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Monitored this issue:

Yellowcake blues: Uranium bulls "as rare as white unicorns"

Author: Jim Green – Nuclear Monitor editor

Uranium bulls are "as rare as white unicorns" according to a commentary in FNArena in September 2019, and the market is "sick and dying" with uranium "quickly becoming a dinosaur of a commodity".[1]

Canadian company Cameco says it cannot see any case for construction of new uranium mines for some years to come. Chief financial officer Grant Isaac says that new mines will not win financial backing without a far stronger recovery in demand for uranium than is currently on the horizon.

"It's pretty hard to say you're going to take the risk on an asset … that isn't licensed, isn't permitted, probably doesn't have a proven mining method, when you have idle tier one capacity that's licensed, permitted, sitting there," Isaac said.[2]

Moreover, Cameco has no plans to restart mines put into care-and-maintenance in 2016 and 2017: McArthur River (and the Key Lake mill) and Rabbit Lake in Canada, and the Crow Butte and Smith Ranch-Highland in-situ leach mines in the US.[3] Plans to expand Crow Butte were abandoned in March 2019.

Instead, Cameco will continue to meet its contracts by purchasing uranium on the spot market. Delivering the company's third-quarter results, chief executive Tim Gitzel said that only 9 million pounds of uranium oxide will be produced from its mines next year, with the remainder of its requirement of 30–32 million pounds supplied from spot market purchases.[4]

Cameco's workforce in Canada has halved. Before the Fukushima disaster, the company employed more than 2,100 people in Saskatchewan. Since then, 810 mine and mill workers have been sacked, along with 219 head office employees in Saskatoon.[5]

Cameco announced a small loss for the third quarter[6] and the company's share price is down more than 75% from the pre-Fukushima price.

Another problem hanging over the company's head is the Canada Revenue Agency's appeal against a Federal Court of Appeal ruling in favor of Cameco. The CRA alleged that Cameco avoided paying as much as C$2.2 billion in tax through its use of a subsidiary in Switzerland.[7]

Gitzel remains bullish, claiming that demand will increase (which seems unlikely) and that production is decreasing (in fact, following years of oversupply after the Fukushima disaster, demand is now roughly equivalent to primary plus secondary supply). He seems to be in denial about the fact that the nuclear power industry will need to run just to stand still: that it will have to markedly increase new build just to match the closure of aging reactors over the next few decades.

Resources journalist Tim Treadgold opined in August 2019:[8]

"The core problem, too much material chasing a slow-growing (or even declining) market, has not been solved despite claims from supporters of the industry that better times are just around the corner. The truth is that better times have been out of reach for decades with three nuclear accidents weighing heavily on public sentiment even as the search for carbon-free energy accelerates. The 1979 Three Mile Island power plant radiation leak in Pennsylvania was the first big setback for nuclear power. The Chernobyl meltdown in 1986 compounded the poor image, and Fukushima delivered a near-fatal blow, powerful enough to see some countries opt to close their existing reactor fleet and others to go slow with expansion plans."

Japan

Traders and specialists say the uranium market is likely to remain depressed for years, Reuters reported in August 2019.[9] Australian financial services company Hartleys doesn't expect a recovery until the second half of the 2020s.[10]

Sellers are buying and buyers are selling: Cameco is buying on the spot market while Japanese companies have begun offloading unwanted inventories onto the global market. The Japanese sales so far have been small, but were made at values well below the purchase price and will likely further depress the uranium market according to two senior market specialists who spoke to Reuters.[9]

"Given the extended shutdown of our reactors, we are selling uranium as well as canceling long-term contracts where necessary," Japan Atomic told Reuters.[9]

"Japanese inventory is a big overhang in the market," a US-based market specialist said. According to Reuters'

Uranium Prices (US$ / pound uranium oxide)

	1 June 2007	1 Dec. 2008	1 Feb. 2011	1 Dec. 2011	1 Dec. 2016	30 Sept 2019
Spot price	136	52.50	69.63	51.88	20.25	25.68
Long-term contract price	95	70	71.50	62	30.00	31.50
Notes	Peak bubble	Bubble burst	Pre-Fukushima	Decline 2011-16	Decline 2011-16	Flat 2017-19

