangers of hair-trigger alert. …

The president then has about 10 minutes to decide whether to launch nuclear weapons. When the US adopted the hair-trigger alert policy during the Cold War, the idea was that if the Soviet Union attacked American military bases with nuclear power, the US could quickly retaliate. The policy is still in effect today.

Besides the US, Russia is the only other country known to have a hair-trigger launch status. It's unclear whether Israel, China, and North Korea have their own hair-trigger alert policies, which means that Kim could theoretically have the same nuclear power as Trump. The US land-based arsenal is siloed in five states, including Nebraska and Colorado, hundreds of miles away from residential communities. It's believed that in total, the US keeps roughly 900 weapons on hair-trigger alert. The locations and exact number of submarines, located in the deep ocean, are confidential.

The US military also keeps around 40 special missiles, called interceptors, on hair-trigger alert as well. It would take three or four of these to ram into and destroy foreign missiles in outer space - in a protocol dubbed "hit to kill." When nuclear missiles are launched into space, they follow a more predictable path, making it easier for interceptors to strike them. (It's still unclear how well these missiles would work in an emergency situation.)

Across the US, the military has installed infrared and satellite sensors that can detect the hot gas a missile expels as it flies through the air. If Russia launched one of these long-range weapons, it would take about 25 minutes to reach the continental US, Gronlund said, and it would take the sensors just a few minutes to identify them.

As the sensors track each missile's movement, an automated system estimates whether or not it's a legitimate attack on the US. The president then has about 10 minutes to decide whether to launch nuclear weapons. When the US adopted the hair-trigger alert policy during the Cold War, the idea was that if the Soviet Union attacked American military bases with nuclear power, the US could quickly retaliate. The policy is still in effect today. These days, it's used as an intimidation strategy for other countries, like Russia and North Korea, that have revealed some of their nuclear capabilities, Gronlund said.

Some proponents of hair-trigger alert also say that the US needs those land-based missiles to act as "sponges" for foreign nuclear weaponry. For example, if Russia launched a full attack, it would

need to use hundreds of weapons to destroy the US land arsenal, Gronlund said. That means it would have fewer weapons left to strike where people actually live. Others say that abandoning hair trigger alert would cut jobs at the military bases that monitor the missiles (which could have consequences on local economies). But USC scientists argue that the risks of false alarms still far outweigh the advantages. …

Source: Leanna Garfieldjun, https://www.businessinsider.in, 13 June 2018.

BALLISTIC MISSILE DEFENCE

INDIA

India Successfully Test-Fires Nuclear-Capable Agni-5

Long-range ballistic missile Agni-5 was successfully test fired off Odisha coast on Sunday June 03, 2018 proving its reliability. This is the sixth successful test of the missile and the second in its pre-induction configuration. "Agni-5 missile was successfully flight tested today June 03, 2018 at 0945 hrs from Dr APJ Abdul Kalam Island [Wheeler Island]. All the radars, electro-optical tracking stations and telemetry stations tracked the vehicle all through the course of the trajectory. All the mission objectives have been achieved," the DRDO said in a statement. Agni-5 can carry nuclear warhead weighing 1.5 tonnes to a distance of over 5,000 km and is the longest missile in India's arsenal capable of reaching most parts of China. With a smaller payload, the range can go up much higher. The missile features many new indigenously-developed technologies, including the very high accuracy Ring Laser Gyro based Inertial Navigation System (RINS), and the most modern and accurate Micro Navigation System (MINS) which improves the accuracy of the missile.

The missile features many new indigenously-developed technologies, including the very high accuracy Ring Laser Gyro based Inertial Navigation System (RINS), and the most modern and accurate Micro Navigation System (MINS) which improves the accuracy of the missile.

The first test was conducted on April 19, 2012 and after two tests, the missile was tested in canisterised configuration for improving its mobility, reducing launch time and improving safety and storage. The last test and the first in pre-induction configuration was conducted on January 18, 2018. Agni-5 is expected to be inducted into the Strategic Forces Command very soon. …

Hitting the Target with Speed and Precision: The missile has been programmed in such a way that after reaching the peak of its trajectory, it will turn towards the earth and continue its journey towards the intended target with an increased speed due to the attraction of earth's gravitational pull. The path has been precisely directed by the advanced on-board computer and inertial navigation system.

As the missile enters the earth's atmosphere, the atmospheric air rubbing the skin of the missile during the re-entry phase raises the temperature beyond 4,000 degrees Celsius, sources said. However, the indigenously designed and developed carbon-carbon composite heat shield continues to burn sacrificially, protecting the payload and maintaining the inside temperature below 50 degrees Celsius, the sources added.

All Mission Objectives Met: Finally, commanded by the on-board computer with a support of ring laser gyro- based inertial navigation system, the micro inertial navigation system, fully digital control system and advanced compact avionics, the missile hit the designated target point accurately, meeting all mission objectives, they said. The ships located in mid-range and at the target point, tracked the vehicle and witnessed the final event. All the radars and electro-optical systems along the path monitored all parameters of the missile and displayed in real time, they added. …

Source: http:// www.thehindu.com, 03 June 2018.

USA

US Needs Better Missile Defense for a Scarier Nuclear Age

America's primary domestic defense system against a nuclear-missile attack is the Ground-Based Midcourse Defense, or GMD, with bases in Alaska and California. More than $40 billion has been spent on this successor to Ronald Reagan's so-called Star Wars project. Yet it has only 44 "kill vehicles" intended to defend against a small-scale intercontinental attack of the sort North Korea might attempt, and its success rate in testing is only about 50 percent.

The Pentagon's "theater defense" systems, designed to take out short- and medium-range conventionally armed missiles (and perhaps tactical nuclear weapons) on the battlefield, have performed far better. The ground-based THAAD, which is now deployed in South Korea and Guam, has been virtually flawless in testing.

A second system based in Eastern Europe since 2016 uses an on-shore version of the Navy's excellent Aegis combat system and is intended to protect Europe from an Iranian nuclear attack. But it isn't geared toward defeating the longer-range ballistic missiles Iran is thought to be developing in violation of United Nations resolutions. Testing of the system has been limited.

Integrating the various defense shields is all the more vital because China and Russia are making great advances in developing hybrid technologies such as hypersonic missiles — which unlike ballistic missiles can change course rapidly — as well as a new generation of long-range (and perhaps nuclear-powered) cruise missiles, better unmanned systems and more.

If the uncertainty over whether these systems could knock even a single attack by a rogue state out of the sky isn't unsettling enough, the US would be all but defenseless from a mass attack by nuclear superpowers China and Russia. The only US defense is its overwhelming offense of 6,800 nuclear warheads in Midwestern bunkers and aboard nuclear submarines and long-range bombers.

Yet there are reasons for optimism. The Pentagon's "theater defense" systems, designed to take out short- and medium-range conventionally armed missiles (and perhaps tactical nuclear weapons) on the battlefield, have performed far better. The ground-based THAAD, which is now deployed in South Korea and Guam, has been virtually flawless in testing, according to the Pentagon. The older Patriot system and the ship-based version of Aegis have also been highly reliable.

It doesn't take a rocket scientist to see that one solid step toward improving matters would be to integrate all these systems into a holistic national missile shield. Movement in that direction, one hopes, will be spurred by the imminent release of the newest congressionally mandated Defense Department comprehensive overview of the issue. Even before the public sees it, there is already a promising signal: While previous versions were titled the "Ballistic Missile Defense Review," that first word has been dropped from the forthcoming document, showing that the Pentagon is looking at the bigger picture.

Integrating the various defense shields is all the more vital because China and Russia are making great advances in developing hybrid technologies such as hypersonic missiles — which unlike ballistic missiles can change course rapidly — as well as a new generation of long-range (and perhaps nuclear-powered) cruise missiles, better unmanned systems and more.

