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A PUBLICATION OF WORLD INFORMATION SERVICE ON ENERGY (WISE) AND THE NUCLEAR INFORMATION &RESOURCE SERVICE (NIRS)

Dear readers of the WISE/NIRS Nuclear Monitor,

In this issue of the Monitor:

- Kendra Ulrich from Greenpeace Japan summarizes her important new report on the Fukushima nuclear disaster and the violation of women's and children's human rights.
- Dr Paul Dorfman writes about the French nuclear industry's failure to set aside adequate funding for decommissioning.
- We summarize the nuclear industry's deluge of bad news over the past month and suggest that a new era is approaching: the Era of Nuclear Decommissioning (END).
- We summarize debates among nuclear lobbyists about how to solve the nuclear power crisis: some favor a multinational effort focused on large light-water reactors while others argue that large reactors are the problem not the solution and favor extensive R&D with an emphasis on small reactors.

The Nuclear News section has reports on a plutonium policy conference in Tokyo; a recent interview with Belorussian investigative journalist and Nobel Prize winner Svetlana Alexievich; and problems at the US Nuclear Regulatory Commission.

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:

Fukushima nuclear disaster and the violation of women's and children's human rights – Kendra Ulrich 2

How much will it really cost to decommission the aging French nuclear fleet? – Paul Dorfman 4

Is nuclear power in crisis, or is it merely the END? 5

Nuclear lobbyists argue about how to solve the nuclear power crisis 8

Nuclear News 10

– Plutonium policy conference in Tokyo

– "We drink our milk and water, eat our bread and meat with Chernobyl"

– USA: Who's watching the nuclear watchdog?

USA: No consolidated "interim" nuclear waste dumps!

Waste Control Specialists (WCS), in Andrews County, Texas, is seeking to expand its existing hazardous waste site to include high-level waste from nuclear power plants across the country. If approved, 40,000 tons of spent fuel could be transported through cities and farmlands across the country to be stored for 40 years or longer on a concrete pad, creating a *de facto* permanent facility at a site that has not been designed or evaluated for permanent isolation.

The communities near WCS are largely Latino and lack the resources to fight off a national nuclear waste dump. WCS's Consolidated "Interim" Storage dump would be near the Ogallala Aquifer, which provides vital drinking and irrigation water to much of the central United States.

Those who live near the site do not consent. Hundreds of Texas and New Mexico residents turned out recently to tell the NRC they don't want a nuclear dump. Now we all need to make our voices heard: No Consolidated "Interim" Storage Waste Dumps! Public comments will be accepted through March 13th. Please either fill in the online submission posted at http://tinyurl.com/nirs-2017 or email the NRC: WCS_CISF_EIS@nrc.gov

Background information: www.nirs.org/campaigns/dont-waste-america/

– *Tim Judson, Nuclear Information & Resource Service*

Fukushima nuclear disaster and the violation of women's and children's human rights

Kendra Ulrich, Senior Global Energy Campaigner with Greenpeace Japan, summarizes key themes in her new report, 'Unequal Impact: Women's & Children's Human Rights Violations and the Fukushima Daiichi Nuclear Disaster'.[1]

NM839.4623 The 2011 Fukushima Daiichi nuclear catastrophe may feel like ancient history in world constantly bombarded with news of another tragedy or disaster. But for those who were impacted by the worst nuclear disaster in a generation, the crisis is far from over. And it is women and children that have borne the brunt of human rights violations resulting from it, both in the immediate aftermath and as a result of the Japan government's nuclear resettlement policy.[1]

Japan has ratified multiple international treaties that recognise the right to health as a fundamental human right. It is defined as the "enjoyment of the highest attainable standard of physical and mental health," and includes the right to information and participation as integral tenets of upholding this right.[2] Individuals must be able to make informed choices about their health and influence policy decisions that affect them.

But in the wake of the accident, unaddressed issues with Japan's nuclear policy and emergency planning, which the UN Committee on Economic, Social and Cultural Rights had warned the government about in 2001, led to the direct violation of women's and children's rights.[3]

And while the injustices faced by women and children in the immediate aftermath of the disaster were the result of policy failure and legislative inaction for a decade prior, the violations of their human rights resulting from the resettlement policy that has been rolled out under current Japanese Prime Minister Shinzo Abe are calculated and deliberate.

Fukushima-impacted women were faced with significantly greater obstacles in coping with the impacts of the disaster according to their own wishes due to a yawning gender gap in Japanese society. In fact, in the most recent ranking of the 34 OECD countries on gender wage gap, Japan was one of the bottom three with only South Korea and Estonia ranking lower.[4]

Despite these financial and social barriers, many women separated from or even divorced husbands who chose to stay in the contaminated region. They evacuated with only their children, in an effort to protect them.

But they continue to face a greater risk of poverty and are more vulnerable to financial pressures. And it is just these financial vulnerabilities that the Abe Government is exploiting now.

Thousands of Fukushima survivors from outside the designated zones will be stripped of their housing support in March 2017. The government is also moving forward with lifting evacuation orders in some of the more heavily contaminated areas in March and April of this year, even though radiation levels still far exceed long-term decontamination targets.[5] Those from areas where orders are lifted will lose compensation payments next year.