Source: Cameco: https://www.cameco.com/invest/markets/uranium-price

calculations, Japan's nuclear companies are sitting on nuclear fuel inventories worth nearly 50% of the market value of the nine publicly-traded nuclear utilities.[9]

TEPCO canceled a supply contract with Cameco in 2017, citing *force majeure* in the aftermath of the Fukushima disaster. Cameco was awarded US$40.3 million in damages in July 2019 by the International Chamber of Commerce (a small fraction of the amount sought).[11]

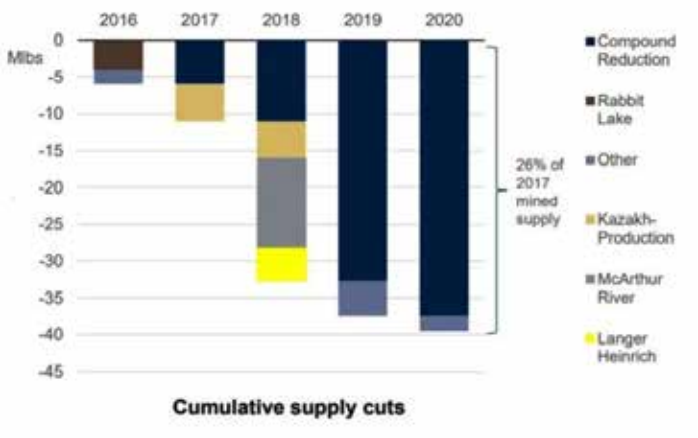
Cut-backs

In addition to Cameco's cut-backs, Kazakhstan's (mostly) state-owned uranium producer Kazatomprom has cut uranium production by 20% since late 2017 in response to oversupply and low prices. Kazatomprom recently announced that the 20% curtailment of production will be extended until 2021, and its statement left plenty of wriggle-room for curtailment beyond then: "Kazatomprom does not expect to return to full production until a sustained market recovery is evident, and demand and supply conditions signal a need for more uranium."[12]

Numerous other mines around the world are in care-and-maintenance (e.g. Beverley, Beverley North and Honeymoon in Australia; and Paladin's Langer Heinrich and Kayelekera mines in Africa) while others are operating at reduced capacity. Paladin is in the process of selling its Kayelekera project, for next-to-nothing.

AMP Capital estimates that around half the world's uranium mines are losing money.[13] Specialist US uranium investor Sachem Cove Partners said in June 2019 that the price of uranium would need to double from today's spot market levels – and to stay there for a sustainable period – before a majority of miners could even contemplate restarting idled capacity or moving ahead with new projects.[14]

Uranium exploration and mine development expenditures in 2016 were just one-third of the 2014 expenditures and are expected to continue to decrease in response to a "sustained depressed uranium market" according to a December 2018 report by the IAEA and the OECD Nuclear Energy Agency.[15] The report further noted that: "[T]he Fukushima Daiichi accident has eroded public confidence in nuclear power in some countries, and prospects for growth in nuclear generating capacity are thus being reduced and are subject to even greater uncertainty than usual. … Challenges remain in the global uranium market with high levels of oversupply and inventories, resulting in continuing pricing pressures."



Cumulative cuts to global uranium production.

Inventories

Uranium mine production increased by 50% from 2007 to 2016.[16] The increase was driven, initially at least, by expectations of a nuclear power renaissance that didn't eventuate. Stockpiles alone would suffice to keep the entire global reactor fleet operating for roughly eight years.[17]

Recent cut-backs have resulted in a closer matching of production and demand. If inventories are being drawn down, that is happening slowly. Kazatomprom said in early 2019 that last year saw a shift in balance toward undersupply, with the market being in slight deficit.[18] And it may not be happening at all. Olga Skorlyakova, senior project manager at the World Nuclear Association, said in June 2018 that "in the near term the market is an oversupply position and we project that accumulation of inventories will continue until the beginning of the 2020s".[19] Likewise, Macquarie Group anticipates a 2–3% surplus of uranium in 2019–20, sufficient to keep the price capped at current levels.[20] Macquarie estimates that global uranium demand, from power generators and investors combined, will fall 1.9% in 2019 and a further 4% in 2020.[20]