While it's certain that the new review won't ignore the China-Russia threat — as the Obama administration's 2010 version largely did, another instance of its general failure to take the Russian threat seriously — it would be a terrible oversight if it doesn't fully consider the implication of a new era of great-power conflict. Thus one pillar of any new strategy should be a rebalancing toward homeland defense, which in

budget terms has been badly undernourished compared to tactical systems over the last decade.

An obvious first step would be to improve the two existing land-based systems. On the domestic shield, the quickest and easiest improvement would be to expand the missile fields at Fort Greeley, Alaska, which could accommodate 60 interceptors or more. The Pentagon should also look at the feasibility of a new shield to defend the eastern half of the country, perhaps with a mobile system that could move between sites on the East Coast and Midwest.

On Eastern Europe, the Trump administration could go ahead with two plans shelved by its predecessor in deference to Russian concerns — placing batteries in one more allied country, likely Poland, and re-arming the system with a new generation of Raytheon's SM-3 interceptors. A second area requiring urgent attention is space. The heavens are currently an arms-free zone under the terms of a 1967 treaty, but there's little doubt that America's adversaries are planning to someday weaponize satellites, and the US should be ready to do the same.

New space-based sensor technologies are needed to track missiles (including low-altitude weapons such as hypersonics) from launch to impact. Ground- and sea-based sensors can't do that because of the curvature of the earth. Such monitoring would also be better than terrestrial systems at discerning decoys and other missile trickery. In addition, most US defenses are designed to intercept incoming missiles at their midcourse phase, just before they re-enter the earth's atmosphere. This is aptly likened to "hitting a bullet with a bullet." A far surer way to defuse the threat would be to blow it up on take-off. Possibilities for this include cyberattacks and directed-energy weapons (that is, laser beams).

Finally, as more money and effort are put into research and development, the US would be well advised to share its advances with its closest allies, particularly Israel (which could return the favor by sharing its Iron Dome technology) and the Gulf Arab states, which have long struggled to build a joint missile-defense system against Iran. Many will worry that if the US steps up its defense architecture in these and other ways, it will simply spur China and Russia to put more money into their own missile capabilities. But those two nations are already in a mad dash to upgrade and expand every aspect of their militaries. Stronger US defenses are the best way to deter their increasing aggressions and bring them, someday, to the negotiating table for arms-reduction talks.

Most US defenses are designed to intercept incoming missiles at their midcourse phase, just before they re-enter the earth's atmosphere. This is aptly likened to "hitting a bullet with a bullet." A far surer way to defuse the threat would be to blow it up on take-off. Possibilities for this include cyberattacks and directed-energy weapons (that is, laser beams).

That said, China and Russia need to be reassured that these new systems are defensive only, and not engineered for preemptive strikes on their strategic arsenals. Any ambiguity about that would be destabilizing — the last thing anybody should want in the life-and-death chess game of nuclear deterrence. …

Source: http:// www.bloomberg.com, 03 June 2018.

NUCLEAR ENERGY

BANGLADESH

HCC Wins First International Nuclear Power Contract in Bangladesh

Infrastructure major, Hindustan Construction Company Ltd. (HCC), in a joint venture with MAX Group, a leading construction company in Bangladesh, has been awarded USD 110 million (Rs.737 crore) contract by Russia's State Nuclear Company, JSC Atomstroyexport, for civil works of Turbine Island for Unit 1 of Rooppur Nuclear Power Plant. HCC's share in the JV is 40 percent (US44 million / Rs.295 crore).

The Rooppur Nuclear Power Plant 190 km northwest of Dhaka will be built with Russian technology and is equipped with two WER

Reactors of 1200 MW each. These reactors are similar to the Kudankulam Nuclear Power Plant in Tamil Nadu.

Commenting on the new order win, Mr. Dhawan, Director and Group CEO, HCC said, "HCC has become the first Indian company to participate in the international civil nuclear market. We are confident of delivering this job on time with precision in quality, safety, and state-of-the-art technology. We look forward to further project awards in Rooppur NPP and expanding our infrastructure footprint in Bangladesh."

HCC has become the first Indian company to participate in the international civil nuclear market. We are confident of delivering this job on time with precision in quality, safety, and state-of-the-art technology. We look forward to further project awards in Rooppur NPP and expanding our infrastructure footprint in Bangladesh.

Recently, India signed an agreement with Bangladesh for civil nuclear cooperation, under which India has extended expertise and project support for Bangladesh's first nuclear power plant. India not being a member of NSG cannot participate directly in the construction of atomic power reactors. But Indian companies can be involved in construction and installation works and in the supply of equipment of non-critical category.

HCC is the only Indian company which has successfully constructed the nuclear power project with Russian WER type Light Water nuclear reactors. HCC has constructed 65 pc of the country's installed nuclear power capacity. 15 out of 24 nuclear reactors in India are built by HCC. India's largest light water reactors built at Kudankulam nuclear power plant was built by HCC in 2010. HCC is currently engaged in the construction of the first phase of Integrated Nuclear Recycle Plant of BARC in Tarapur, Fast Reactor Fuel Cycle Facility (FRFCF) in Kalpakkam and Units 7 & 8 (2x700 MW) PWHR at Rawatbhata, Kota, Rajasthan.

Source: *http:// www.netindia123.com, 06 June 2018.*

GERMANY

Germany to Return to Full Nuclear Availability

Germany's 1.4-GW Philippsburg-2 nuclear plant and 1.3-GW Emsland A reactor are currently both scheduled to come back on 13 June evening local time after their return dates have been changed multiple times, EEX Transparency data showed.

The Philippsburg-2 had its latest return date set for June 14 and Emsland A for June 12 before EEX Transparency updated the restart to June 13, 11:00 pm 2100 GMT) and 9:00 pm local time, respectively.

Nuclear output has been 40% lower year on year in May, due to the refueling and maintenance work at the two plants and because of the closure of the 1.3-GW Gundremmingen B reactor. Their return to the grid will bring nuclear availability in Germany to 9.4 GW following their full ramp-up, with all the remaining seven nuclear reactors on grid, according to EEX.

Nuclear output has been 40% lower year on year in May, due to the refueling and maintenance work at the two plants and because of the closure of the 1.3-GW Gundremmingen B reactor. Their return to the grid will bring nuclear availability in Germany to 9.4.

Fundamentals in the German short-term market have been bullish for the last few weeks due to a low-wind scenario, higher generating fuel costs and a multitude of outages, supporting above-average prices. Week 23 – the seven days to last Sunday – had the highest average spot price since 2011. With wind set to remain below 10 GW this week, the plants' return will increase supply sharply.

However, apart from the overlap of nuclear outages from end-May to mid-June, maintenance will be more evenly spread in 2018 than last year, putting less overall pressure on the supply system. Maintenance outages stretch from the end of February to late September.

Last winter, German reactor availability fell to its lowest since the early 1980s with two reactors (Philippsburg 2 and Brokdorf) needing major additional repairs. Outages overlapped as the expiry of the fuel tax by the end of 2016 incentivized nuclear plants to operate in stretching mode and postpone planned repairs and refueling to the start of 2017.

The business secretary, Clark, announced plans to pump £5bn into a new nuclear power station at Wylfa in north Wales. It was a reversal of a longstanding Conservative policy not to underwrite nuclear construction. So why the sudden enthusiasm? And what does Clark know that the rest of the world does not?.

This year, Philippsburg-2 is the plant with the longest maintenance, with over one month off the grid. Stopping operation at the end 2017, the Gundremmingen-B reactor was the second modern reactor to lose its operating license under the nuclear phase-out timetable set in 2011 following the Fukushima nuclear crisis, which reversed Germany's plan to extend the life-span of its nuclear power plants. The next reactor to permanently close after Gundremmingen-B is Philippsburg-2 by end-2019, with three more reactors closing by end-2021 and end-2022.

Source: https://www.platts.com, 12 Jun 2018.

UK

Britain's Nuclear U-turn Puts Us in a Very Lonely Club

Nuclear is a proven large-scale source of low-carbon electricity. But renewable sources like solar and wind are both now cheaper, and are becoming cheaper still, while nuclear costs only rise. Some who call themselves "eco-modernists" argue that nuclear and renewables would make a great mix.

For once, ministers have put their money where their mouth is – into taking another stab at nuclear power. The business secretary, Clark, announced plans to pump £5bn into a new nuclear power station at Wylfa in north Wales. It was a reversal of a longstanding Conservative policy not to underwrite nuclear construction. So why the sudden enthusiasm? And what does Clark know that the rest of the world does not?

For almost everywhere else, governments and corporations are pulling the plug on nuclear. Even in a world fearful of climate change, in which nations have promised to wean themselves off fossil fuels by the mid-century, almost no one wants to touch nuclear. Germany will be nuclear-free by 2022. France – once Europe's great nuclear advocates – is backtracking. President Macron is committed to cutting nuclear's contribution to grid power from the 75% to 50%. Seven years after the Fukushima accident, all but a handful of Japan's 54 nuclear power plants remain closed.

US utilities are shutting reactors fast too, even those with years of their operating licences yet to run. In America's deregulated energy markets, nuclear cannot compete. Last week President Trump called for the utilities to suspend closures, citing national energy security. He may resort to the law to get his way, but even Trump is not demanding new reactors.

Meanwhile, the state-sponsored nuclear enthusiasm of China, recently the world's premier builder, has dimmed. Beijing has issued no new construction approvals for over two years. Only Russia keeps up the momentum – which puts Britain in an embarrassing club. Britain hasn't completed a new nuclear power station for 23 years. The government's professed reason for its newfound enthusiasm is fighting climate change, and in particular the need to find replacements on the grid for the remaining coal-fired power plants that it has pledged to shut by 2025. But while the cause is correct, the solution is increasingly at odds with the rest of the world.

Yes, nuclear is a proven large-scale source of low-carbon electricity. But renewable sources like solar and wind are both now cheaper, and are becoming

cheaper still, while nuclear costs only rise. Some who call themselves "eco-modernists" argue that nuclear and renewables would make a great mix: nuclear could fill in when the sun goes down and the winds drop. But there is a problem. Any effective stand-in for fickle renewables needs to be available at the flick of a switch. Hydropower or natural gas can do the job, but not nuclear. Its forte is to deliver constant baseload power.

If nuclear ticked enough other boxes, it might still have a role to play in keeping the lights on. But it has always been a bad neighbour and troublesome citizen. Some of our fears about radiation may be exaggerated, but they are real fears nonetheless. And nuclear power's links to nuclear weapons are not just about shared technology – at least not while Britain remains home to the world's largest stockpile of plutonium.

We are sitting on 130 tonnes of a human-made element that lies at the heart of most nuclear weapons. The stockpile is at a warehouse at Sellafield in Cumbria, in defiance of warnings from scientists at the Royal Society a decade ago that in its present form it poses a major security risk, whether diverted for weapons or breached by terrorists. The plutonium was manufactured over decades from used power-station reactor fuel. Britain wanted to be at the forefront of a new global industry using plutonium to fuel new designs of reactors. But production continues even though there is no sign of a world market for plutonium. And neither the new Hinkley Point reactor under construction in Somerset, nor the proposed plant at Wylfa, will burn the stuff.

The government seems determined to pursue a nuclear dream, even though it has palpably failed to come to terms with the toxic legacy of the country's nuclear past. Next to the site of the planned Wylfa plant sits the shell of an old nuclear power station. It was shut in 2015, but is not scheduled for demolition for almost another century, in 2105. It is one of 11 former plants that sit abandoned around our coastlines, from Dungeness in Kent to Trawsfynydd in Snowdonia, and Sizewell in Suffolk to Hunterston in south-west Scotland. They are currently being put into what the industry terms "care and maintenance" – mothballed while their radioactivity decays, and until the government's Nuclear Decommissioning Authority can find somewhere to put their remains.

On present form, that day may never come. Britain is today no nearer agreeing a final resting place for its most dangerous and long-lasting radioactive wastes than it was back in 1976, when the royal commission on environmental pollution said we should build no more nuclear power plants until that problem was resolved. Absurdly, the most recent plan has been to bury the waste in tunnels to be dug beneath the Lake District national park. …

Source: https://www. www.theguardian.com, 08 June 2018.

NUCLEAR COOPERATION

FRANCE–RUSSIA

France, Russia Extend Nuclear Power Cooperation

Russia's Rosatom and the French Alternative Energies and Atomic Energy Commission (CEA) have signed a strategic document on partnership in the peaceful uses of nuclear energy. The agreement was signed on May 24, 2018 by Rosatom Director General Likhachov and CEA Chairman Jacq in the presence of the Russian and French presidents, Putin and Macron, during the St. Petersburg International Economic Forum.

Rosatom said the document "gives a new impetus" to cooperation between the two countries and "expresses their mutual intention" to develop cooperation in energy efficiency and renewable energy. "It underscores the fact both parties share a common approach to nuclear power development and its role in achieving the goal of the Paris Agreement as part of the UN Framework Convention on Climate Change," the Russian state nuclear corporation said. …

The parties are to strengthen their technical and commercial interaction in: energy efficiency and alternative energy sources; the development of

energy accumulation systems and fast neutron reactors; engineering and equipment supplies for nuclear power plants; the supply of nuclear fuel for commercial and scientific purposes; the processing of used nuclear fuel; and the reuse of recovered materials. Rosatom and CEA will jointly work on industrial facilities in third countries, it added, and the document also provides for scientific exchanges between students of nuclear energy disciplines and broadening contacts between employees of research nuclear centres.

The parties are to strengthen their technical and commercial interaction in: energy efficiency and alternative energy sources; the development of energy accumulation systems and fast neutron reactors; engineering and equipment supplies for nuclear power plants; the supply of nuclear fuel for commercial and scientific purposes; the processing of used nuclear fuel; and the reuse of recovered materials.

Source: *http:// www.world-nuclear-news.org, 29 May 2018.*

RUSSIA–INDIA

Russia to Supply Advanced Safe Fuel for Kudankulam Nuclear Plant

New, more advanced and safe fuel will be reloaded into the two running reactors of the KNPP and also into the subsequent units being built in Tamil Nadu with the technical assistance of the Russian national atomic power corporation Rosatom, according to a senior company official. Alexander Ugryumov, Vice President (R&D) of Rosatom's fuel arm TVEL, told IANS in an interview here that the company hoped to conclude the final agreements for supply of the new fuel with the KNPP builder, the state-run NPCIL.

The TVS-2M fuel assembly offers increased uranium capacity, improved heat reliability and enhanced operational safety, while supply agreements have already been reached in principle. "Upgrading to TVS-2M will help improve efficiency of the Indian VVER units as well as reduce the cost of electricity.

Rosatom is also the equipment supplier for the KNPP, whose first two units of 1,000 MW each have already been commissioned. Ugryumov said that at the time of negotiating for units 1 and 2, the company only had the international licence for the UTVS fuel loaded into the VVER-1000 type reactors. "The UTVS fuel was applied to all international projects of Rosatom, including units 1 and 2 of the Tianwan Nuclear Power Plant in China and unit 1 of the Bushehr NPP in Iran," he said. "Now we have the licence to sell TVS-2M which is the reference solution for all power units with VVER-1000 reactors which Rosatom builds abroad. From the very beginning, TVS-2M will be loaded into the reactors of Kudankulam's units 3, 4, 5 and 6."

Ugryumov said the TVS-2M fuel assembly offers increased uranium capacity, improved heat reliability and enhanced operational safety, while supply agreements have already been reached in principle. "Upgrading to TVS-2M will help improve efficiency of the Indian VVER units as well as reduce the cost of electricity. Being more robust, with higher stiffness, this fuel bundle does not bow in the reactor and preserves its initial shape, making operations safer and reliable," he said. "While UTVS are packed with 490 kg of enriched uranium pellets, TVS-2M bundles weigh 527 kg. For a nuclear plant operator it gives a lot of options in terms of an extension of a fuel cycle length from 250 up to 510 effective full-power days," the official said.

The new solution is also more efficient in terms of economy. "This is because you save the amount of money spent on the scheduled outages, while still providing the highest safety standards," Ugryumov said. "Secondly, with more uranium mass you will need less fuel bundles to generate electricity, so after the end of the operation there will be less spent nuclear fuel."

With the expiry of the original 10-year fuel supply agreement for KNPP last year, Ugryumov hoped to have the engineering contract signed this year for the introduction of TVS-2M fuel in the already commissioned first two units at Kudankulam. ...

Source: http:// www. thenewsminute. com, 08 June 2018.

RUSSIA–CHINA

Russia Joins China's Race for Next-Gen Nuke Reactors

China has agreed to pursue building next-generation nuclear reactors designed by Russia's Rosatom Corp, the latest player seeking a boost for its new technology from China's embrace of atomic power. A plan to build four Russian units was among four deals signed on June 08, 2018 during a ceremony in Beijing attended by presidents Xi and Putin.

The agreements are worth more than 20bn yuan ($3.1bn) and total construction costs could exceed 100bn yuan, according to China National Nuclear Corp, adding it's the biggest nuclear pact ever between the two countries. China will finance the reactor construction, Rosatom chief executive officer Likhachev said after the ceremony.

The agreements are worth more than 20bn yuan ($3.1bn) and total construction costs could exceed 100bn yuan, according to China National Nuclear Corp, adding it's the biggest nuclear pact ever between the two countries. China will finance the reactor construction, Rosatom chief executive officer Likhachev said after the ceremony.

China's nuclear industry has grown from its experience importing technology sold by foreign companies hoping to benefit from booming demand in the world's largest energy consumer. The nation's ambitions to build out its nuclear power industry at home, and sell its own technology abroad, is beginning to overcome cost overruns and tighter regulations. The nation signalled in March 2018 it would end a multiyear freeze on new reactor construction this year, and a month later approved the fuel-loading of Westinghouse Electric Co's AP1000 in Zhejiang province's Sanmen and French-designed EPR in Guangdong's Taishan. That paves the way for startups within months, which would be the first successful operations globally for units of their kind.

As part of the agreements signed on June 08, 2018, the countries will seek to build two Russian VVER-1200 units at the Xudabao power plant in China's Liaoning province and two more at Tianwan in Jiangsu, according to a statement from Moscow-based Rosatom. China already uses some of Russia's older technology. Two VVER-1000 units at Tianwan started in 2007, and a third was connected to the grid in December, Rosatom said. … The two countries also on June 08, 2018 signed deals for the supply of equipment, fuel and services for the CFR-600 fast reactor pilot project developed by state-owned CNNC, as well as the supply of generator parts for China's lunar exploration programme. …

Source: http:// www.gulf-times.com, 09 June 2018.

URANIUM PRODUCTION

CHINA

Despite an Improved 1st-Quarter 2018, the Outlook for Cameco Corp. Remains Poor

It has been a tough few years for one-time high-flying uranium miner Cameco Corp. Over the last five years, its value has plummeted by 38% after nuclear power fell into disfavour after the 2011 Fukushima disaster in Japan, which caused the price of uranium to collapse. Since then, uranium has remained caught in a protracted slump, despite claims by industry insiders and analysts that it is poised to rebound because of a combination of growing demand and emerging supply constraints.

Nonetheless, despite these claims, there has been

no sign of a sustained rally, and an upturn in the fortunes of the radioactive metal may never occur. This is because the outlook for uranium is not as bright as claimed, and there is every indication that nuclear power will remain in disfavour. That will continue to weight on Cameco's market value.

Now What?: The greatest threat to nuclear power is the secular trend to cleaner renewable sources of energy, which forms a vital part of the battle against climate change. Key to adding additional momentum to the growth of renewable sources of energy has been the Paris Agreement, which seeks to keep the global temperature rise this century below two degrees Celsius above pre-industrial levels. While on initial appearances this should create a favourable environment for nuclear power generation, which is the single largest consumer of uranium globally, it is not necessarily the case.

Countries such as France, South Korea, Germany, Spain, and Switzerland focus on either phasing out or reducing their dependence on nuclear power. Even the additional demand for uranium that will arise because of the 55 reactors currently under construction globally likely won't be sufficient to make up the decline in demand caused by these countries.

You see, while nuclear energy does not produce air pollution or greenhouse gas emissions, there are considerable concerns regarding the radioactive waste produced, and the significant threat posed by the critical failure of a reactor. The Fukushima catastrophe, which was the most significant nuclear incident since the 1986 Chernobyl disaster, magnified these fears.

… It is these worries that have seen countries such as France, South Korea, Germany, Spain, and Switzerland focus on either phasing out or reducing their dependence on nuclear power. Even the additional demand for uranium that will arise because of the 55 reactors currently under construction globally likely won't be sufficient to make up the decline in demand caused by these countries mothballing existing reactors. This will be exacerbated by the growing popularity of natural gas, which has become the favoured transitional fuel for electricity generation and falling costs for renewable power.

This is not good news for the long-term outlook for uranium or Cameco. The impact of these factors on uranium can be seen from Cameco's first-quarter 2018 results. Both the average spot and long-term price for the radioactive metal were 12% lower than they had been for the same period a year earlier. While Cameco did report stronger financial results for the quarter compared to a year earlier, including a $55 million profit against a loss of $18 million that can be attributed to other factors — the most notable being a gain from the restructuring of JV Inkai and reorganizing a contract with a utility customer, which advanced future deliveries into the first quarter.

So What?: Much of the optimism surrounding the outlook for uranium appears overblown, and there are no catalysts on the horizon that appear capable of triggering a sustained rally in the fuel. For that reason, Cameco is an unappealing investment and appears to be a value trap.

Source: http:// www.fool.ca, 28 May 2018.

NUCLEAR PROLIFERATION

IRAN

Iran Informs UN of Increase in Nuclear Enrichment Capacity

Iran has informed the UN nuclear watchdog that it will increase its nuclear enrichment capacity within the limits set by the 2015 agreement with world powers. The modest steps announced on June 05, 2018 appeared to be mainly aimed at signalling that Iran could resume its drive toward industrial-scale enrichment if the nuclear accord comes unravelled.

Behrouz Kamalvandi, the spokesman for Iran's nuclear agency, was quoted by state TV as saying a letter was submitted to the International Atomic Energy Agency detailing the move. Kamalvandi said Iran is "providing infrastructure and arrangements for high-speed and capacity in

production of UF4 and UF6 gases as well as rotor of centrifuges." Spinning centrifuges convert the gases into enriched uranium that can be used for reactor fuel and medical isotopes. If enriched to higher levels, the material can be used for weapons.

JCPOA Set Enrichment Levels: The head of Iran's nuclear agency, Salehi, said Iran is prepared to resume work on advanced centrifuges that would dramatically increase its capacity for enrichment. But he said that so far the work is limited to building a new facility for assembling the centrifuges.

Supreme Leader Khamenei had ordered the increase in capacity in a speech on June 04, 2018, in which he vowed that Iran would preserve its nuclear program despite the US withdrawal from the landmark 2015 accord…. The agreement set strict limits on Iran's uranium enrichment in return for the lifting of US and international sanctions.

Supreme Leader Khamenei had ordered the increase in capacity in a speech on June 04, 2018, in which he vowed that Iran would preserve its nuclear program despite the US withdrawal from the landmark 2015 accord…. The agreement set strict limits on Iran's uranium enrichment in return for the lifting of US and international sanctions.

Source: https:// www.cbc.ca, 05 June 2018.

NORTH KOREA–PAKISTAN

New Delhi Wants North Korea-Pakistan Nuclear Axis Addressed

India on 22 June welcomed the US-North Korea summit that sought to denuclearise the Korean Peninsula, but desired that any solution should address Delhi's concerns over the Pyongyang-Islamabad nuclear axis as well. "This is a positive development. India has always supported all efforts to bring about peace and stability in the Korean Peninsula through dialogue and diplomacy.

We hope that the outcomes of the US-DPRK Summit will be implemented, thus paving the way for lasting peace and stability in the Korean Peninsula," the Ministry of External Affairs said in a statement following the summit. But the ministry was quick to raise India's concerns over the North Korea-Pakistan axis. "We also hope that the resolution of the Korean Peninsula issue will take into account and address our concerns about proliferation linkages extending to India's neighbourhood."

India was the only country besides the US, South Korea and Singapore whose ministers (minister of state for external affairs VK Singh from India) visited North Korea after Trump and Kim announced that they would hold the summit to seek peace in peninsula. Singh, during his meetings, highlighted the threat from nuclear proliferation, in particular India's concerns in the context of the proliferation linkages with India's neighbourhood.

The Korean side emphasised that as a friendly country, it would never allow any action that would create concerns for India's security. The role of Pakistan's AQ Khan in developing North Korea's nuclear programme and Pyongyang's support to the Pak missile programme have been the biggest irritant in ties with Pyongyang.

The Korean side emphasised that as a friendly country, it would never allow any action that would create concerns for India's security. The role of Pakistan's AQ Khan in developing North Korea's nuclear programme and Pyongyang's support to the Pak missile programme have been the biggest irritant in ties with Pyongyang. During Singh's visit, Delhi and Pyongyang decided to explore the possibilities of cooperation in areas of mutual interest.

Source: Dipanjan Roy Chaudhury, The Economic Times, 13 June 2018.

PAKISTAN

Pakistan Must Not be Admitted to NSG: US Nuclear Watchdog

A US-based international nuclear proliferation watchdog said Pakistan's application to the NSG should not be granted, mainly because of its ongoing illicit nuclear procurements abroad and

its refusal to even minimally split its military and civil atomic programmes.

This was stated by the Institute for Science and International Security (ISIS) in a report authored by Albright, Burkhard, and Pabian. "Pakistan's application to the NSG should not be granted at the present time," ISIS said as it released latest satellite images of the Kahuta nuclear power plant site in Pakistan. "Although there are many reasons to refuse its membership, some more obvious reasons include its ongoing illicit nuclear procurements abroad and its refusal to even minimally split its military and civil nuclear programs," it said. The report discusses the purpose and size of the likely enrichment plant at Kahuta and estimates the amount of enriched uranium it could produce. "We could not determine if Pakistan is building one or two enrichment plants. We are certainly interested in learning more," it said.

In terms of instances of illicit nuclear-related procurements by the three countries, Pakistan has carried out the most,Over the last decade, Pakistan has renovated or expanded its uranium enrichment, plutonium production, and nuclear weaponisation capabilities.

While much of the world's attention has been directed to the nuclear programmes of Iran and North Korea, Pakistan has greatly expanded its nuclear complex dedicated to roducing nuclear weapons, the report rued. One European official stated in an interview in late 2016 that in terms of instances of illicit nuclear-related procurements by the three countries, Pakistan has carried out the most, the report said. Over the last decade, Pakistan has renovated or expanded its uranium enrichment, plutonium production, and nuclear weaponisation capabilities, according to this official. It has also been expanding the number of its nuclear power plants and the means to make fuel for these new reactors, it said.

The restoration of US sanctions on AEOI would expose non-US companies to the risk of punishment by the United States for dealing with it, including Chinese state-owned China National Nuclear Corp. and Russia's Rosatom, which are doing nonproliferation work respectively at Arak and Fordow.

In a detailed analysis of the latest satellite images it obtained, ISIS says Pakistan appears committed to building one or two large uranium enrichment plants. Whether the plants will be exclusively for peaceful purposes is undetermined, it said. ... The report said, if the Kahuta site is indeed a centrifuge plant, it will require a great deal of equipment, much of which Pakistan does not make domestically. ..."Financial sanctions should also be applied on these entities and individuals. China should be told explicitly by other members of the NSG that the supply of goods to Pakistan's enrichment programme would violate China's NSG commitments," said the report.

Source: http:// www. newindianexpress. com, 30 May 2018.

NUCLEAR NON-PROLIFERATION

IRAN

US Withdrawal may Halt Nuclear Nonproliferation Work in Iran

The remaining parties to the Iran nuclear deal have warned the United States that its decision to withdraw from the pact jeopardises Russian and Chinese efforts to limit Iran's ability to develop atomic weapons, Western diplomats told Reuters. In pulling out of the 2015 deal, US President Trump triggered the revival of sanctions against the Atomic Energy Organization of Iran (AEOI), which oversees the Arak heavy water research reactor and the Fordow fuel enrichment plant. Under the deal, the Arak reactor was to be redesigned to render it unable to make bomb-grade plutonium under normal operation, while the Fordow plant was to stop enriching uranium and be converted into a nuclear, physics and technology center.

The restoration of US sanctions on AEOI would expose non-US companies to the risk of punishment by the United States for dealing with it, including Chinese state-owned China National Nuclear Corp. and Russia's Rosatom, which are

doing nonproliferation work respectively at Arak and Fordow. Neither company responded to requests for comment.

At a meeting in Vienna on May 25, 2018, the non-US parties to the deal - Britain, China, France, Germany, Russia and Iran - discussed the subject extensively, with Beijing and Moscow stressing their concerns, three European diplomats said. One senior European diplomat called the situation "crazy" and said the US withdrawal risked triggering a proliferation problem because its sanctions may halt work on Arak and Fordow. "It may force the interruption of the dismantling of Iran's nuclear sites. It's completely absurd," the diplomat said. Iranian officials were not immediately available for comment.

Asked how Washington planned to address the concerns about AEOI being sanctioned and how it would serve US interests not to carry out the nonproliferation work at Arak and Fordow, Assistant Secretary of State Christopher Ford said the US was aware of the other parties' positions regarding AEOI. …

Source: http:// in.reuters.com/, 31 May 2018.

NORTH KOREA

A Nuclear Deal with DPRK would Require Unprecedented Access to Secret Weapons Sites

… President Trump has acknowledged the summit will start "a process." But if Kim subsequently agrees to disarm in stages over the next decade or longer, the most likely outcome if a nuclear deal ultimately is struck, the massive effort would require hundreds of international nuclear inspectors to help dismantle warheads, shut down facilities, interview North Korean scientists, unravel procurement systems, physically tag and monitor bomb-making equipment, and do much more.

At this point, not enough nuclear experts may exist to visit the hundreds of buildings, track down the voluminous records and conduct the comprehensive inspections required to verify compliance. Nothing approaching such a sweeping agreement with a closed police state like North Korea has been attempted in the history of nuclear disarmament. This situation is without precedent," said Kimball, a nonproliferation expert with the Arms Control Assn., a Washington policy organization. "No country that has openly conducted test explosions and amassed a nuclear arsenal as North Korea has done has ever willingly eliminated its stockpile."

US intelligence agencies believe Pyongyang has assembled as many as 60 nuclear weapons and built a widely dispersed network of secret development and production facilities, some deep underground in the country's rugged northern mountains, to create fissile material and testing components, and to assemble and store the actual warheads.

Pyongyang has assembled as many as 60 nuclear weapons and built a widely dispersed network of secret development and production facilities, some deep underground in the country's rugged northern mountains, to create fissile material and testing components, and to assemble and store the actual warheads.

As part of any deal, US officials also are likely to seek restrictions on North Korea's ballistic missiles, especially those capable of hitting US soil. Additional outside experts thus would be needed to inspect missile factories and test sites. No matter how intrusive the inspections, there would be almost no way to guarantee North Korea wasn't concealing a stash of components or a fully assembled warhead in case Kim or his successors faced a future threat to their survival, former officials and inspectors said.

… Given the scale of Pyongyang's program, the IAEA would need to hire and train a major new workforce and build or buy sophisticated monitoring equipment, from sensors to cameras, to ensure North Korea doesn't cheat. The agency also would need the UNSC to approve the operation and fund it with a budget increase. The IAEA said last year it had about 300 inspectors, including 80 who are working to monitor Iran's 27

mostly dormant nuclear facilities as part of the 2015 nuclear accord that Trump abandoned last month. Iran and the other signatories are still honoring the agreement. North Korea, by contrast, is believed to have up to 100 clandestine sites, according to a report by Rand Corp., a think tank based in Santa Monica. And Iran never built any nuclear weapons or intercontinental ballistic missiles.

The report suggests small, achievable steps, including a continued freeze on nuclear and ballistic missile tests and a shut-down of the enrichment facility at Yongbyon. It might take six to 10 years of phased concessions on both sides before the nuclear risk is substantially eliminated.

Trump administration officials say their goal is complete, verifiable and irreversible disarmament, a high bar in a country that has pursued nuclear weapons for decades and on a far larger scale than Iran, Iraq, Libya and South Africa ever did. Those countries all gave up or were forced to give up their nuclear programs. South Africa may be the closest parallel. It dismantled its arsenal in 1989, the only country ever to give up nuclear arms that it had developed itself, as it prepared to move from apartheid to black majority rule. But its program was tiny compared to North Korea's.

… Hecker, a former director of the nuclear weapons laboratory at Los Alamos, N.M., has toured North Korea's major nuclear facilities four times and is the only US scientist to visit its facility for enriching uranium, a bomb fuel. US intelligence agencies had not spotted its construction. A new study on the issue that Hecker co-authored with fellow Stanford University researchers Carlin and Serbin warns that "in the short term, North Korea will surely hedge its bets by retaining parts of the program."

Uranium enrichment facilities "would be problematic," they wrote. "North Korea has covert facilities that it is unlikely to declare and eliminate initially." Rather than pushing for a swift disarmament, the report suggests small, achievable steps, including a continued freeze on nuclear and ballistic missile tests and a shut-down of the enrichment facility at Yongbyon. It might take six to 10 years of phased concessions on both sides before the nuclear risk is substantially eliminated.

Even if Pyongyang cooperated initially with the inspectors, it is likely to ratchet its compliance up and down, seeking leverage over the US and others rivals in the region, experts said. If the IAEA gains access to North Korean records, it may be able to determine how much fissile material it has produced. That could lead to a more precise understanding about how many operational nuclear devices Pyongyang has built.

Dismantling the warheads probably would be carried out by North Korean scientists, monitored by experts from other nuclear powers, possibly including the United States, which has extensive experience in disassembling warheads. The IAEA doesn't have that expertise and Hecker warns that shipping them out of the country "is naive and dangerous."

To ensure Pyonyang cannot rebuild its warheads, the US may push for taking fissile material out of North Korea permanently. But after decades of working to acquire fuel for nuclear weapons, Pyongyang would almost certainly balk at giving it up. In that case, fissile material might have to be stored in North Korea, in sealed facilities subject to IAEA monitoring.

To ensure Pyonyang cannot rebuild its warheads, the US may push for taking fissile material out of North Korea permanently. But after decades of working to acquire fuel for nuclear weapons, Pyongyang would almost certainly balk at giving it up. In that case, fissile material might have to be stored in North Korea, in sealed facilities subject to IAEA monitoring. …

Source: https:// www.latimes.com, 03 June 2018.

NUCLEAR SAFETY

USA

The Secret 'White Trains' that Carried Nuclear Weapons around the US

At first glance, the job posting looks like a standard help-wanted ad for a cross-country trucker. Up to three weeks a month on the road in an 18-wheel tractor-trailer, traveling through the contiguous 48 states. Risks include inclement weather, around-the-clock travel, and potentially adverse environmental conditions. But then the fine print: Candidates should have "experience in performing high-risk armed tactical security work…and maneuvering against a hostile adversary."

The United States relies almost entirely on million-dollar, Lockheed Martin tractor-trailers, known as Safeguard Transporters (SGTs) and Safe Secure Trailers (SSTs) to move nuclear material. But from the 1950s through the 1980s, the great hope for safe transit was so-called "white trains.

The US government is hiring "Nuclear Materials Couriers." Since the 1950s, this team of federal agents, most of them ex-military, has been tasked with ferrying America's 6,800 nuclear warheads and extensive supply of nuclear materials across the roads and highways of the United States. America's nuclear facilities are spread out throughout the country, on over 2.4 million acres of federal real estate, overseen by the DOE—a labyrinth of a system … "highly scattered and fragmented…with few enforceable rules."

The epicenter of nuclear transit was the Pantex Plant, about 17 miles outside of downtown Amarillo, Texas, a maze-like complex of dozens of buildings located on 10,000 acres of land. Amarillo was the final destination for almost all of America's nuclear trains and the Pantex Plant was the nation's only assembly point for nuclear weapons, a role it maintains to this day.

Some sites are for assembly, some are for active weapons, some are for chemicals, some are for mechanical parts. What this means in practice is that nuclear materials have to move around—a lot. For as long as the United States has had nuclear weapons, it has struggled with the question of how to transport America's most destructive technology throughout the country without incident. "It's the weak link in the chain of nuclear security," said Dr. Lyman of the Union of Concerned Scientists.

Today the United States relies almost entirely on million-dollar, Lockheed Martin tractor-trailers, known as Safeguard Transporters (SGTs) and Safe Secure Trailers (SSTs) to move nuclear material. But from the 1950s through the 1980s, the great hope for safe transit was so-called "white trains." These trains looked entirely ordinary, except for a few key details. They featured multiple heavily armored boxcars sandwiched in between "turret cars," which protruded above the rest of the train. The turrets had slit windows through which armed DOE guards peered out, prepared to shoot if they needed to defend the train. Some guards had simple rifles, while others reportedly had automatic machine guns and hand-grenade launchers. Known in DOE parlance "safe, secure railcars," or SSRs, the white trains were highly resistant to attack and unauthorized entry. They also offered "a high degree of cargo protection in event of fire or serious accident," the DOE assured a wary Congress in 1979.

Though nuclear trains staffed by snipers guarding powerful weapons sounds like something out of an action-adventure film, the trains were far from glamorous. They moved slowly, maxing out at 35 miles per hour—a virtual crawl compared to the average Amtrak train. This meant very long cross-country journeys for their seven-member crews. One of the most common routes for the train took nuclear bombs from Texas to Bangor, Washington, delivering the weapons at a submarine base on the banks of the Puget Sound. Another frequent route took bombs from Texas to Charleston, South Carolina, where a set of submarines sat poised for missions in the Atlantic.

The epicenter of nuclear transit was the Pantex Plant, about 17 miles outside of downtown Amarillo, Texas, a maze-like complex of dozens of buildings located on 10,000 acres of land. Amarillo was the final destination for almost all of America's nuclear trains and the Pantex Plant

was the nation's only assembly point for nuclear weapons, a role it maintains to this day. The United States built Pantex in 1941 as a World War II munitions base, and in 1951, it was quietly refurbished to serve a new Cold War role. Soon, a growing portion of Amarillo's 100,000 citizens were employed in bomb assembly and disassembly. "Inside Gravel Gertie bunkers designed to contain explosions and contamination, moonlighting farmers and silent young mechanics bolt together the warheads for Trident missiles and delicately dismantle older weapons," wrote the Washington Post in 1982.

Amarillo, Texas, a maze-like complex of dozens of buildings located on 10,000 acres of land. Amarillo was the final destination for almost all of America's nuclear trains and the Pantex Plant was the nation's only assembly point for nuclear weapons, a role it maintains to this day.

While the site received materials like uranium and plutonium from around the country, only Pantex had the heavily shielded cells where the bombs' mechanical parts could be joined to nuclear material. Assemblers of nuclear warheads, clothed in blue overalls, thick gloves, and safety shoes with rubber slipcovers, worked in pairs to attach the nuclear material and the explosives. From these cells, the bombs were taken to bays where workers would add firing components, casings and tails.

Each day trucks and trains rolled in, carrying plutonium from Georgia and Washington, bomb triggers from Colorado, uranium from Tennessee and neutron generators from Florida. They rolled out on white trains, carrying fully assembled nuclear weapons. These trains quietly snaked along America's railroads for 30 years, a top-secret project with an impeccable track record.

Each day trucks and trains rolled in, carrying plutonium from Georgia and Washington, bomb triggers from Colorado, uranium from Tennessee and neutron generators from Florida. They rolled out on white trains, carrying fully assembled nuclear weapons. These trains quietly snaked along America's railroads for 30 years, a top-secret project with an impeccable track record. Yet today, every white train sits in a junkyard or a museum. Why did America abandon its nuclear trains, which many Cold War nuclear experts considered to be the safest mode of transport for sensitive weapons material?

Derailing the White Trains: Anxieties about nuclear war loomed heavily in the national psyche at the turn of the 1980s, and as a growing roster of cities became involved in US nuclear development, Americans began to express (often very justified) fears about the materials being stealthily moved around amid the backgrounds of their lives.

In his first term in office, President Reagan quadrupled defense spending and suggested that the United States was willing to use nuclear strength against the Soviets if necessary. In March 1982, Time Magazine published a cover featuring a billowing red mushroom cloud and the phrase "Thinking the Unthinkable." One American reckoning with the "unthinkable" was Douglass, a Catholic theologian affiliated with a nuclear resistance group called Ground Zero Center for Nonviolent Action. In 1981, Douglass purchased a home in Washington, overlooking the Naval Submarine Base Bangor on the coast of the Puget Sound. Each day Douglass and his wife would look out their front window onto the bay, and again and again they saw the same thing: a white train entering and exiting the heavily secured base.

… Jim and Shelley Douglass, with the aid of the Ground Zero Center, launched a controversial fight to stop the white trains, what Mr. Douglass called "the most concentrated symbol we have of the hell of nuclear war." With the aid of a train-buff friend, they determined the most likely route from Amarillo to Washington. They then contacted peace and religious groups on the route, asking them to watch for the train, to organize a prayer vigil or a nonviolent protest when the train appeared, and to inform local newspapers about the train's arrival.

Actions against the white trains took place throughout the United States, with vigils occurring in more than 300 communities. In Memphis, a

white train came inches away from hitting a nun who stood in the middle of the tracks. In Washington, D.C. activists laid a section of railroad in front of the DOE building, and surrounded the track with a blown-up photograph of a white train, a map of its known routes, and a large banner reading, "The Nuclear Train Starts Here."

The nuclear resistance movement posed serious problems for the DOE. Not only did it generate terrible press, it also directed public attention to what the agency had carefully designed to be a classified process. The DOE wasn't just worried about angry pacifists, it was worried about someone learning the routes and hijacking a train—a worst case scenario for American nuclear security.

The DOE's first attempt to thwart protesters involved rerouting the trains. From the DOE command center in Albuquerque, New Mexico, officials issued last minute directives to the engineers to take "the tracks of least resistance." But as the network of anti-nuclear activists grew, they became increasingly adept at tipping off the community if they saw an unmarked white train plow down their railways. They agency proposed new regulations that would make it illegal to pass information about the routing of the white train, but got little traction.

So the DOE undertook a logical next step: changing the color of the trains. A July 1984 memorandum titled "Color Change of Safe-Secure Railcars" noted that "the painting of these railcars will not stop dedicated protesters from identifying our special trains. However, it will make tracking our trains more difficult, and we believe, enhances the safety and security…" The DOE painted the trains red, green, grey, and blue, but anti-nuclear activists continued to track the trains with relative ease—after all, not many commercial trains had turrets for snipers.

The battle against the white trains reached its peak in 1985, when 146 people were arrested over the course of one train's journey from Amarillo to Bangor. Jim and Shelley Douglass, as well as many of their closest collaborators were charged with trespassing and conspiracy. But surprisingly, a Washington jury returned a not-guilty verdict for the 20 activists who sat on the train tracks and county officials announced they would no longer arrest people for protesting and obstructing the weapons trains.

Public pressure, activist interference, and a growing constellation of nuclear sites in the US triggered the demise of the controversy-ridden trains. Shortly after the Washington lawsuit, the US government began exclusively using Safeguard Transporters for moving nuclear materials. The DOE expressed confidence that a system of trucks would be easier to obscure and would provide a practical solution to reaching the many nuclear sites far away from train tracks.

So the DOE undertook a logical next step: changing the color of the trains. A July 1984 memorandum titled "Color Change of Safe-Secure Railcars" noted that "the painting of these railcars will not stop dedicated protesters from identifying our special trains. However, it will make tracking our trains more difficult.

The Future of Nuclear Rail: While the white trains came to an unceremonious end in 1987, the Department of Energy didn't abandon all hope for using trains in experimental national security measures. In 1986, President Reagan approved a system for launching ICBMs from railways, an initiative known as Peacekeeper Rail Garrison. The plan would park 25 trains carrying two missiles apiece at military bases throughout the US In the case of Soviet agitation, the locomotives would move onto the nation's railroad network, where missiles could be launched from the train.

Though a group of protesters had effectively brought down the white trains, officials appeared confident that the nation's rail network could provide an effective means of hiding weapons. By the late 1980s, the United States had 120,000 miles of available track, 20,000 locomotives, and 1.2 million railcars. At any given time, there were more than 1,700 trains on the tracks; military representatives insisted this would make it almost impossible for the Soviets to track where in the US these 50 missile-laden trains had gone. "Rail-garrison will be the mainstay of our strategic defense well into the 21st century," predicted one Texas Senator.

The Cold War ended before a single missile could roll onto the tracks. When the Soviet Union broke apart in 1991, the US began decommissioning much of its nuclear arsenal and discontinued expensive, experimental projects like Peacekeeper Rail Garrison. But in 2013, the US Air Force briefly toyed with the idea of a similar system, which would move missiles around the tracks of an underground subway system. The Air Force's rationale remained much the same: if you could keep the missiles moving, you would deter attackers and make it be nearly impossible to pinpoint the weapons' exact location. Critics have dismissed this proposal as a pie-in-the-sky idea, and even its proponents conceded it would likely take another 50 years to make such a project operational.

By the late 1980s, the United States had 120,000 miles of available track, 20,000 locomotives, and 1.2 million railcars. At any given time, there were more than 1,700 trains on the tracks; military representatives insisted this would make it almost impossible for the Soviets to track where in the US these 50 missile-laden trains had gone.

Today's nuclear infrastructure—much of which is focused on decommissioning rather than building weapons—is reliant on Safeguard Transporters and their armed drivers. Much like the rest of the America's nuclear arsenal, many of the trucks are antiquated; about half of the SSTs are over 15 years old. The trucks, which log over three and a half million miles each year, are accompanied by unmarked escort vehicles and their only easily recognizable feature is their US Government license plates.

Major challenges remain for nuclear transportation in America. Plans to "modernize" America's nuclear arsenal, supported by both the Obama and Trump administrations, mean that weapons will be taking more trips than ever on American roads. Beginning in 2010, around one thousand W76 warheads traveled from Bangor, Washington back to Amarillo, Texas, for upgrades.

… Transportation of nuclear materials is currently overseen by the Office of Secure Transportation (OST), an agency that has attracted only minimal attention in the years since the fall of the Soviet Union. But a 2017 Los Angeles Times investigation suggested problems may lurk beneath the surface. OST is understaffed, with the average courier working about 75 hours a week. Turnover is extremely high. In 2010, a DOE investigation found "widespread alcohol problems" within the agency, including incidents that occurred while couriers were on secure transportation missions. The DOE conceded that these episodes "indicate a potential vulnerability in OST's critical national security mission."

Major challenges remain for nuclear transportation in America. Plans to "modernize" America's nuclear arsenal, supported by both the Obama and Trump administrations, mean that weapons will be taking more trips than ever on American roads. Beginning in 2010, around one thousand W76 warheads traveled from Bangor, Washington back to Amarillo, Texas, for upgrades to extend the life of the weapon by 30 years—a massive undertaking, entirely dependent on the OST's fleet of Safeguard Transporters. Perhaps the most pressing issue is nuclear waste and in particular, excess plutonium, most of which remains at Amarillo's Pantex plant and will need to be moved to secure disposal facilities in the years to come.

Whether waste or weapons, trains or trucks, the United States has been remarkably fortunate in avoiding major transportation mishaps. Since the days of the white trains, the government has insisted that nuclear materials are being moved across the American landscape in the safest possible way, persisting through crashes, fires, and interfering nuns. Yet public fears endure about whether moving such materials can ever truly be "safe." …

Source: https://www. history. com, 31 May 2018.

NUCLEAR WASTE MANAGEMENT

JAPAN

About that Tritiated Water: Who will Decide and When?

Virtually every news story about the Fukushima No. 1 nuclear power plant acknowledges the

tremendous ongoing problem of contaminated water that is accumulating in approximately 850 large tanks on-site. There are about 850,000 tons of water in the tanks at present, from which all radionuclides of concern except tritium — radioactive hydrogen — have been effectively removed. More water accumulates each day, in quantities roughly equal to the amount of groundwater that seeps into the damaged reactor buildings. Tokyo Electric Power Company Holdings estimates that at the current rate it will run out of tank space in 2020. Something needs to be done well before then, and the decision should address the concerns of all stakeholders, public and private.

There are about 850,000 tons of water in the tanks at present, from which all radionuclides of concern except tritium — radioactive hydrogen — have been effectively removed. More water accumulates each day, in quantities roughly equal to the amount of groundwater that seeps into the damaged reactor buildings. Tokyo Electric Power Company Holdings estimates that at the current rate it will run out of tank space in 2020.

The Ministry of Economy, Trade and Industry recently announced that meetings will be held where the public can hear explanations of proposed solutions and comment on them. Unless they think seriously about how to prevent this from becoming yet another clumsy exercise in DAD — "decide, announce, defend" — these meetings will be a mere fig leaf that will allow the government to claim it has adequately consulted the public. As it is, the government's decision-making process itself appears to be dysfunctional, and we have reason to be skeptical that it will be possible to avert very bad domestic and international public reactions if and when this water is disposed of.

Leaving the tritiated water in the tanks at No. 1 is the riskiest thing to do, due to the possibility of ruptures or uncontrolled leaks. As far back as 2014, the IAEA recommended a controlled release to the ocean as the safest course of action, and Japan's Nuclear Regulation Agency concurred.

The Subcommittee on Handling Water Treated by the Polynuclide Removal Facility is one of several Japanese government committees organized by METI tasked with formulating a response to the problem of the radioactive water. The planned public sessions were announced at its eighth meeting, on May 18, 2018. This is a step in the right direction, and is long overdue. Nevertheless it may well be a case of "too little, too late." The decision, delayed for years, will almost certainly be to dilute the water and release it to the ocean, and meanwhile, public opposition to this idea has hardened. The issue hinges on both scientific understanding and public perception.

Leaving the tritiated water in the tanks at No. 1 is the riskiest thing to do, due to the possibility of ruptures or uncontrolled leaks. As far back as 2014, the IAEA recommended a controlled release to the ocean as the safest course of action, and Japan's Nuclear Regulation Agency concurred. A Tritiated Water Task Force convened by METI in 2013 examined five options in detail, and in 2016 concluded that for reasons of cost, available technology, time required, and safety, diluting and discharging it to the ocean was the least objectionable approach. The task force presented relevant monitoring data from decades of similar releases of tritium to the ocean from nuclear facilities in Japan and abroad, noting that the quantities from the No. 1 plant would be many times smaller and the tritium levels in ocean life too low to be of real concern.

Tepco has made it clear that ocean release is its preference as well. The company says that it strives to meet government recommendations, and does not intend to act without government support, but is ultimately responsible for any actual decision. In July 2017 Takashi Kawamura, chairman of Tepco, said publicly that the decision to release the tritiated water had already been made, and the public outcry was immediate, particularly from Fukushima fishermen who expected to be consulted. The company quickly backpedaled.

Constructing the dilution facilities and pipelines that an ocean release would require is expected to require almost a year after any decision is made. At the current rate, that means the "go"

signal must be given by early 2019 at the latest. That no decision has been officially announced to date can be ascribed to the very reasonable expectation of a strong public backlash, and, I believe, the reluctance of any responsible government officials to be associated with such an unpopular decision.

… Much hinges on public understanding of the risks, and therefore on transparency. Robust and effective two-way communication is essential, not to persuade the public that official plans are acceptable, but to better equip them to participate in the debate in an informed way, and to push back where they feel it is necessary. It is the public's right to demand this kind of inclusion.

Communication should be aimed not only at fishermen and Japanese consumers, but internationally to all who are concerned about what the effect on the Pacific will be. The government has been sitting on the Task Force recommendations for almost two years without taking action. That it has taken this long to even begin planning to engage the public on this issue is, again, because no one in a governmental decision-making position wants to be politically associated with the consequences of a tritium release.

Robust and effective two-way communication is essential, not to persuade the public that official plans are acceptable, but to better equip them to participate in the debate in an informed way, and to push back where they feel it is necessary. It is the public's right to demand this kind of inclusion.

… Regardless of whether one trusts scientific opinion or Tepco, the tritiated water cannot be left in the tanks at No. 1 indefinitely, and releasing it to the ocean, though not without risk, is the least objectionable of the available options. As it stands now, given the depth of public mistrust and the nature of misinformation in our current era, the situation is ripe for the maximum misunderstanding and negative social impact to occur if and when this tritiated water is finally released. …

Source: *https:// www.japantimes.co.jp, 05 June 2018.*

Centre for Air Power Studies

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

Centre for Air Power Studies
P-284
Arjan Path, Subroto Park,
New Delhi - 110010
Tel.: +91 - 11 - 25699131/32
Fax: +91 - 11 - 25682533
Email: capsnetdroff@gmail.com
Website: www.capsindia.org

Edited by: Director General, CAPS

Editorial Team: Dr. Sitakanta Mishra, Hina Pandey, Anushree Dutta, Dr. Poonam Mann, Wg Cmdr Kaura, Sreoshi Sinha

Composed by: CAPS