Protest in Tokyo, March 2015.

According to the most recent government data from October 2016, thousands of those losing housing support this month had nowhere else to go. They are at risk of homelessness. This means that some people may be forced to return to contaminated areas, even though they do not want to.

That is not only a direct violation of their rights under international treaty obligations, but also violates Japanese domestic law. In June 2012, the National Diet – Japan's legislature – unanimously passed the 'Nuclear Disaster Victims Support Act.' The law clearly defines the government's commitments to Fukushima disaster survivors – including the provision of full support as long as it is necessary, the right of victims to freely choose where to live, and the obligation to consider the greater vulnerability of pregnant women and children.

To be clear, the resettlement is a cynical effort to avoid a long-term exclusion zone, like the one near Chernobyl, which serves as a constant reminder that a major nuclear disaster causes irreparable damage to vast areas of land. Both in Japan and globally, the industry has been desperate to create a false reality that the contamination can be cleaned up and people's lives can return to normal.

Massive investments were made in so-called 'decontamination'. Evacuated areas, where there is little chance for success, were prioritised. This also meant that areas where people were still living and decontamination could have made a real impact on reducing exposures, were not. As a result, hot spots in these populated areas continue to be found years after the disaster.

In Iitate, which lies 30-50 km northwest of the reactor site and was heavily contaminated in the disaster, decontamination efforts are extremely limited in scope and success. Though the Ministry of Environment website declares the decontamination of Iitate 100% completed, in reality, only 24% of Iitate has even been touched (5,600 hectares 'decontaminated' out of a total municipal area of 23,013 hectares).

The remaining 76% of Iitate remains heavily contaminated mountainous forests which cannot be decontaminated, and will pose the threat of recontamination of the decontaminated areas for the foreseeable future.[6] Evacuation orders in much of Iitate will be lifted by the end of this month.

While exposure to ionizing radiation poses a risk to all people, studies of atomic bomb survivors[7] and medical radiation exposures[8-10] clearly show that women and children are much greater risk for suffering health effects from it.

The right to health includes the right to participation, yet women are woefully underrepresented in decision-making bodies for both the 'reconstruction' and emergency planning. Thus, their ability to see their concerns and needs reflected in policy decisions is quite low.

But women have not been silent victims in this whole grossly unjust system. What political processes have denied them – a mechanism to participate in the decisions that affect them – they have pursued in the courts instead. Fukushima mothers who evacuated are living all across Japan, and thousands are plaintiffs in lawsuits to fight for continuation of housing support, fair compensation, accountability on the part of TEPCO and the government for the disaster, and even criminal cases against TEPCO.

They have been at the forefront of organising resistance – from marches to nonviolent direct actions. In the face of impossible odds, they have truly shown stunning resiliency and leadership.

And we, as the international Greenpeace community, stand with them. We are calling on the Abe government to take urgent action to protect Fukushima-impacted women's and children's human rights.

We have sent a joint letter with Japanese civil society organizations to the UN Human Rights Council Special Rapporteurs asking that they assess the current situation of Fukushima survivors. We will also be submitting comments to the UN Universal Periodic Review of Japan on the plight of Fukushima victims.

And we will continue to fight beside them for their rights, for justice, and for a healthy, sustainable nuclear-free future.

Greenpeace is asking people to sign an online petition calling on the Japanese government to provide fair compensation and housing support, and to be fully transparent about the radiation risks. https://act.greenpeace.org/page/6288/petition/1

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How much will it really cost to decommission the aging French nuclear fleet?

Author: *Paul Dorfman*

NM839.4624 A recently published French governmental report has blown a significant hole in the French nuclear decommissioning strategy. The report, on the technical and financial feasibility of dismantling nuclear facilities, was produced by the National Assembly's Commission for Sustainable Development and Regional Development.[1]

In late January, the Committee took evidence from the EDF head of decommissioning and me. Given the Commission had been working on this for months, and had listened to mounds of complex data, I decided to cut to the chase and make as clear an argument as I could. What follows is that evidence.

How much have France, Germany and UK set aside for decommissioning?

Whereas Germany has set aside €38 billion to decommission 17 nuclear reactors, and the UK Nuclear Decommissioning Authority estimates that clean-up of UK's 17 nuclear sites will cost between €109–250 billion over the next 120 years, France has set aside only €23 billion to decommissioning its 58 reactors. To put this in context, according to the European Commission, France estimates it will cost €300 million per gigawatt (GW) of generating capacity to decommission a nuclear reactor – far below Germany's assumption of €1.4 billion per GW and the UK estimate of €2.7 billion per GW.

How can EDF decommission at such low cost?

EDF maintain that because of standardization of some of the reactors and because there are multiple reactors located on single sites, they can decommission at a low cost. Does this claim stack up? Well, probably not. Reactors are complex pieces of kit, and each has a differing operational and safety history. In other words, nuclear reactor decommissioning is essentially a 'bespoke' process.

Who will pay?

Germany has made multiple provision, enrolling the reactor owners involved – EnBW, EOn, RWE and Vattenfall – to pay into a state-owned fund to decommission the plants and manage radioactive waste. The UK Government will pay most of the costs for nuclear decommissioning and existing waste. In France, EDF must pay for it all. For the French, the big question is: Has EDF set aside enough money to cover the huge cost of dismantling and cleaning up its existing nuclear power stations?

EDF says it wants to set aside a €23 billion fund to cover decommissioning and waste storage for an estimated €54 billion final bill – and the difference between these two figures will be closed through the appreciating value of its equities, bonds and investments – in other words, 'discounting'. Discounting involves hoping that the value of these equities, bonds and investments will increase over time. Unfortunately, recent experience has taught us that markets can go up and down over time – especially the very long-time periods involved in radioactive waste management.

Why has EDF underestimated the costs of decommissioning and waste storage?

Even EDFs €23 billion limited provision for decommissioning and waste storage is a large sum of money for a company that has huge borrowings and enormous debt, which is currently running at €37 billion. Already, Standard and Poor and Moodys (the two biggest international credit rating agencies) have downgraded EDFs credit-worthiness over the corporation's potentially ill-advised decision to go ahead with attempting to construct two more of the failing Areva reactor design (the EPR) at Hinkley Point, UK. And any significant change in the cost of decommissioning would have an immediate and disastrous impact on EDFs credit rating – something that the debt-ridden corporation can simply not afford.

EDF's other financial woes

EDF is already in financial trouble. Along with bailing out the collapsing French nuclear engineering design company (Areva), not only must EDF bear the huge financial burden of their failing reactor new-build at Flamanville, but also pay for extending the life of France's existing nuclear power stations (to 2025), at a cost of €55 billion.

Meanwhile, the estimated cost of radioactive waste management is steadily rising. There are three elements to the waste costs: decommissioning; spent fuel and waste storage (and conditioning) prior to disposal; and spent fuel and waste disposal.

The French nuclear regulator (ASN) says that storing and disposal are much bigger and costlier problems than just dismantling the reactors. This is because nuclear waste (high and medium level waste, including spent fuel) must be dismantled and moved to a new facility, which has not even begun to be built yet. And the French authority tasked with disposal of all the countries vast and increasing waste burden (Andra) has recently ramped the estimated cost for the planned national nuclear waste repository at Cigéo, to €25 billion – and EDF must pay for most of Cigéo's construction. Although €5 billion more than EDF anticipated, it still seems a gross underestimation, and the costs are likely to rise considerably.

Spent nuclear fuel build-up

Then there's EDF's existential problems at France's high-level waste storage and reprocessing facility at La

Hague, where spent nuclear fuel stores are reaching current cooling capacity limits. This means La Hague may now have to turn away spent fuel shipments from France's reactor fleet. In any case, since ASN has identified safety problems with some spent fuel transport flasks, spent fuel transport to La Hague has substantially slowed. All this means the build-up of spent fuel at nuclear sites across France, with the associated problem of cooling the spent fuel at those sites during dry summer periods, with all that means for further escalation of rad-waste costs.

French National Assembly Commission findings

Happily, and perhaps unexpectedly, when the National Assembly's Commission for Sustainable Development and Regional Development published its final key findings last month, they came down on the side of those who voiced concerns about EDF's provisioning for reactor decommissioning and waste management, noting that there is "obvious under-provisioning" regarding "certain heavy expenses" such as taxes and insurance, remediation of contaminated soil, the reprocessing of spent fuel and the social impact of decommissioning.

The Commission found that the clean-up of French reactors will take longer, be more challenging and c ost much more than EDF anticipates.

The Commission reported that EDF showed "excessive optimism" in the decommissioning of its nuclear power plants. "Other countries have embarked on the dismantling of their power plants, and the feedback we have generally contradicts EDF's optimism about both the financial and technical aspects of decommissioning," the report states. The cost of decommissioning "is likely to be greater than the provisions", the technical feasibility is "not fully assured" and the dismantling work will take "presumably more time than expected".

Critically, the Commission's report says that EDF arrived at its cost estimate by extrapolating to all sites the estimated cost of decommissioning a generic plant comprising four 900 MWe reactors, such as Dampierre, noting that: "The initial assumption according to which the dismantling of the whole fleet will be homogeneous is questioned by some specialists who argue that each reactor has a particular history with different incidents that have occurred during its history".

So what now?

Soon EDF will have to start the biggest, most complex and costliest nuclear decommissioning and radioactive waste management programme on earth. It seems very likely that – for various reasons associated with its current bank balance – EDF may have seriously underestimated the real challenges and costs, with serious consequences for its already unhealthy balance sheet. This will have profound consequences for the French State, which underwrites EDF.

The National Assembly's report (in French) is posted at www2.assemblee-nationale.fr/documents/notice/14/rap-info/i4428/%28index%29/depots

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Is nuclear power in crisis, or is it merely the END?