Uranium industry insiders and investors hope that Chinese demand will save the day. But China only intends to source one-third of its demand on the open market, with another third produced domestically, and the third third obtained through foreign equity in mines and joint ventures overseas.[1]

Arguments advanced by former World Nuclear Association executive Steve Kidd in 2014 still hold.[21] He argued that "the case made by the uranium bulls is in reality full of holes" and that a new era is emerging with the uranium market split into three:

- The Chinese will favor investing directly in mines to satisfy their requirements; they are not going to 'play ball' with the established uranium market.
- The Russians will continue to be significant nuclear fuel exporters but their own market will remain essentially closed to outsiders. They still have secondary supplies to tap into (plenty of surplus highly-enriched uranium remains to be down-blended) and they will follow the Chinese and invest directly in uranium assets if their own domestic production remains constrained.
- The established uranium producers will have the remainder of the market to satisfy and that will likely be declining in magnitude.

Even the World Nuclear Association acknowledges some glum realities about the uranium market, albeit the case that its realism is interspersed with speculative enthusiasm. The Association said in September 2019:[22]

"The uranium market has been characterized by oversupply in recent years, which has led to a sizable reduction in uranium production levels at existing mines and a sharp decrease in investment in the development of new and existing mines. ... There are more than adequate uranium resources to meet future needs; however, oversupply and associated low uranium prices

are preventing the investment needed to convert these resources into production. ...

"The relative contribution of secondary supply to overall uranium supply will gradually diminish. However, a major component of secondary supply, commercial inventories, are playing an increasingly important role in the market, as many participants try to benefit from the current low prices of uranium and enrichment, increasing their stockpiles. Thus it is expected that in the short- or medium-term potential supply gap or shortfall may be covered by commercial inventories."

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Navajo women and infants: high levels of uranium exposure

Associated Press reported in October 2019:

About a quarter of Navajo women and some infants who were part of a federally funded study on uranium exposure had high levels of the radioactive metal in their systems, decades after mining for Cold War weaponry ended on their reservation.

The early findings from the University of New Mexico study were shared during a congressional field hearing in Albuquerque. Dr. Loretta Christensen – the chief medical officer on the Navajo Nation for Indian Health Service, a partner in the research – said 781 women were screened during an initial phase of the study that ended last year.

Among them, 26% had concentrations of uranium that exceeded levels found in the highest 5% of the U.S. population, and newborns with equally high concentrations continued to be exposed to uranium during their first year, she said.

The research is continuing as authorities work to clear uranium mining sites across the Navajo Nation.

"It forces us to own up to the known detriments associated with a nuclear-forward society," said U.S. Rep. Deb Haaland, who is an enrolled member of Laguna Pueblo, a tribe whose jurisdiction lies west of Albuquerque.

The hearing held in Albuquerque by U.S. Sen. Tom Udall, Haaland and U.S. Rep. Ben Ray Lujan, all Democrats from New Mexico, sought to underscore the atomic age's impact on Native American communities.

The three are pushing for legislation that would expand radiation compensation to residents in their state, including post-1971 uranium workers and residents who lived downwind from the Trinity Test site in southern New Mexico. …

On the Navajo Nation, … the EPA has identified more than 200 abandoned uranium mines where it wants to complete investigation and clean up under an upcoming five-year plan, using settlements and other agreements to pay for the work that has taken decades.

Abridged from: Mary Hudetz, 8 Oct 2019, 'US official: Research finds uranium in Navajo women, babies', https://apnews.com/334124280ace4b36beb6b8d58c328ae3

2019 uranium news highlights and lowlights

Here's a collection of 2019 uranium news highlights and lowlights taken from the WISE-Uranium website (www.wise-uranium.org) – a remarkable resource maintained by Peter Diehl for as long as anyone can remember.

For more information on these news items, see the 2019 Uranium News webpage (www.wise-uranium.org/new.html) and follow the links.

Australia:

– ERA releases updated Closure Plan for Ranger uranium mine

> Report identifies need for improvements with clean-up of Ranger uranium mine to address long-term risks for Kakadu national park

> Decommissioning cost estimate for Ranger uranium mine increases further to A$830 million

– Court dismisses appeal against federal environmental clearance for Yeelirrie uranium mine in Western Australia

– Evaporation ponds at Olympic Dam mine are still killing hundreds of birds

Consequence of potential failure of Olympic Dam tailings dams rated 'extreme'

Brazil:

– INB signs agreement with Public Prosecutor's Office on necessary improvement of management of Pocos de Caldas tailings

> CNEN establishes 'action plan' for inspection of Pocos de Caldas tailings dam

– Five years after halt of operations, license renewed for Caetite uranium mine

– Brazil's government plans to allow public-private partnerships for uranium mines, circumventing parliament

– Nuclear fuel convoy attacked by armed men

Canada:

– Tribunal orders TEPCO to pay damages in dispute over cancellation of Fukushima uranium supply contract, but reduces TEPCO's obligation to 6% of amount claimed by Cameco

– Small fluorine release in Cameco Port Hope UF6 plant (Ontario)

> Heavy rain causes water inflow at Cameco Port Hope conversion plant

> Property remediation resumes at Canada's Port Hope Project

– Nova Scotia legislators deny request from mining industry lobby to lift province's uranium ban

– CNSC to hold un-hearing on revised financial guarantee for McArthur River mine

– Cameco opposes more stringent environmental review process for uranium mining projects

– CNSC seeks comments on project description for Wheeler River in situ leach uranium mine project with freeze wall

– Spill at mothballed Key Lake uranium mill contained uranium concentrations exceeding standard ten-fold

– Proposed production of nuclear fuel pellets at BWXT Peterborough nuclear fuel facility raises concern among residents

France:

– Violation of criticality rules at Framatome's FBFC Romans nuclear fuel fabrication plant

– Justice bars Greenpeace from approaching Orano's uranium transports

– Greenpeace 'repaints' train carrying reprocessed uranyl nitrate from La Hague to Pierrelatte

– Anti-nuclear sabotage against electrical equipment on railway siding to Areva's depleted uranium storage facility at Bessines

– Environmental guidance values for uranium in waters downstream from former uranium mines in France not met at four sites, at least

– Orano plans to construct four additional buildings to extend storage capacity for reprocessed uranium at Tricastin

– Almost 100,000 t of depleted uranium oxide in use as radiation shield for Orano's reprocessed uranium stored at Tricastin

– ASN demands Orano for improvements with storage of uranium material after loss of containment at decommissioning uranium conversion plant for reprocessed uranium at Pierrelatte

Germany:

– 300 demonstrate against Framatome Lingen nuclear fuel plant and nuclear power plant

– Wismut's former uranium mining site in the Ore Mountains becomes World Heritage

– Wismut starts construction of final cover on Culmitzsch uranium mill tailings pile

> Further financing assured for reclamation of Wismut legacy sites in Saxony

– Demonstration against Urenco's Gronau enrichment plant

– Demonstration against Framatome Lingen nuclear fuel plant and nuclear power plant

– Preparations started for reclamation of abandoned Hakenkruemme uranium mill tailings site

– 250 Easter March participants demonstrate against Urenco's Gronau enrichment plant

– Injured mineral collector rescued from unsecured abandoned uranium mine

Greenland

– Government of Greenland rejects company's complaint about handling of EIA report for Kvanefjeld uranium mine

– Stability of tailings dam at proposed Kvanefjeld uranium mine unclear

– Demonstration against proposed Kvanefjeld uranium mine

– Formation of joint venture with CNNC for processing of Kvanefjeld rare earth – uranium minerals raises concern that Greenlandic uranium may end up with Chinese military

India:

– Uranium mining polluting groundwater in Andhra Pradesh villages, scientists warn

– Residents living near Tummalapalle uranium mine block UCIL vehicles demanding supply of purified drinking water

> State Pollution Control Board issues directions to UCIL on impacts of Tummalapalle uranium mine

> State Pollution Control Board to hold hearing on alleged violations leading to groundwater contamination at Tummalapalle uranium mine

> Expert committee urges medical care for residents affected from impacts of Tummalapalle uranium mine

– Rally held against proposed uranium mining in Nallamala forest

> 70,000 people to be displaced for uranium mine in Amrabad Tiger Reserve

> Telangana State Assembly passes resolution opposing uranium mining in Nallamala forest

> Telangana Congress party demands reversal of state government's approval of uranium exploration in Nallamala forest

> Protesters prevent UCIL officials from conducting uranium survey in Nallamala forests

> Rallies and road blockade against uranium exploration in Amrabad tiger reserve

> State official vows they won't allow anyone inside for uranium exploration in Amrabad Tiger Reserve

> Campaign launched to save Amrabad Tiger Reserve from uranium mining

> Environmentalists back Chenchus' fight against uranium mining at Amrabad

> Professor arrested on his way to meet opponents of uranium mining in Nallamala forest

> Professor arrested on his way to meet tribes affected from proposed uranium mining in Nallamala forest – again

– Environmental approval of uranium exploration affects tribals in Betul, Madhya Pradesh

– Displaced people demonstrate at Narwapahar uranium mine (Jharkhand)

– Workers at several uranium mines in India on strike

– India to develop 13 new uranium mine projects, increasing production by factor of up to four

Iran:

– Iran to restart uranium enrichment at Fordo underground facility in breach of nuclear deal

– Iran announces tenfold increase in enriched uranium production in breach of nuclear deal

– Ardakan uranium mine delivers yellow cake consignment

Kyrgyzstan

– Kyrgyzstan's parliament bans uranium exploration and mining after protests

> Association of Miners and Geologists supports uranium ban in Kyrgyzstan

> At demonstration in Bishkek, more than 300 demand ban on uranium mining in Kyrgyzstan

> Kyrgyz Prime Minister bans exploration and mining of uranium before legal response

– Residents mined sand from Kyzyl-Ompul uranium deposit

> Demonstration in Karakol against Kyzyl-Ompul uranium mine project

> Prime Minister orders suspension of works at proposed Kyzyl-Ompul uranium mine site amid growing protests

> Licensing commission suspends exploration license for uranium at Kyzyl-Ompul

> Over 10,000 people sign online petition against proposed uranium mine at Kyzyl-Ompul

– Cleanup to start at two uranium legacy sites in Kyrgyzstan

– Hundreds join march from Balykchy to Bishkek to protest against proposed uranium mine

– More than 300 people gather for protest at proposed Tash-Bulak uranium mine site

– Chhattisgarh chief minister categorically opposes uranium mining in his state

– Kyrgyzstan issued 20 uranium prospection and exploration licenses, so far

Malawi:

– Paladin acting big: mothballed Kayelekera uranium mine discharged over 1.1 billion cubic metres of treated water into Sere River, according to 2018 Sustainability Report

– Paladin to sell its interest in mothballed Kayelekera uranium mine

– New Mines and Minerals law for Malawi

Namibia:

– Rio Tinto completes sale of its stake in Roessing Uranium Limited share

– China to fund construction of new SWAPO headquarters in exchange for uranium prospection licenses

– Upon sale to CNNC, Roessing uranium mine life 'potentially' to be extended beyond 2025

– Decommissioning fund for Roessing uranium mine currently holds 54% of amount required

– Swakop Uranium agrees to some of Husab uranium mine workers' safety demands

– Husab mine operations halted after protests against negligent handling of explosives

Niger:

– Orano's Akouta uranium mine to be closed in 2021

– Additional deposits included in Madaouela mining permit without requirement for new environmental assessment

– Foundation stone laid for Madaouela uranium mine

Solar power for proposed Madaouela uranium mine?

Russia:

– Presidential Council on Human Rights concerned about storage of depleted uranium hexafluoride in open air at Angarsk

– Moscow residents hold protest against road construction through tailings dump on bank of Moskva River

Spain:

– National Court dismisses appeal against authorization for Retortillo uranium mine project

> