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Dear readers of the WISE/NIRS Nuclear Monitor,

In this issue of the Monitor:

- An update by Jan Haverkamp on nuclear developments in Europe.
- News from Japan on reactor restarts, the plight of evacuees, and legal challenges.
- An update on the Toshiba / Westinghouse crisis, and AP1000 reactor projects in the US, the UK and India.
- Jan Haverkamp interviews Andrew Blowers, author of the book 'The Legacy of Nuclear Power'

The Nuclear News section has reports on the plan to turn South Australia into the world's high-level nuclear waste dump – the plan is now 'dead' according to the state Premier; a new report on the risks associated with spent nuclear fuel pools, and a new Bellona report on the Russian nuclear industry.

Feel free to contact us if you have feedback on this issue of the Monitor, or if there are topics you would like to see covered in future issues.

Regards from the editorial team.

Email: monitor@wiseinternational.org

Monitored this issue:

Nuclear Europe roundup

Author: *Jan Haverkamp*

Czech Republic – Dukovany and Temelín

NM845.4651 German environmentalists have started a petition to demand their government to take action on faulty welding work in the first reactor of the Temelín nuclear power station in the south of the Czech Republic. Over 75,000 signatures will be handed over before summer to environment minister Hendricks. More information is posted at www.change.org/p/stop-temelin-investigate-dangerous-welding-seams

During the European Nuclear Energy Forum (ENEF) in Prague on 23 May, Czech Prime Minister Bohuslav Sobotka declared that he saw no other way for the country's energy mix other than nuclear power. He criticised attempts to diminish its role, hinting at criticism from neighbouring Austria and Germany about Czech plans to expand its nuclear fleet with new reactors in Dukovany and Temelín. He expected the environmental impact assessment for new capacity in Dukovany to be finalised in 2018.

Slovakia – Mochovce 3,4 and New Bohunice

The Slovak Prime Minister Robert Fico announced during the same ENEF meeting that Slovakia will finalise the Mochovce 3,4 project no matter what. According to *Euractiv* on 26 May, he said that Slovakia will always strive for the further development of nuclear energy: "Our government will never abandon this policy and will always fight for the right to choose the way for the production of energy in the future." The Slovak Industry Minister Peter Žiga said at the same event that although the plan for new reactors at the Jaslovské Bohunice site is technically prepared, current economic conditions are not favourable: "We are waiting for better times, when the prices of electricity at the wholesale market will be a bit higher."

In the run-up to this year's Chernobyl anniversary, Global2000, the Austrian member of Friends of the Earth, found elevated tritium levels near the Mochovce nuclear power station in Slovakia. In the Malé Kozmálovce reservoir they found 1347 Bq/l, around 13 times higher than the drinking water limit.

Hungary – Paks II

According to sources, the Convention on Nuclear Safety (CNS) 7th Review Conference discussed the recent law changes in Hungary that could infringe on the independence of the nuclear regulator HAEA. Also the European Commission continued communication with Hungary on the issue. A final result of its inquiry is expected in the coming months.

The Hungarian government appointed former Paks director and mayor of the city of Paks János Süli as a special minister without portfolio for the Paks II project. Rosatom opened a tender procedure for the turbine building and related accessories.

EnergiaKlub and Greenpeace filed a court appeal on 24 May against the approval of the environmental license for Paks II.

Finland – Olkiluoto 3, Hanhikivi

The owner of the Olkiluoto 3 project, TVO, announced it will drop its compensation claims in the international arbitration court against Areva. This in an attempt to ensure that the Olkiluoto 3 reactor will go into a test phase in the coming year.

The town of Helsinki decided to try to get out of Fennovoima, the company behind the Hanhikivi project. This will not be easy, though, because it is only is a minority shareholder in Vantaan Energia, the company over which it owns shares in Fennovoima.

Nuclear regulator STUK announced recently that it will not be able to process the Fennovoima documentation before the end of 2018. Finland is facing parliamentary elections in April 2018.

Russia – the floating reactors of the "Akademik Lomonosov"

Greenpeace Russia made an assessment of the nuclear regulatory oversight over the construction of a floating nuclear power station in the centre of St. Petersburg, 3.5 km from the Hermitage. It came to the conclusion that there is only one annual pre-announced inspection visit by the Russian nuclear regulator Rostechnadzor. It calls for the same regulatory oversight of the entire project, including construction and transport, as other Russian nuclear power stations. A proposal along those lines from the Yablokov fraction in the town's parliament environmental committee was approved on 1 June and has to be confirmed later this month in a plenary session.

Spain – Santa Maria de Garoña, Almarez

During a seminar in the European Parliament, Spanish and Portuguese Parliament members asked that attention be given to the upcoming life-time extension of the Almarez nuclear power plant in Spain, as well as for the plans to restart Santa Maria de Garoña. They demanded public participation before the final decisions for these life-time extensions.

The restart of Santa Maria de Garoña by regulator CNS been conditional on upgrade investments. While 50% owner Iberdrola already said it wanted to refrain from re-opening the reactor, Endesa, the owner of the other 50%, prefers to wait for the decision of the Ministry of Energy.

Initially, the submission period for a request for life-time extension of the Almarez nuclear reactor would run out on 7 June. However, the Ministry of Energy with the support of CNS changed the procedure so that it now still has two years to do so.

Belgium – Tihange and Doel

Preparations for a human chain from Tihange (Belgium), over Maastricht (Netherlands) to Aachen (Germany) on 25 June over 90 km are in full swing. The event is receiving support from German and Dutch municipalities most affected by the power station, as well as from a broad range of people from culture and media, including the annual Dutch PinkPop rock festival. More information: www.chain-reaction-tihange.eu/en/

Belarus – Astravets

During the European Nuclear Energy Forum, 22 May in Prague, Lithuanian vice-minister for the environment Martynas Norbutas heavily criticised the Astravets project, 20 km from the border with Lithuania. He explained among others that the site choice happened without being informed by an environmental impact assessment, and based on population densities in Belarus but excluding Lithuania.

The Lithuanian – Belarussian tensions are expected to influence the Meeting of Parties of the Espoo Convention that takes place June 13–16 in the Belarussian capital Minsk.

Jan Haverkamp is expert consultant on nuclear energy and energy policy for WISE, Greenpeace Central and Eastern Europe, Greenpeace Switzerland and vice-chair of Nuclear Transparency Watch.

Fukushima Fallout: Updates from Japan

NM845.4652 The latest issue of *Nuke Info Tokyo*, the bimonthly English-language newsletter produced by Japan's Citizens' Nuclear Information Centre (CNIC), has been published. It's well worth subscribing to the newsletter and it's free – email cnic@nifty.com. Some of the content from the latest newsletter is summarized here.

Federation for Nuclear-Free Renewable Energy Launched

"Genpatsu Zero – Shizen Enerugi Suishin Renmei" (translated as "Federation to Promote Nuclear-Free Renewable Energy") was established on April 14, with a press conference held in Tokyo. Tsuyoshi Yoshiwara,

who has served as advisor to the board of the Johnan Shinkin Bank and has appealed for the elimination of nuclear energy from a managerial standpoint, was appointed as president. Hiroyuki Kawai, who represents "Datsu Genpatsu Bengodan Zenkoku Renrakkai" (the Nationwide Liaison Association of Nuclear-Free Defense Lawyers), was appointed managing director. Two former prime ministers – Junichiro Koizumi and Morihiro Hosokawa – are listed as advisers.

Reactor restarts

Kansai Electric Power Co.'s (KEPCO's) Takahama Unit 4 reactor (PWR, 870 MW) was restarted on May 17, and Takahama Unit 3 (also PWR, 870 MW) was restarted in early June. Together with Kyushu Electric Power Co.'s Sendai Units 1 and 2 (both PWR, 890 MW) and Shikoku Electric Power Co.'s Ikata Unit 3 (PWR, 890 MW), which have previously resumed operation, this will make five nuclear reactors that have been restarted in Japan. All of them are pressurized water reactors (PWR). Not one boiling water reactor (BWR) has yet been restarted.

CNIC statements on compensation for Fukushima victims and Takahama reactor restarts

CNIC recently released two statements on court cases related to nuclear issues, which have been translated into English so that international readers can read about these important court rulings as well as get an update on what is happening on the legal scene in Japan.

In May 2016, Nuke Info Tokyo #172 published an article on court cases associated with nuclear facilities in Japan after the Otsu District Court in Shiga Prefecture, western Japan, issued a provisional injunction ordering Kansai Electric Power Company (KEPCO) to shut down Takahama Units 3 and 4. Unfortunately this court order was overturned by the Osaka High Court, the subject of one of the CNIC statements. Although the higher court in Osaka overturned the lower court's injunction on Takahama, the fact that this NPP was unable to operate over the past year is significant, both in terms of reducing the risk of an accident during this time and in disrupting the finances and planning of KEPCO.

The other CNIC statement applauds the Maebashi District Court for its ruling which makes clear that the government of Japan and TEPCO may be liable for the Fukushima Daiichi accident. It is hoped that the Maebashi District Court's judgment will not be overturned even though TEPCO and the government have lodged an appeal.

The two statements are posted at: www.cnic.jp/english/?p=3851

India-Japan Nuclear Cooperation Agreement approval bill passes the Lower House of the Diet

The India-Japan Nuclear Cooperation Agreement, which was signed with great fanfare when Indian PM Narendra Modi was visiting Japan in November 2016, has since been working through the Japanese ratification process. It was presented to the Lower House of the Diet on April 14 and was then referred to the Lower House Committee on Foreign Affairs for deliberation.

After two hours of deliberations on April 28, when Committee members questioned three witnesses, and then another full day of questioning, the Minister of Foreign Affairs and related bureaucrats on May 10, the Committee approved the Agreement in the vote on May 12. Many serious questions were raised by both the independent witnesses and opposition lawmakers, such as whether provisions in the Agreement would adequately prevent India, a country possessing nuclear weapons, from using Japanese technology for military purposes; if India conducted another nuclear test, would Japan even be able to end the Agreement? And even if they could, what could be done about reactors that had already been sold to India? There were no clear answers from the Minister down and it seemed that they were hardly serious about debating this vitally important issue, knowing that they had the numbers to push it through.

After clearing the Committee in this way, the bill was sent back to the Lower House where Shinji Oguma, an MP from Fukushima, led the opposition against it. Once again, however, because of the ruling coalition's overwhelming majority, the serious problems with the Agreement, which were again emphasized by Oguma and others, were ignored and the bill passed. The battleground shifted to the Upper House, which approved the Agreement on June 7.

Evacuation orders lifted for Iitate, Kawamata, Namie, Tomioka

The Japanese government has lifted evacuation orders for zones it had designated as "areas to which evacuation orders are ready to be lifted" and "areas in which residents are not permitted to live" as a result of the Fukushima Daiichi nuclear accident. The orders were lifted in Iitate, Namie and the Yamakiya district of Kawamata on March 31 and in Tomioka on April 1. Evacuation orders for "areas where it is expected that residents will face difficulties in returning for a long time" (or, more briefly, "difficult-to-return zones") remain in place.

The evacuation orders originally affected a total of 12 municipalities, but had been lifted for six of those as of last year. The latest rescission of orders has brought the ratio of refugees allowed to return to their homes to about 70%, with the area still under evacuation orders reduced to about 30% of its original size. TEPCO intends to cut off compensation to these refugees, with a target date of March 2018, roughly a year after the evacuation orders were lifted. Additionally, the provision of free housing to "voluntary evacuees," who evacuated from areas not under evacuation orders, was discontinued at the end of March 2017.

The number of people forced to abandon their homes due to the Fukushima nuclear accident reached a peak of 164,865 people in May 2012, when they had no choice but to evacuate. Now, even six years later, 79,446 evacuees (as of February 2017) continue to lead difficult lives as refugees.

In the six municipalities for which the evacuation orders were lifted last year, the repatriation of residents has not proceeded well. Repatriation ratios compared to the pre-disaster population have been about 50 to 60% for

Hirono and Tamura, about 20% for Kawauchi, and not even 10% for Naraha, Katsurao and the Odaka district of Minamisoma, where radiation doses were high.

The number of evacuees affected by the current lifting of evacuation orders for the four municipalities is 32,169. The ratio of positive responses to a residents' opinion survey conducted by the Reconstruction Agency from last year to this year saying they would like to be repatriated was rather low, with about 30 to 40% for Iitate and Kawamata, and less than 20% for Namie and Tomioka. During the long course of their evacuation, spanning six years, many of the residents had already built foundations for their lives in the places to which they had evacuated.

In a Cabinet Decision on December 20, 2016, the Japanese government adopted a "Policy for Accelerating Fukushima's Reconstruction." This policy promotes the preparation of "reconstruction bases" in parts of the "difficult-to-return zones" and the use of government funds for decontamination toward a target of lifting the evacuation orders for these areas in five years and urging repatriation. "Difficult-to-return zones" span the seven municipalities of Futaba, Okuma, Tomioka, Namie, Iitate, Katsurao and Minamisoma. By area, they account for 62% of Okuma and 96% of Futaba. The affected population numbers about 24,000 people.

The government's repatriation policy, however, is resulting in bankruptcies. Rather than repatriation, they should be promoting a "policy of evacuation" in consideration of current conditions. Policies should be immediately implemented to provide economic, social and health support to the evacuees, enabling them to live healthy, civilized lives, regardless of whether they choose to repatriate or continue their evacuation.

Citizens' Nuclear Information Centre, May/June 2017, Nuke Info Tokyo No. 178, www.cnic.jp/english/?p=3868

Update on the Toshiba / Westinghouse crisis

Author: *Jim Green – Nuclear Monitor editor*

NM845.4653 *Nuclear Monitor* has been covering the Toshiba / Westinghouse crisis in detail, on the expectation that it might soon reach a dramatic resolution, and because we think it is useful to have a detailed record of these momentous developments. The resolution might yet be dramatic but it won't be reached anytime soon. Japanese conglomerate Toshiba and its US nuclear subsidiary Westinghouse are undergoing complex negotiations about restructuring options, including selling profitable parts of their operations to stave off bankruptcy. Decisions on the fate of the four Westinghouse AP1000 reactors under construction in the US are also unfolding slowly.

The best-case scenario from the point of view of Toshiba and Westinghouse is that both companies survive – albeit with some painful downsizing. And they hope that the US AP1000 projects will be completed, though the fate of those projects is largely out of their hands. Even in the best-case scenario (from their point of view), much damage has already been done: the multi-billion-dollar cost overruns with the US reactor projects, and the near-collapse of nuclear industry giants, will have a chilling effect on the global nuclear power industry for decades to come.

Toshiba

Toshiba announced on May 15 that it expects to report a consolidated net loss of ¥950 billion (US$8.6 billion) for the 2016-2017 financial year which ended March 31.[1] But the figure was an unaudited projection as the company and its auditor PricewaterhouseCoopers (PwC) Aarata remain in dispute about Toshiba's accounting for cost overruns with the four AP1000 reactors under construction in the US.

Toshiba said it aims to file a financial report with the Tokyo Stock Exchange and Tokyo's Kanto Finance Bureau by the legally required deadline of June 30. But audited figures will not be available ahead of a June 28 general meeting of shareholders. An extraordinary general meeting will be held at a later date to present audited financial figures. "The company expresses its sincere apologies to its shareholders, investors and all other stakeholders for any concerns or inconvenience caused by this situation," Toshiba said in a statement.[2]

In addition to the unresolved dispute over Toshiba's historical accounting for AP1000 cost overruns in the US, the company is unsure how much it will have to pay US utilities building those reactors, further complicating efforts to accurately assess its financial position. And Westinghouse's Chapter 11 bankruptcy filing further complicates the process. *Nikkei Asian Review* reported: "The Chapter 11 bankruptcy filing itself also is slowing the process. Westinghouse looks to firm up a turnaround plan in late July, which will confirm the extent of Toshiba's losses. This will let PwC Aarata kick the auditing process into high gear."[3]

Toshiba's efforts to find a new auditor to replace PwC Aarata have been unsuccessful. Finding a new, second-tier auditor in a short space of time to endorse figures from the past fiscal year, when a large auditing firm has refused to sign off on those figures, has proven to be impossible.[4]

Thus Toshiba plans to work with PwC Aarata to finalize figures for the March 2016 to March 2017 fiscal year, and then to find a new auditor. *Nikkei Asian Review* reported: "PwC Aarata has reportedly agreed to audit Toshiba's earnings only under certain conditions, including further investigation into the Westinghouse problems. Ironing

out these issues is likely to take some time. Toshiba may submit a request soon to the Financial Services Agency to extend the securities report deadline beyond June. Some company insiders say the final report may not come out until around September."[5]

One of Toshiba's many problems is that its efforts to sell its lucrative NAND flash memory chip business are being frustrated by joint partner Western Digital. US-based Western Digital announced on May 14 that several of its SanDisk subsidiaries have filed a request for arbitration through the International Chamber of Commerce related to flash-memory joint ventures operated with Toshiba.[1]

Western Digital wants to increase its stake in NAND but its proposed purchase price is "low-ball" according to Nisha Gopalan, a *Bloomberg* columnist.[6] Gopalan wrote on May 29: "Western Digital has Toshiba over a barrel. It took the Japanese company to the International Chamber of Commerce's International Court of Arbitration, and has refused to allow Toshiba to use its shares as collateral to access a much-needed 700 billion yen credit line. Western Digital has since softened its stance, but the point's been made: There's not going to be a sale unless Western Digital is invited to the party."[6]

Arbitration between Western Digital and Toshiba could take a year or so.[7] But Toshiba doesn't have that amount of time to sort out its current mess. It has to recover its financial situation, and produce audited financial figures, to avoid a stock-exchange delisting that would make the company's current situation much worse and possibly irretrievable. A negotiated settlement over the sale of NAND seems likely.[8]

In a piece titled 'Toshiba: From nuclear renaissance to nuclear nightmare', market analyst Venkat Subramaniam notes that Toshiba faces "significant risks on a number of fronts – e.g. delisting risk with the TSE [Tokyo Stock Exchange], banks pulling the plug, execution risk with NAND sale, getting auditor sign-off on the accounts, and the very real possibility of crippling additional liabilities on the Westinghouse side."[9]

A growing number of Toshiba's subsidiaries and affiliates are withdrawing money from the parent company, seeking to minimize risks and appease shareholders.[10]

Associated Press reported on May 31 that Toshiba is facing 20 lawsuits in Japan filed by banks, individuals, overseas investors and other parties seeking damages totaling ¥50 billion (US$455 million).[11]

Masashi Goto, a former Toshiba engineer who specialized in nuclear containment vessels, told *Associated Press* that nuclear reactors can be likened to bedridden patients, who must be cared for and eventually properly buried – an onerous, decades or possibly centuries-long task for the industry. "Even after Fukushima," he said, "Toshiba management did not have the wisdom to change course."[11]

Westinghouse

Mark Marano, Westinghouse's chief operating officer, said on May 23 that Toshiba has "signalled pretty clearly to the market" that it wants to divest a majority stake in Westinghouse.[12] The process of selling Toshiba's 90% stake in Westinghouse "may materialize into the fall, once we get further along in the Chapter 11 process," Marano said.[12]

But previous efforts to sell Westinghouse have failed and future attempts will be unlikely to succeed unless Westinghouse is sold for a song (Toshiba chief executive Satoshi Tsunakawa said in mid-March that Toshiba might have to pay a buyer to take Westinghouse off its hands[13]) and/or broken up into bite-sized chunks. There will certainly be bidders for Westinghouse's profitable operations.

Westinghouse says it plans to file a business plan with the bankruptcy court in July, but approval of the plan may have to wait until "some months after" according to company executive David Howell.[12]

Westinghouse's interim president and CEO José Gutíerrez said on May 24 that the company remains committed to its reactor design business and will pursue future sales with opportunities in China, India, Turkey and the UK.[14] That may be wishful thinking, of course.

Westinghouse is working to develop a "more achievable delivery model" to reduce risk, Gutíerrez said.[14] The company hopes to remain involved in the nuclear industry in areas such as engineering and procurement, instrumentation and controls, and fuel services – but will no longer take on reactor construction contracts such as the AP1000 projects that have led it to seek bankruptcy protection. "Construction is not our forte, and we certainly have decided from a risk perspective, never to do that again," David Howell said.[15]

One of the company's problems is keeping skilled staff – and more broadly, the lack of skilled, experienced staff goes some way to explaining the failure of the US AP1000 projects, and the failure of the AP1000 projects will make a bad situation worse. Westinghouse notified around 75 former senior managers in April that it will stop paying their pension entitlements, thus removing a benefit that has helped the company retain top talent.[16] Some of the former managers may take Westinghouse to court, *Reuters* reported on May 25. Former Westinghouse CEO Steve Tritch told *Reuters* the company may struggle to keep top talent without the plan in place.[16]

Westinghouse's ability to keep skilled staff was further strained by a lockout of over 170 workers from the company's Newington plant in New Hampshire, and a smaller facility at Pease Development Authority, beginning May 21. Westinghouse wanted workers to sign a new agreement freezing wages for three years and severely curtailing conditions relating to health care, pensions, and severance packages.[17] Newington worker and union leader Duane Egan said the union is willing to forgo wage increases but the contract put forward by Westinghouse "strips us of most of our benefits, and we're not agreeable to that."[18] The two-week lockout ended on June 5 with a compromise agreement on employment conditions.[19]

The Newington plant manufactures the reactor vessel barrel and the parts that go into it for AP1000 nuclear

power plants. Currently, it is working on reactor vessel parts and coolant pumps that will go into the AP1000 projects in Georgia and South Carolina.[18]

Further disputes between Westinghouse and other unions are anticipated in the coming months. Union members claim that Westinghouse is trying to bring union employees in line with its non-unionized workers, who have seen their pensions frozen, their severance pay slashed, and their health-care costs increase in recent months.[18] Westinghouse has 713 union employees across its operations, according to the company's bankruptcy documents, a small fraction of its total workforce which numbers around 11,500 worldwide.[18]

Westinghouse is also having problems at its nuclear fuel plant in Columbia, South Carolina. Since finding an accumulation of uranium in an air pollution control device last year – leading to a shut-down of part of the plant for several months – the Nuclear Regulatory Commission has cited one additional violation related to the same piece of equipment. The NRC says it will conduct comprehensive performance reviews annually instead of every two years.[20]

The problems just keep piling up for Westinghouse. The *Pittsburgh Post-Gazette* reported on June 6:[21]

"In new documents, Westinghouse disclosed a litany of lawsuits, including those stemming from its AP1000 construction projects. It also listed conflicts that may at some point lead to more lawsuits, including potential breach-of-contract claims against Curtiss-Wright Electro-Mechanical Corp., whose Cheswick plant makes reactor coolant pumps. Defects in coolant pumps delivered to Westinghouse's AP1000 projects in China and in the U.S. delayed progress there.

"Westinghouse indicated it is mulling an action against its Japanese parent company, Toshiba Corp., for breach of contract. And the company disclosed that it received a subpoena from the U.S. Securities and Exchange commission in March, a year after Toshiba confirmed the federal agency is investigating it for potential fraud around an accounting scandal."

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AP1000 reactor projects in the US, the UK and India

Author: *Jim Green – Nuclear Monitor editor*

NM845.4654 It remains unclear whether the four partially-built Westinghouse AP1000 reactors in the US will be completed – and it will probably remain unclear for some months. Westinghouse CEO Jose Gutierrez said the company is working with the owners of the Vogtle and V.C. Summer nuclear plants – Southern Co. in Georgia, and SCANA Corp. in South Carolina – "to find a long-term solution to complete those reactors".[1] Gutierrez said he hopes more reactors get built in the US and that "we hope they do a better job than we did".[1]

Southern Co. CEO Thomas Fanning said a decision may not be made on the Vogtle project in Georgia until August.[2] A decision on the Summer project in South Carolina might be made by the end of June[3] – but none of the deadlines associated with the crisis are being met and it's unlikely the fate of the Summer project will be decided this month.

Work is proceeding on the Vogtle and Summer projects, albeit without Westinghouse funding, under interim agreements. The latest agreement to continue work on the Vogtle project expired on June 5 (an agreement extending to June 3 was extended for 48 hours). Presumably there will soon be another announcement extending the interim agreement – or possibly a more significant, decisive announcement on the future of the project. The interim agreement to keep the South Carolina project moving ahead ends on June 26.

Anya Litvak summarized some recent developments in the *Pittsburgh Post-Gazette* on June 6:[4]

"On May 16, Westinghouse reached a tentative agreement with Southern Co., the parent of the utility that commissioned the Plant Vogtle AP1000 projects in Georgia. The deal called for Southern to take over responsibility for completing the construction. The two parties were supposed to finalize a path forward by Sunday, but they were still negotiating Monday.

"Parallel discussions are ongoing between Westinghouse and Scana Co., which owns the two AP1000 units under construction at V.C. Summer in South Carolina.

"It has been rumored for months that Fluor Corp. and Bechtel Corp., two of the country's largest engineering and construction firms, might be preparing bids to take over the projects in Georgia and South Carolina. Fluor was brought in by Westinghouse more than a year ago to straighten things out after the nuclear firm's ill-fated takeover of the nuclear construction firm that was previously in charge of that effort, Stone & Webster. Bechtel, according to the recently filed financial statements, has also been on the job since at least January, as evidenced by two "staff augmentation contracts," one at each site."

Westinghouse is expected to break its construction contracts with the owners of the Vogtle and Summer projects but would gladly remain involved in some capacity if asked to do so. The owners must estimate the costs required to complete the reactors and then decide whether (and how) to proceed. Possible funding sources include contractual guarantees from Westinghouse's parent company Toshiba, further government subsidies, and ratepayers.

The extension of a federal government tax credit program has been seen as the most likely way of securing federal support for the Vogtle and Summer projects. The extension could translate into about US$2 billion in funding support for each of the projects. But Congress has not supported an extension to date, and if it arrives it may be too late to save the projects.[5]

Toshiba is reportedly prepared to pay about US$3.6 billion towards the completion of the Vogtle plant, payable over at least three years. The agreement is not final and is said to be contingent on a similar agreement between Toshiba and the owners of the Summer plant.[6] But that US$3.6 billion may not be enough to complete the Vogtle plant.[7] Likewise, Toshiba's commitment to pay about US$1.7 billion towards the completion of the Summer plant isn't set in stone, and it may not be sufficient to complete the plant.[3]

There has been speculation that Toshiba may seek bankruptcy protection in Japan, just as Westinghouse has in the US, which would probably be the final straw for the Vogtle and Summer projects – but it remains nothing more than speculation.[3]

Another possible source of funding to help complete the reactors would be to once again increase power bills in Georgia and South Carolina. Ratepayers are paying in advance for the Vogtle and Summer projects. Georgia Power had collected almost US$1.2 billion by the end of 2016 to pay for Vogtle.[8] Power prices in South Carolina have increased by 20% since 2009 to pay for the Summer reactors[3] and at least US$1.4 billion has been collected.[9]

Public utility commissions would need to approve further rate increases. Numerous increases have been approved as the cost of the reactor projects has escalated time and time again. Ratepayers are fed up, and politicians or commissioners proposing further increases might find themselves out of a job. The *Atlanta Journal-Constitution* said that funding the two AP1000 reactors in Georgia "may become the most volatile issue of the 2018 campaign for governor, lieutenant governor, Congress, the state Legislature, and perhaps dogcatcher."[10]

Given the history of state utility commissions repeatedly approving further imposts on ratepayers, no-one would be surprised if power bills are increased yet again. But there is some push-back. Public Service Commissioner Bubba McDonald said Georgia Power should voluntarily stop billing ratepayers for Vogtle costs, and the Public

Service Commission has asked the state attorney general's office for advice as to whether it would be legal for Georgia Power to remove the charge.[11] In circumstances where existing charges are being challenged, it will be difficult to increase those charges.

Georgia Power spokesperson Jacob Hawkins said the pay-in-advance model "saves customers hundreds of millions of dollars by reducing financing and borrowing costs"[11] – but Georgians and South Carolinians have paid over US$1 billion for reactors that may never be completed. Georgians are paying about US$23 million each month – not far short of US$1 million per day – for reactors that may never be completed.[12]

Kennedy Maize, contributing editor at *Power* magazine, thinks the projects will be abandoned: "My guess – and it's just that, based on my reading of U.S. nuclear history – is that both Vogtle and Summer eventually will crater. While both utilities enjoy supine state regulators and the ability to earn on construction costs as they are incurred, that will trigger rate shock and political backlash, killing the projects. That's what we saw in the 1980s."[13]

The *Atlanta Journal-Constitution* summarized some of that unhappy history: "[C]onstruction of Plant Vogtle's first two reactors had provided a vivid example of the potential complications. Plant Vogtle was conceived around 1970, with an original cost estimate of about $660 million. Construction was expected to take about eight years. Then, Three Mile Island happened. Regulations tightened. Demand for materials and interest rates shot up in the 1980s. Construction took 13 years. The final price tag: around $9 billion."[8]

AP1000 reactor plans in the UK

NuGen's plan for three AP1000 reactors at Moorside in the UK has descended into farce. Tom Samson, chief executive of the NuGen consortium, insists the project has "100 per cent backing" from Toshiba[14] and he is "110% certain" the reactors will be built.[15] But Toshiba is 100% committed to selling its stake in NuGen and has no intention of building reactors in the UK or anywhere else ... for reasons that must be all too obvious. The likelihood of the Moorside project going ahead is closer to 10% than 110%. French company Engie recently exited the Moorside project, forcing Toshiba to acquire its 40% stake based on contractual agreements, and previously Iberdrola and SSE exited the project.[16]

Samson says there is a "universe of options ... to progress this phenomenal project of national significance".[14] South Korea's Kepco is the most likely saviour, but South Korean interest in NuGen dates from 2013, if not earlier, yet nothing has been agreed – and the recent election of Moon Jae-in as President may complicate South Korean involvement in NuGen. A delegation from China's State Nuclear Power Technology Corporation (SNPTC) visited the UK in May, reportedly to meet NuGen. The *Carlisle News and Star* reported that "both organisations have not denied that such a meeting will take place."[17] Chinese involvement has raised national security concerns[18] that could scupper any such involvement.

NuGen has set up a 'strategic review' to assess whether the Moorside project can be revived.[19]

Meanwhile, David Wright, a director at UK's National Grid, says he is "sure" that the NuGen project will go ahead – his confidence based on discussions with Tom Samson (!). But National Grid recently suspended its £2.8bn (US$3.6bn) project to provide a transmission link to the Moorside site.[20]

Oliver Tickell and Ian Fairlie wrote an obituary for Britain's nuclear renaissance in *The Ecologist* on May 18.[21] They concluded: "[T]he prospects for new nuclear power in the UK have never been gloomier. The only way new nuclear power stations will ever be built in the UK is with massive political and financial commitment from government. That commitment is clearly absent. So yes, this finally looks like the end of the UK's 'nuclear renaissance'. Not with a bang, nor even with a whimper, but with a deep and profoundly meaningful silence. Not a moment too soon."[21]

AP1000 reactor plans in India

World Nuclear News reported on June 2 that six AP1000 reactors planned for the Mithi Virdi plant in the Bhavnagar district of India's northern Gujarat state will now be constructed at the Kovvada site in the southern state of Andhra Pradesh.[22] But there's precious little chance of AP1000 reactors being built anywhere in India. Both Toshiba and Westinghouse are exiting the reactor construction industry, and it's doubtful whether another company or utility would take over the project.

No binding contracts have been signed. No-one has any idea where the money might come from to pay for the AP1000 reactors. India's liability law remains an obstacle. And public opposition is still a major obstacle – public opposition goes a long way to explaining the decision to abandon the Mithi Virdi AP1000 project and opposition will be keenly felt in Andhra Pradesh.[23] That is, opposition will be keenly felt if the Andhra Pradesh project gathers any momentum, which seems unlikely for the foreseeable future.

Nuclear Engineering International reported on May 9 that India has asked Toshiba to offer ways to resolve the issue of reactor sales following the bankruptcy of its subsidiary Westinghouse.[24] A firm agreement on AP1000 reactors was meant to be concluded by the end of June 2017, but that deadline will come and go without any agreement. *Nuclear Engineering International* also reported that India is seeking a loan of around US$8–9 billion from the US Export-Import Bank to part-fund the AP1000 reactors.[24] But there is very little likelihood that the Export-Import Bank will provide the funding.

According to a recent *Reuters* report, India's Cabinet has decided that foreign reactors will not be bought unless such reactors are already in operation elsewhere.[25] Likewise, Sekhar Basu, secretary of India's Department of Atomic Energy, said in May that potential foreign reactor suppliers "have to sort out their financial issues before anything can come on the table" and India "will not buy a reactor unless a plant is operating in their own country."[26]

Some long-delayed AP1000 and EPR projects may be completed in the next couple of years; but even so, plans for AP1000 and EPR reactors in India will likely be scrapped.

In May, India's Cabinet approved a plan to build 10 indigenous pressurized heavy water reactors (PHWR). That decision clearly reflects doubts about the ability of

Westinghouse to deliver AP1000 reactors and French utilities to deliver EPR reactors. The plan for 10 new PHWRs faces major challenges[27] but suffice it here to note that the PHWR program has more chance of success than the AP1000 or EPR plans.

Suvrat Raju and M.V. Ramana wrote in *The Hindu* on June 7:[28]

"Both Areva and Westinghouse had entered into agreements with the Indian government to develop nuclear plants. Areva had promised to build the world's largest nuclear complex at Jaitapur (Maharashtra), while last June, Prime Minister Narendra Modi and U.S. President Barack Obama announced, with great fanfare, that Westinghouse would build six reactors at Kovvada (Andhra Pradesh).

"The collapse of these companies vindicates critics of these deals, who consistently pointed out that India's agreements with Areva and Westinghouse were fiscally irresponsible. If these projects had gone ahead, Indian taxpayers would have been left holding the bag – billions of dollars of debt, and incomplete projects. This narrow escape calls not only for a hard look at the credibility of those members of the nuclear establishment who advocated these deals for a decade, but for a comprehensive re-evaluation of the role of nuclear power in the country's energy mix.

"Therefore, the government's recent decision to approve the construction of ten 700 MW Pressurised Heavy Water Reactors (PHWRs) deserves to be scrutinised carefully. Strictly speaking, there is little that is new in this decision. A list of all the sites where the PHWRs are to be constructed had already been provided to Parliament by the United Progressive Alliance government in 2012. But delays with the first 700 MW PHWRs already under construction, the changed international scenario for nuclear energy, and the ongoing reductions in the cost of renewable energy all imply that these earlier plans are best abandoned."

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In the hope of a better legacy: An interview with Prof. Andrew Blowers

Jan Haverkamp interviews Andrew Blowers, Emeritus Professor at The Open University. Jan reviewed Andrew's book 'The Legacy of Nuclear Power' in Nuclear Monitor #843 and this interview explores the issues in more detail.

NM845.4655 Andrew Blowers is sitting for this interview in the very same study at home where he was confronted in 1983 as a county councillor with the proposal by the then UK authority responsible for nuclear waste, NIREX, to set up a near-surface disposal facility for low and intermediate level nuclear waste in Bedfordshire. We end our almost two hour session reflecting on what drove him to dedicate over 30 years of his life to the issue of radioactive waste and the nuclear legacy. It is that legacy that he addresses in his latest book 'The Legacy of Nuclear Power'.

Blowers: *"I find this as academic and politician intellectually fascinating. The book has an intellectual core. And when confronted with these kind of happenings, I tend to react. But basically my initial reaction was 'this is wrong, this needs to be opposed and I will commit myself to this opposition'. And I have found out, that it is fundamentally wrong, ethically and scientifically. I have now started an NGO opposing plans for a new nuclear power station at Bradwell on the Essex coast in England. Those plans are diabolical. That is the correct word. It is going to bring environmental degradation and more than that an impact for generations to come. I look at the potential danger, which I believe to be massive, and see it is all unnecessary because I believe we can do with an energy future which is not nuclear. It is a matter of faith to me. A set of values."*

Because Blowers dedicates his book to 'Varrie and our children and grandchildren in the hope of a better legacy', we discuss Václav Havel's reflections on hope in his 1986 interview Dálkový Výslech with Karel Hvíždala.

Blowers: *"Havel says that hope is not necessarily optimistic. I vary in my optimism, whether or not there will be a nuclear future for the UK. But that does not detract from that I think this is wrong and that one should oppose it and therefore I put that dedication not just for my family but for future generations in general. My hope is that we are not going to consign and hand such a future to them. Apart from that, nuclear is a nice target to have. The nuclear industry is vulnerable. Its arguments are weak and they can be countered. I am not in a cause without momentum behind it. The intellectual and moral arguments are on the side of those who are opposed."*

Five communities facing a nuclear legacy

Blowers analyses in his book the way that five communities are dealing with large nuclear legacies: Hanford in the US, Sellafield in the UK, La Hague and Bure in France and Gorleben in Germany. Hanford is a long-established legacy site. Its roots are in the second World War, the nuclear installations on the site do not function any longer, and it is all about clean-up. Sellafield is also an older site, with two-thirds of the country's legacy wastes awaiting clean-up and a few remaining production activities. The reprocessing is slowly winding down, but there are plans for a new nuclear power station at Moorside and the area is on and off in discussion for deep geological disposal of high level waste. La Hague is a still operating reprocessing site, and Bure is foreseen as the final depository for the high-level waste created in La Hague, but the process of establishing a depository is only in its early stages.

Where Blowers noticed that the first three sites were established in a period of hegemony of technology, where few questions were asked, followed by a period of confrontation moving into a more participative search for solutions, the dynamic in Bure is still in its infancy. Gorleben has a completely different history. Planned as a reprocessing site and final disposal for high level waste, local resistance slowly ground everything to a halt. Although there is still a temporary on-surface storage of high-level waste and the possibility of deep geological disposal has not been completely taken off the table, there is the impression that the region has been able to prevent becoming a major nuclear legacy spot.

The common denominator that Blowers works out is that all sites belong to the periphery of their countries: lightly populated, economically weak and politically powerless. And that they all are dealing with the longest legacy of the nuclear industry: high-level waste.

Blowers mentions in his book several times that there is said to be a consensus that deep geological disposal is the best solution for this high-level waste.

Blowers: *"A consensus? I drafted as a member of the CoRWM* [the Committee on Radioactive Waste Management, set up by the UK government in the early 2000s to advise about the policies on radioactive waste management] *the fundamental policy statement on this. We said that in the present state of knowledge, geological disposal is the best method. However, if you read the rest of those recommendations, they are qualified in the sense that this has to be preceded by a period of intermediate storage and a search for alternatives and so on. That is not the way that the British government has interpreted it. We have got to look at the time scales here. Any deep disposal in any country is a long way off, and I mean a generation off. The material we are dealing with is generation after generation after generation. And the material that would be produced by new build in the UK would have to be stored at least until the middle of the next century.*

"Whatever you think about deep disposal being potentially the ultimate solution, it isn't here and now.

The only actual solution for the most serious radioactive waste is to store it properly and effectively and that is in effect what countries are doing. But the message of that is because we do not have a long-term solution in most countries (apart from the Finns and Swedes and possibly the French), we do not have a concept that is agreed scientifically and we do not have a site that is publicly acceptable. It's a long way off and politicians tend to be stalling all the time. In the end the answer is simple. The storage is for the longer term. That is the point I would like to make. The other message is that it would be absolutely irresponsible to continue with the nuclear industry producing yet more waste which we cannot deal with, which would give us an interminable time scale without knowing what the inventory would be."

Not just technical, fundamentally social and political

Blowers mentions politics slowing down decisions, but I note that also the environmental movement is often accused of stalling progress.

Blowers: *"Radioactive waste is a social, not only a scientific problem. You cannot just dump it on people. In the case of repositories you need consent from the community. That consent is difficult to achieve. If you look at Sellafield more recently where there was an attempt to apply some of the principles of our* [CoRWM's] *radioactive waste management policy in West Cumbria, probably the most nuclear friendly part of the country, it did not get overall community consent. That was partly touched off by the opposition movement, who certainly mobilised well, but I would say that that would become difficult in any case, because it was the county of Cumbria that decided it was not going to proceed. It might be revisited, but certainly not soon.*

"If we go to Germany, one could argue that the German reluctance to go anywhere [with nuclear] *is because of the success of the Gorleben movement, which started in the late 1970s. That long, hard, broad-ranging resistance over the years did not actually stop things, but prevented things moving forward. There is a half-open mine now there, there is an interim store in Gorleben and they are still there while you have a policy of a white map. It still could go anywhere. This is deeply political, with involvement of federal structures and all the rest of it and with an industry that is in retreat, it will mean they have to focus on temporary storage at the moment. I do not get the impression there is a huge hurry about things. They have a Commission, they are nominating places to store waste in the long term, and essentially Germany is facing now a long-term storage issue while there is the ongoing discussion about where are we going to put the material in the very long term."*

Reality: temporary storage is the solution now

I bring up that the Netherlands decided to store waste for a hundred years, but in their focus on that refuse to look beyond that period.

Blowers: *"There is a failure to look at the time scales. What the Dutch have recognised is to be pragmatic and realise maybe someone will come with a solution in the long term and piggy-back on that – with small countries that is always in the back of their minds – why should we bother to be first when others tread water. Storage is the solution for the foreseeable future. It is the problem of the unforeseeable future with which we cannot deal but we have to think about it. How far can we look forward in reality. I would say not more than two generations. We may have to rely on the future looking after itself, but we cannot allow more development* [of nuclear power].

"If you look at Britain for some context. If the Chinese build Bradwell, it is, like the other proposed sites, a coastal site. All these coastal sites are very vulnerable. If we keep the spent fuel on site, we create a long term supposed solution, but it would be utterly foolish if we look at the conditions of the site. The waste it would create will be a colossal problem into the far future. My answer is: Don't build it."

Discourse the way to go

We move to the dynamic that Blowers has found at all of the five sites in the book, from faith in technology over confrontation towards some kind of more discourse oriented approach. But he also sees a backlash. Blowers concluded that that backlash is particularly strong in the UK on the basis of the argument of security – environmental and energy security. That argument was embraced by the nuclear industry. However, in spite of the open public discourse retreating, the idea of public consent is still standing. And in spite of political prevarications pushing decisions forwards in time, society still recognises the problem and is obliged to solve it.

The problem we are facing is a shift in the discourse. In 1976, the British policy was that one should not embark on further development of nuclear energy unless a solution for the long-term management of its wastes had been found. Now there is a claim, but nothing more than a claim, that nuclear can deal with this problem of managing wastes. The UK government is satisfied that a method will exist.

Blowers: *"I don't share this optimistic vision. You should not make such pronouncements until it is actual reality. Two almost empirical rules in the nuclear industry are that it will cost much more than you ever thought it would, and the other is that it will take much longer than you thought it would. There is no way you can believe the claims that have been made. I am sceptical not because I am a rabid anti-nuclear activist, but because it is a no-brainer if you look at the politics, the geological problems, the sense of priorities of people and so on."*

Nevertheless, the developments as we saw them in the mid-2000s in CoRWM and before that in the Arbeitskreis Endlagerung (AkEnd) in Germany, were interesting. Blowers explains that CoRWM was very advanced in creating discourse. There was enormous public engagement, a lot of science involved, different debating techniques. It also brought the political and ethical angle in. Blowers commented on the membership of CoRWM at that time: *"We were a motley crew of people. Not particularly with any sense of balance, but unusually having at least four of the members who were if not sceptical, actually hostile to nuclear interests, which is very rare for a government committee. Still, we came as close to a consensus as was possible."*

The recommendations were highly interrelated and interdependent and the result of a genuine discourse. The government did not entirely overturn them, but at the time the recommendations were finished, it embarked on a new build programme. Blowers: *"Instead of the measured approach we set out, they seized on the idea we had put forward for deep disposal and then wanted deep disposal as soon as possible, which is different from the recommendations we had. Without Prime Minister Blair's nuclear revival, we'd probably still be working with the full suite of recommendations. But CoRWM's main recommendations still stand."* And they are based on voluntarism, partnership, and a scientifically suitable site concept.

Periphery in France

The French setting is completely different. Blowers describes Bure, being under active development but not yet approved, as a slow Chinese torture. It is in his eyes a classic case of periphery. Tiny villages, small population, on the border of two departments. *"The secret France. However much transparency you build in, it is not going to manifest itself very powerfully in Bure, because there is not much there. So the debate is one level up on a departmental and regional level."*

Many activists in France find the use of local information committees (CLIs) a form of co-optation. It does not deliver the kind of divisive and polarised debate as you see in Gorleben. With that, the CLIs are not so distant from the industry. Blowers: *"I look at communities. The idea of periphery is more complex than it sounds, but it helps explain how you get in these communities the dependency on the industry."* He points out that because other communities do not want these nuclear activities, they are pushed to powerless places. And in these places, co-optation tools like compensation payments as in France and attraction of funds for other developments like in Hanford become very effective.

Blowers concludes his book with the moral obligation in the search for how our generation is dealing with the legacies of nuclear power in terms of procedural equity, intra-generational equity through voluntarism and an emphasis on community well-being, and intergenerational equity. We agree on the parallel with the conclusions of the German Ethics Commission on a Safe Energy Future that was established after the Fukushima disaster and gave Angela Merkel the moral basis for the German nuclear phase-out. One of the vital problems we identified is that a lot of the debate is framed in a technical scientific framework, delivering so-called hard facts. In reality, that technical-scientific debate is spattered with terms like "reasonable" and "proportional" – terms that include a deeply ethical and political dimension. I question whether the scientists involved in these debates have the ethical and political mandates to determine what is reasonable or proportional.

Blowers: *"All issues to do with the nuclear legacy are social as well as scientific. [When I started as advisor to the government] this hadn't been registered, really. Until the end of the last century, we would get scientific solutions that were just like that plumped onto the landscape. It was decide and then defend. Science driven, engineer based solutions. No idea of the social consequences."*

It was a long battle to get people realise the social side of it. The ethical dimension is a step further. Blowers: *"I am not an ethicist, by the way. I picked up that particular badge and ran with it. But there was a recognition. Scientists and engineers still go for the idea of scientific method, the rationality and the rest of it, but there is a recognition there that we also are dealing with something that is socially sensitive and has implications for future generations, as it has implications within generations – some places have to host these sites and some don't – there is an inequality there. And the ethical implications are such things as community involvement, community well-being. They were seen as typical social sciences, things you cannot really get anywhere with, with all sorts of nuances, but behind that there is something really important. The social scientists now involved in decision making have made quite some impact, which you can now recognise in how issues are brought forward. For instance in the form of the German Ethical Commission."*

At the start of the interview, we noticed we are two succeeding generations in the nuclear debate and we would discuss issues from that perspective. Binding us is the conclusion that nuclear power is a concept that has lost its sense, and what drives us to work on its role-back is the "hope" from Blower's dedication of his book as Havel defined it: Hope is definitely not the same thing as optimism. It's not the conviction that something will turn out well, but the certainty that something makes sense, regardless of how it turns out.

Jan Haverkamp is expert consultant on nuclear energy and energy policy for WISE, Greenpeace Central and Eastern Europe, Greenpeace Switzerland and vice-chair of Nuclear Transparency Watch.

NUCLEAR NEWS

High-level dump for South Australia declared 'dead'

South Australian Premier Jay Weatherill has backed away from his Labor Party government's plan to import 138,000 tonnes of spent fuel and 390,000 cubic metres of intermediate-level waste as a money-making venture.

The SA Labor government promoted the project but it began to fall apart late last year. A 350-member Citizens' Jury strongly rejected the proposal. The main opposition Liberal Party then decided to oppose it; as did in a minor party – the Nick Xenophon Team; and the SA Greens opposed it from the start. The project never gained majority public support despite furious spinning by the state government and the Murdoch press.

Earlier this week, the Premier said the project is "dead", there is "no foreseeable opportunity for this", and it is "not something that will be progressed by the Labor Party in Government".

The Premier's statements have been welcomed by Aboriginal Traditional Owners and communities and environmental groups.

Yankunytjatjara Native Title Aboriginal Corporation chair and No Dump Alliance spokesperson Karina Lester said: "Today's news has come as a relief and is very much welcomed by the Alliance. We are glad that Jay has opened his ears and listened to the community of South Australia who has worked hard to be heard on this matter. We know nuclear is not the answer for our lands and people – we have always said NO."

Narungga man and human rights activist Tauto Sansbury said: "We absolutely welcome Jay Weatherill's courageous decision for looking after South Australia. It's a great outcome for all involved."

Despite the victory, two sites in South Australia are still being targeted for a national nuclear waste dump by the federal government. Craig Wilkins, Conservation SA's Chief Executive, said: "We now look forward to the Premier standing up for the people in Kimba and the Flinders Ranges fighting against the federal government's push to impose radioactive waste from Sydney's Lucas Height's research reactor onto their communities," Wilkins said.

Spent fuel pool risks

A recent article in Science warns of the risks of densely-packed spent fuel pools in the US.[1] The article is behind a paywall but the arguments are neatly summarized in a May 25 web-post[2] by co-author Ed Lyman, senior scientist with the Union of Concerned Scientists. That post is reproduced here:

In a Policy Forum article published in this week's Science magazine, I argue, along with my co-authors Frank von Hippel and Michael Schoeppner, that the U.S. Nuclear Regulatory Commission (NRC) needs to take prompt action to reduce the alarmingly high potential for fires in spent fuel pools at U.S. nuclear plants.

The NRC allows nuclear plant owners to pack spent fuel into cooling pools at much higher densities than they were originally designed to handle. This has greatly increased the risk to the public should a large earthquake or terrorist attack breach the liner of a spent fuel pool, causing the pool to rapidly lose its cooling water. In such a scenario the spent fuel could heat up and catch fire within hours, releasing a large fraction of its highly radioactive contents. Since spent fuel pools are not enclosed in high-strength, leak-tight containment buildings, unlike the reactors themselves, much of this radioactive material could be readily discharged into the environment.

The consequences of a fire could be truly disastrous at densely packed pools, which typically contains much more cesium-137 – a long-lived, extremely hazardous radioactive isotope – than is present in reactor cores. My Princeton University co-authors have calculated, using sophisticated computer models, that a spent fuel pool fire at the Peach Bottom nuclear plant in Pennsylvania could heavily contaminate over 30,000 square miles with long-lived radioactivity and require the long-term relocation of nearly 20 million people, for average weather conditions.[3] Depending on the wind direction and other factors, the plume could reach anywhere from Maine to Georgia. My co-authors estimate the financial impact on the American economy of such contamination could reach $2 trillion[4]: ten times the estimated $200 billion in damages caused by the release of radioactivity from the damaged Fukushima Daiichi plant.

The danger could be greatly reduced if plant owners thinned out the pools by transferring their older fuel to dry storage casks. But despite the relatively modest cost of this common-sense step – about $50 million per reactor – owners won't do it voluntarily because they care more about their bottom line.

The NRC could require plant owners to expedite transfer of spent fuel to dry casks. But it refuses to do so, basing its decision on quantitative risk analyses that, as discussed in our Science article, underestimate the benefits of such a transfer by making numerous unrealistic and faulty assumptions. For example, its estimate of the economic damages of a fire in a densely packed spent fuel pool was $125 billion; nearly 20 times lower than the independent estimate of my Princeton co-authors.

In light of our findings, our article calls on the NRC to strengthen the technical basis of its risk analysis methodology by basing it on sound science and sensible policy judgments. We are confident that such an analysis will reveal that the substantial benefits of expedited transfer would more than justify the cost.

1. Edwin Lyman, Michael Schoeppner, and Frank von Hippel, 26 May 2017, 'Nuclear safety regulation in the post-Fukushima era', Science, Vol. 356, Issue 6340, pp. 808-809, http://science.sciencemag.org/content/356/6340/808
2. Ed Lyman, 25 May 2017, 'UCS in Science: The NRC Must Act to Reduce the Dangers of Spent Fuel Pool Fires at Nuclear Plants', http://allthingsnuclear.org/elyman/science-article-may-2017
3. Frank N. von Hippel and Michael Schoeppner, 2016, 'Reducing the Danger from Fires in Spent Fuel Pools', Science & Global Security, http://scienceandglobalsecurity.org/archive/sgs24vonhippel.pdf
4. Frank N. von Hippel and Michael Schoeppner, 2017, 'Economic Losses From a Fire in a Dense-Packed U.S. Spent Fuel Pool', Science & Global Security, http://scienceandglobalsecurity.org/archive/sgs25vonhippel.pdf

Russian nuclear industry spending money in the wrong places

Charles Digges summarizes[1] a new Bellona report[2] on Russia's nuclear industry:

The risk of a nuclear accident at the Kola Nuclear Power Plant near Murmansk and only kilometers from Norway's border with Russia, will continue to increase until it is closed – at the earliest in 2030 when it will have operated twice as long as it was designed to.

Kola is just one nuclear power plant that Russia is letting grow old and decay while it spends the bulk of its money building nuclear power plants in other countries, a new report by Bellona has found.

Independent international experts widely consider the Kola Nuclear Power Plant to be one of the world's most dangerous. It went into service over four decades ago, in 1973, and lacks the concrete reinforcements present in new reactor designs. This means that radioactivity could be released far easier in the event of an accident.

Although Russia makes an effort to maintain the plant, it is only becoming more worn. Most critically, the steel in its reactor vessels will become more fatigued as they continue to be exposed to radiation.

Should there be an accident at the plant, its severity is largely in the hands of the prevailing winds – which would likely focus the fallout on Murmansk's population of 300,000, and farther to the Barents Sea. Additionally, according to wind simulation models, the country of Finnmark in northern Norway, the coastal town of Tromsø and northern Sweden would also be hit.

Despite this, there are no near-future plans to close the plant. Instead, Russia invests in continual maintenance and upgrades to Band-Aid emerging problems. Norway itself contributes money and expertise to these efforts in the hopes of delaying an incident.

"Unfortunately, this also contributes to this old nuclear plant being in operation for longer," said Nils Bøhmer, Bellona's general manager and nuclear physicist, who is one of the report's co-authors. "This means that the Kola Nuclear Power Plant is an increasing safety risk for Norway."

One reason why Rosatom, Russia's state nuclear corporation, doesn't prioritize phasing out facilities like Kola is because it is spending money on building new nuclear plants in other countries. "They do this to consolidate their position internationally – the nuclear facilities act as political bridges," said Bøhmer.

Bellona's new report described these conditions for plants Russia is building in Turkey, Hungary, India, Bangladesh, Belarus, Iran, Finland and China. When these plants are up and running, Rosatom will deliver their fuel and, later, deal with their waste. They can also be used for political leverage."

Meanwhile the Kola Nuclear Power Plant continues to operate even though the Murmansk region routinely has surplus energy, particularly from safer sources like hydroelectric, wind and other renewable sources.

1. Charles Digges, 31 May 2017, 'Russian nuclear industry is spending its money in the wrong places', http://bellona.org/news/nuclear-issues/2017-05-new-bellona-report-says-russian-nuclear-industry-is-spending-its-money-in-the-wrong-places
2. Bellona Foundation, May 2017, 'Russian nuclear power – 2017', http://network.bellona.org/content/uploads/sites/3/2017/05/2017-Russian-nuclear-power-NO-ISBN.pdf

WISE/NIRS Nuclear Monitor

The World Information Service on Energy (WISE) was founded in 1978 and is based in Amsterdam, the Netherlands.

The Nuclear Information & Resource Service (NIRS) was set up in the same year and is based in Washington D.C., US.

WISE and NIRS joined forces in the year 2000, creating a worldwide network of information and resource centers for citizens and environmental organizations concerned about nuclear power, radioactive waste, proliferation, uranium, and sustainable energy issues.

The WISE / NIRS Nuclear Monitor publishes information in English 20 times a year. The magazine can be obtained both on paper and as an email (pdf format) version. Old issues are (after 2 months) available through the WISE homepage: www.wiseinternational.org

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