Author: *Jim Green – Nuclear Monitor editor*

NM839.4625 In the last issue of *Nuclear Monitor* we reported on the crippling debts facing nuclear industry giants[1] – French utilities EDF and Areva, Japanese conglomerate Toshiba and its US-based nuclear subsidiary Westinghouse – and on pro-nuclear responses to the nuclear power crisis.[2]

Is crisis too strong a word? Nuclear advocates and lobbyists are increasingly using that language. A February 22 piece in the online investment publication *Seeking Alpha* states: "The global nuclear power generation industry is in crisis. The nuclear power companies are not undertaking many new ventures while most of the projects in progress are on the rough patch."[3]

Michael Shellenberger from the Breakthrough Institute has recently written articles about nuclear power's "rapidly accelerating crisis"[4] and the "crisis that threatens the death of nuclear energy in the West".[5] Environmental Progress, another pro-nuclear lobby group connected to Shellenberger, has a webpage dedicated to the nuclear power crisis – among other things, it states that 151 gigawatts (GW) of worldwide nuclear power capacity (38% of the total) could be lost by 2030 (compared to 33 GW of retirements over the past decade), and over half of the US reactor fleet is at risk of closure by 2030.[6]

A recent article from the Breakthrough Institute and the like-minded Third Way lobby group discusses "the crisis that the nuclear industry is presently facing in developed countries" and the reasons why "the industry is on life support in the United States and other developed economies", and asserts that "the era of building large fleets of light-water reactors is over in much of the developed world."[7] Another article from the same authors states that the nuclear power "crisis, at bottom, is the result of the industry's inability to adapt to changing economic, institutional, and technological realities."[8]

As a worldwide generalization, the nuclear power industry can't be said to be in crisis. To take the extreme example, China's nuclear power program isn't in crisis – it is moving

ahead at pace. However, large parts of the industry are in crisis. The US nuclear industry is in crisis, with no likelihood of new reactors for the foreseeable future (other than the four under construction) and a very old reactor fleet. Toshiba and Westinghouse are in crisis and their attempt to establish a Japanese/US reactor construction and export industry is in tatters.

The French nuclear industry is in crisis ... its "worst situation ever" according to former EDF director Gérard Magnin.[9] The French industry faces multiple serious problems domestically, and its EPR export ambitions are "in tatters" as *Bloomberg* noted in 2015.[10] EDF and Areva would both be bankrupt if not for the largesse of the French state.

No-one would dispute that Japan's nuclear power industry has been in crisis for the past six years, with no end in sight.

Combined, the crisis-ridden US, French and Japanese nuclear industries account for 45% of the world's 'operable' nuclear reactors according to the World Nuclear Association's database, and they accounted for 50% of nuclear power generation in 2015 (and 57% in 2010).[11]

Countries with crisis-ridden nuclear programs or phase-out policies (e.g. Germany, Belgium, and Taiwan) account for about half of the world's operable reactors and more than half of worldwide nuclear power generation.

The Era of Nuclear Decommissioning (END)

The aging of the global reactor fleet isn't yet a crisis for the industry, but it is heading that way. In many countries with nuclear power, the prospects for new reactors are dim and rear-guard battles are being fought to extend the lifespans of aging reactors that are approaching or past their design date.

Perhaps the best characterization of the global nuclear industry is that a new era is approaching – the Era of Nuclear Decommissioning (END). Nuclear power's END will entail:

- a slow decline in the number of operating reactors (unless growth in China can match the decline elsewhere);
- an increasingly unreliable and accident-prone reactor fleet as aging sets in;[12]
- countless battles over lifespan extensions for aging reactors;
- an internationalization of anti-nuclear opposition as neighboring countries object to the continued operation of aging reactors (international opposition to Belgium's aging reactors is a case in point[13]);
- many battles over the nature and timing of decommissioning operations;
- many battles over taxpayer bailouts for companies a nd utilities that haven't set aside adequate funding for decommissioning;
- more battles over proposals to impose nuclear waste repositories on unwilling or divided communities; and
- battles over taxpayer bailouts for companies and utilities that haven't set aside adequate funding for nuclear waste disposal.

As discussed in *Nuclear Monitor #837*, nuclear power is likely to enjoy a small, short-lived upswing in the next couple of years as reactors ordered in the few years before the Fukushima disaster come online.[14] Beyond that, the Era of Nuclear Decommissioning sets in, characterized by escalating battles (and escalating sticker shock) over lifespan extensions, decommissioning and nuclear waste management. In those circumstances, it will become even more difficult than it currently is for the industry to pursue new reactor projects. A positive feedback loop could take hold and then the industry will be well and truly in crisis.

Recent bad news for the nuclear industry

If nuclear power isn't yet in crisis, it is heading that way. Just in the past month there has been a steady stream of bad news for the industry – summarized here.

Of course the most significant news over the past month was Toshiba's February 14 announcement that it was booking a US$6.3 billion (€5.9bn) writedown on its US nuclear subsidiary Westinghouse and exiting the reactor construction industry.[1] *Reuters* reported on March 1 that Toshiba is seeking legal advice as to whether Westinghouse should file for Chapter 11 bankruptcy.[15] But even under a Chapter 11 filing, *Reuters* reported, "Toshiba could still be on the hook for up to $7 billion in contingent liabilities as it has guaranteed Westinghouse's contractual commitments".

Toshiba plans to sell profitable businesses to cover the debts from Westinghouse's multi-billion dollar cost overruns building AP1000 reactors in the US. Toshiba would likely sell Westinghouse if it could find a buyer, but even if a buyer could be found Toshiba would likely be stuck with the mounting debts from the US AP1000 projects due to contractual obligations.

Commercial operation dates for the two AP1000 reactors in Vogtle, Georgia have been pushed back by another three and six months – the new start-up dates are December 2019 and September 2020.[16] Originally, completion of the reactors was scheduled for 2016 and 2017. There is plenty of scope for further delays and cost overruns. Already, the combined cost overruns for the four AP1000 reactors in the US (two each in Georgia and South Carolina) amount to about US$11.2bn (€10.7bn).[17]

Georgia Power, 45.7% owner of the Vogtle AP1000 project, has suspended plans for another nuclear plant in Georgia, with more than US$50 million of ratepayers' money already wasted on the Stewart County project.[18]

The *Nikkei Asian Review* reported on February 20 that Toshiba plans to pull out of the plan for two Advanced Boiling Water Reactors at the South Texas Plant.[19] The reactors were scheduled to be completed as early as 2016 but work never began and likely never will. Toshiba booked writedowns totaling 72 billion yen (US$638 million at current rates) on the project in fiscal years 2013 and 2014.

The UK pro-nuclear lobby group New Nuclear Watch Europe said in late February that there is a danger that no new nuclear capacity will come online in the UK before 2030, and that the subsidies on offer to support new reactors are insufficient and need to be expanded.[20] The lobby group pointed to:

- delays with the EPR reactor in Flamanville, France and the possibility that those delays would flow on to the two planned EPR reactors at Hinkley Point in the UK;
- the lack of investors for the proposed Advanced Boiling Water Reactors at Wylfa in Wales;
- the acknowledgement by the NuGen (Toshiba/Engie) consortium that the plan for three AP1000 reactors at Moorside faces a "significant funding gap"; and
- the fact that the Hualong One technology which China General Nuclear Power Corporation hopes to deploy at Bradwell in Essex has yet to undergo its generic design assessment.

The *Financial Times* reported on March 2 that French company Engie booked a €1bn impairment on its nuclear decommissioning provisions in Belgium.[21]

The start-up dates for two EPR reactors in China's Guangdong province have been pushed back another six months.[22] The project is several years behind schedule – construction began in 2009/10 and the original schedule for start-up in 2014/15 has been pushed back to 2017/18.[23]

On March 1, French utility Areva posted a €665 million (US$700m) net loss for 2016.[24] Losses in the preceding five years exceeded €10 billion (US$10.5 bn).[25] A large majority of a €5 billion recapitalization scheduled for June will come from French taxpayers.[26]

On February 14, French utility EDF released its financial figures for 2016: earnings fell 6.7%, revenue declined 5.1%, net income excluding non-recurring items fell 15%, and EDF's debt remained steady at €37.4 billion.[27] All that EDF chief executive Jean-Bernard Levy could offer was the hope that EDF would "hit the bottom of the cycle" in 2017 and rebound next year.[28] The French government provided EDF with €3 billion in extra capital in 2016[29] and will contribute €3 billion towards a €4 billion capital raising this year.[27,28]

EDF is being forced to take over parts of its struggling sibling Areva's operations – a fate you wouldn't wish on your worst enemy. And just when it seemed that things couldn't get any worse for EDF, a fire took hold in the turbine room of one of its Flamanville reactors on February 9 and the reactor will likely be offline until late March at an estimated cost of roughly €1.2m per day.[30]

And that's just *some* of the nuclear industry's bad news over the past month ...

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Nuclear lobbyists argue about how to solve the nuclear power crisis

Author: *Jim Green – Nuclear Monitor editor*

NM839.4626 Michael Shellenberger from the US-based Breakthrough Institute (and sundry other pro-nuclear lobby groups) offers the following explanation for the "crisis that threatens the death of nuclear energy in the West":[1]

- Lack of standardization and scaling: The constant switching of designs deprives the people who build, operate and regulate nuclear plants of the experience they need to become more efficient.
- The "war" on nuclear power by the environmental movement ... "a powerful, $500 million annual lobby that does everything it can to deliberately make nuclear expensive."
- Too much focus on machines, too little on human beings: "Areva, Toshiba-Westinghouse and others claimed their new designs would be safer and thus, at least eventually, cheaper, but there were always strong reasons to doubt such claims. First, what is proven to make nuclear plants safer is experience, not new designs. Human factors swamp design. ... In fact, new designs risk depriving managers and workers the experience they need to operate plants more safely, just as it deprives construction companies the experience they need to build plants more rapidly."

Shellenberger has a three-point rescue plan:[1]

- 'Consolidate or Die': "If nuclear is going to survive in the West, it needs a single, large firm – the equivalent of a Boeing or Airbus – to compete against the Koreans, Chinese and Russians."
- 'Standardize or Die': He draws attention to the "astonishing" heterogeneity of planned reactors in the UK and says the UK "should scrap all existing plans and start from a blank piece of paper", that all new plants should be of the same design and "the criteria for choosing the design should emphasize experience in construction and operation, since that is the key factor for lowering costs."
- 'Scale or Die': Nations "must work together to develop a long-term plan for new nuclear plant construction to achieve economies of scale", and governments "should invest directly or provide low-cost loans."

Josh Freed and Todd Allen from pro-nuclear lobby group Third Way, and Ted Nordhaus and Jessica Lovering from the Breakthrough Institute, argue that Shellenberger draws the wrong lessons from Toshiba's recent losses and from nuclear power's "longer-term struggles" in developed economies.[2]

They argue that "too little innovation, not too much, is the reason that the industry is on life support in the United States and other developed economies":[2]

- The Westinghouse AP1000 represents a fairly straightforward evolution in light-water reactor design, not a radical departure as Shellenberger claims. Rather, it represents "just the sort of incremental innovation in design and operation that Shellenberger argues elsewhere holds the key to reducing nuclear costs."
- Standardization is important but it is not a panacea. Standardization and building multiple reactors on the same site has limited cost escalation, not brought costs down. "France, the poster child for standardization and economies of multiples in light-water reactor design and deployment, has seen modest cost escalation over time, not cost declines."
- Most of the causes of rising cost and construction delays associated with new nuclear builds in the US are attributable to the 30-year hiatus in US nuclear construction, not the novelty of the AP1000 design. The AP1000 projects in Georgia and South Carolina are "for most practical purposes ... a first-of-kind-build" and the same challenges would have been faced even if a Generation II plant had been chosen instead of the AP1000.

Reasonable regulatory reform will not dramatically reduce the cost of new light-water reactors, as Shellenberger suggests. Not even the most zealous reformers would advocate dispensing with expensive items such as containment domes or multiple redundant back up cooling systems.

They write this obituary for large light-water reactors:[2]

"If there is one central lesson to be learned from the delays and cost overruns that have plagued recent builds in the US and Europe, it is that the era of building large fleets of light-water reactors is over in much of the developed world. From a climate and clean energy perspective, it is essential that we keep existing reactors online as long as possible. But slow demand growth in developed world markets makes ten billion dollar, sixty-year investments in future electricity demand a poor bet for utilities, investors, and ratepayers.

"Liberalized electricity markets only further exacerbate the risk associated with these investments. Conventional light-water reactors are capital intensive, long-lived infrastructure that require central planning, cheap capital, and long operating lifetimes to pay off, none of which exist in liberalized markets. Neither standardized conventional light-water designs nor regulatory reform address any of these challenges, which are in fact the central challenges that investment in new nuclear capacity faces. ..."

"Standardization and learning by doing are key requirements for sustainable nuclear economics. But those criteria alone will be insufficient to make new nuclear an economically rational option so long as they are coupled to large light-water technology. Whether Gen II or Gen III, learning by doing and economies of

multiples require sufficient replication to bring declining costs. That replication is unlikely so long as the reactor in question is a 1GW, multi-billion dollar proposition, at least in the United States and Western Europe."

A radical break

The four Third Way / Breakthrough Institute authors conclude that "a radical break from the present light-water regime ... will be necessary to revive the nuclear industry". Exactly what that means, the authors said, would be the subject of a follow-up article. So readers were left hanging – will nuclear power be saved by failed fast-reactor technology[3], or failed high-temperature gas-cooled reactors[4-6] including failed pebble-bed reactors[7], or by thorium pipe-dreams[8] or fusion pipe-dreams[9] or molten salt reactor pipe-dreams[10] or small modular reactor pipe-dreams?[11,12] Perhaps we've been too quick to write off cold fusion?

The answers came in a follow-up article on February 28.[13] They want a thousand flowers to bloom, a bottom-up R&D-led nuclear recovery as opposed to Shellenberger's approach, which they characterize as "a massive, state-directed consolidation of the nuclear sector in developed economies" and a "single state-sponsored nuclear behemoth [that] would deploy a single standardized light-water reactor design".

They argue against top-down, state-led innovation: "State-led development of advanced designs, bringing together large incumbent firms and scientists from national laboratories failed in United States, France, Britain, Japan, and Germany in the 60's and 70's. It will likely fail as well in Korea, China, France, and Russia today."

The authors don't just want a new reactor type (or types), they have much greater ambitions for innovation in "nuclear technology, business models, and the underlying structure of the sector" and they note that "a radical break from the light water regime that would enable this sort of innovation is not a small undertaking and will require a major reorganization of the nuclear sector."

Beyond that, the authors offer Silicon Valley-inspired gobbledegook and flapdoodle rather than anything meaningful: "[R]adical nuclear innovation must be informed by markets, end users, and modern fabrication and manufacturing methods. This is centrally a job for entrepreneurial engineers, not scientists at national laboratories, technocrats at the Department of Energy, or division heads at Westinghouse or General Electric. Public policy that empowers nuclear innovation and entrepreneurship will need to support engineers and start-ups, not direct them."

To the extent that the four authors want to tear down the existing nuclear industry and replace it with a new one, they share some common ground with nuclear critics who want to tear down the existing nuclear industry and not replace it with a new one. Shellenberger also shares some common ground with nuclear critics: he thinks the UK should scrap all existing plans for new reactors and "start from a blank piece of paper"[1] whereas nuclear critics think the UK should scrap all existing plans for new reactors and not start from a blank piece of paper.

Small reactors

The four Third Way / Breakthrough Institute authors argue that nuclear power must become substantially cheaper – thus ruling out large conventional reactors "operated at high atmospheric pressures, requiring enormous containment structures, multiply redundant back-up cooling systems, and water cooling towers and ponds, which account for much of the cost associated with building light-water reactors."[13]

Substantial cost reductions will not be possible "so long as nuclear reactors must be constructed on site one gigawatt at a time. ... At 10 MW or 100 MW, by contrast, there is ample opportunity for learning by doing and economies of multiples for several reactor classes and designs, even in the absence of rapid demand growth or geopolitical imperatives."

Other than their promotion of small reactors and their rejection of large ones, the four authors are non-specific about their preferred reactor types. Any number of small-reactor concepts have been proposed.[11]

We've discussed small modular reactors (SMRs) frequently in *Nuclear Monitor.*[14] The bottom line is that there isn't the slightest chance that they will fulfil the ambition of making nuclear power "substantially cheaper" unless and until a manufacturing supply chain is established at vast expense ... and even then it's far from certain that the power would be cheaper and unlikely that it would be substantially cheaper.

As things stand, no country, company or utility has any intention of betting billions on building an SMR supply chain. The prevailing skepticism is evident in a February 2017 Lloyd's Register report based on "insights and opinions of leaders across the sector" and the views of almost 600 professionals and experts from utilities, distributors, operators and equipment manufacturers. The report states that the potential contribution of SMRs "is unclear at this stage, although its impact will most likely apply to smaller grids and isolated markets."[15] Respondents predicted that SMRs have a "low likelihood of eventual take-up, and will have a minimal impact when they do arrive".[16]

An analysis of SMRs in the *Bulletin of the Atomic Scientists* sums up the problems:[17]

"Without a clear-cut case for their advantages, it seems that small nuclear modular reactors are a solution looking for a problem. Of course in the world of digital innovation, this kind of upside-down relationship between solution and problem is pretty normal. Smart phones, Twitter, and high-definition television all began as solutions looking for problems. In the realm of nuclear technology, however, the enormous expense required to launch a new model as well as the built-in dangers of nuclear fission require a more straightforward relationship between problem and solution. Small modular nuclear reactors may be attractive, but they will not, in themselves, offer satisfactory solutions to the most pressing problems of nuclear energy: high cost, safety, and weapons proliferation."

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NUCLEAR NEWS

Plutonium policy conference in Tokyo

On February 23 and 24, the Tokyo-based Citizens Nuclear Information Center (CNIC) and the US-based Union of Concerned Scientists held an international conference titled 'US-Japan Nuclear Cooperation Agreement and Japan's Plutonium Policy'. The conference brought together speakers from not only the US and Japan but also Korea, Taiwan, China, France and Germany. The conference resolution read, in part:

Plutonium Policy 2017 Statement, Tokyo, 24 February 2017

We recognize that Japan must make its own decisions about nuclear power in the best interests of its people, taking into consideration issues such as its effects on energy security and the environment. Yet Japan's plutonium policy has undeniable international and regional impacts, which, as a responsible nation, it must address in order to maintain regional and international peace, safety and stability.

Japan clearly acknowledges this responsibility, as demonstrated by its international commitments – for example, in its joint declaration with the United States at The Hague Nuclear Security Summit in March 2014 where Japan mentioned "all Summit Communiqués' spirit to minimize stocks of nuclear material" and said it would "encourage other countries to consider what they can do to further HEU (highly enriched uranium) and plutonium minimization."

Some of the major conclusions we came to in our discussions were:

1) Many in countries neighboring Japan and the USA are deeply concerned about the security implications of Japan's stockpile of 48 tons of separated plutonium, as well as its plans to begin to separate up to an additional 8 tons annually at the Rokkasho reprocessing facility, starting in 2018. They regard this plutonium as both a proliferation threat, which could lead to heightened tension in the region, and a nuclear terrorism threat, due to its vulnerability to theft.

2) Although general awareness of the dangers of nuclear power generation has grown substantially since the Fukushima Daiichi accident, there is still a lack of interest on the part of the general public regarding the issues associated with reprocessing, including proliferation, nuclear terrorism, excessive cost and safety risks.

3) Reprocessing of spent nuclear fuel does not offer any advantages over storage and direct disposal with regard to radioactive waste management, energy security, or cost that would justify the major risks it poses. Japan should learn from other countries around the world that are pursuing safer, more secure and less costly alternatives – specifically dry cask storage pending deep underground disposal.

We therefore recommend that the governments of the United States and Japan:

Form joint commission(s), in the context of the US-Japan Nuclear Cooperation Agreement, to

(1) Review the issue of the Rokkasho reprocessing plant in particular with regard to its implication for regional and international security.

(2) Analyze ways of keeping Japan's existing separated plutonium safely and securely while mitigating the regional and international concern including the possibility of putting it under the custody of the IAEA.

The Chernobyl sarcophagus seen from the ghost town of Pripyat. © *Gerd Ludwig / INSTITUTE*

(3) Exchange information and analyses on plutonium disposition.

and the government of Japan together with those of China and Korea:

1) Commit to a reprocessing moratorium in order to prevent the further accumulation of separated plutonium in the North East Asian region. Japan's government should lead the way by indefinitely postponing the startup of the Rokkasho reprocessing plant since Japan has already accumulated 48 tons of separated plutonium. Other governments in the region should follow this example by committing to suspend all activities and future plans to separate plutonium through reprocessing.

The full conference resolution is posted at: www.cnic.jp/english/?p=3701

"We drink our milk and water, eat our bread and meat with Chernobyl"

"Chernobyl keeps on, much bigger than a human life. Now the effect of low radiation is setting in. We drink Chernobyl every day with our milk, with our water. Daily we eat Chernobyl with our meat and bread" – the words of Belorussian investigative journalist and non-fiction prose writer, Svetlana Alexandrovna Alexievich[1], in an interview[2] with the German daily, *Hamburger Abendblatt*.

Alexievich, 68**,** wrote a highly-praised oral history of the Chernobyl disaster, *Chernobyl Prayer / Voices from Chernobyl*, won the 2015 Nobel literature prize and spoke on February 20 at an anti-nuclear literary festival in Hamburg, *The Renewable Reading Days – Reading without Nuclear Power*.[3]

"But our newspapers and TV broadcasters don't mention any of it," she says. "The state does all it can to keep us knowing as little as possible about Chernobyl. A new death now comes in a different garment – and its mechanism has only just been set in motion.

"It's designed for centuries – that's how long the radioactive decomposition goes on. But how are we to save people from it? Chernobyl is not just a catastrophe, it is the dividing line between two worlds. It's a new perception of the world, a new realisation. The Belarussians [northern neighbors of Ukraine] describe themselves as 'black box'. Since Chernobyl the Belarussians also record information, information for everyone, for all humankind."

In Belarus, nothing was heard of the Chernobyl disaster for months, only "after it had already penetrated our tiniest fibre."

"I remember how people were evacuated. I saw old women with icons, begging on her knees not to be taken away. The sun was shining, the gardens were in bloom, why should they leave?"

She recalls women of "a suicide squad" who washed by hand the contaminated protective clothes of the meltdown clean-up workers, who were promised washing machines that never came.

Alexievich criss-crossed Chernobyl-land for three years interviewing people, most of whom were uninformed and unprepared for the disaster.

"Russia is right now building a nuclear power station in Belarus at the border with Lithuania, despite the protests of people and the Lithuanian government. Another reason why Chernobyl is still a taboo subject for us.

"Again they're touting 'the peaceful atom' while there are still cancer-suffering children in the hospitals."

The reporter suggested that in a way Trump has plagiarized Putin. Long before he came with his "America First" agenda, Putin had worked on "Russian Greatness". Who was more dangerous to world peace?

"Both, I think. God forbid that they get together like Hitler and Stalin did."

– Diet Simon

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USA: Who's watching the nuclear watchdog?

David Lochbaum from the Union of Concerned Scientists (UCS) has written an important, detailed report on problems within the US Nuclear Regulatory Commission (NRC).[1] Lochbaum is a nuclear engineer who worked at nuclear power plants for 17 years and the NRC for one year. He left the industry after blowing the whistle on unsafe practices.

The report finds that the NRC has failed to foster a positive safety culture within the agency itself. Numerous surveys of NRC employees reveal that an unacceptably high percentage of staff are afraid of reprisal and unwilling to contradict the agency's official conclusions:

The percentage of NRC workers who stated they could not disclose a suspected violation of law for fear of reprisal increased every year from 2010 to 2015, with 13% of workers falling into this category in 2015.

Surveys have shown that only 15% of the NRC workforce would be willing to raise a safety concern via the "Differing Professional Opinion Program".

53% of the NRC workforce stated that their co-workers would not use an official non-concurrence process to raise a safety concern.

In 2013, 75% of NRC workers who had raised a safety concern reported feeling negative reactions in the form of lower performance appraisals and being excluded from work activities.

A 2012 survey of the NRC's workforce revealed that 39% felt unable to raise a safety concern to their supervisors without fear of retaliation. The NRC has intervened at nuclear power plants when lower percentages of workers report fears of retaliation.

Lochbaum writes: "Taken together, what all these statistics show is that when it comes to chilled work environments, the NRC may have the largest refrigerator in town. According to several different reports, NRC staff show a marked fear of reprisal, a reluctance to formally disagree with an NRC position, and a reluctance to use their right to refuse to sign onto technical documents whose contents they disagree with."[2]

Congress should act to improve the situation. Lochbaum writes: "The US Congress needs to intervene with the NRC just as the agency intervened at plants with comparable, or lesser, signs of safety culture distress. With aging nuclear reactors and shrinking maintenance budgets, the American public needs the Nuclear Regulatory Commission to be a nuclear RoboCop – and not a Sergeant Schultz."[2]

Lochbaum proposes that House and Senate oversight committees should hold hearings into the NRC's safety culture and bring in NRC managers to testify. Two vacancies on the Commission provide another opportunity to strengthen the safety culture.

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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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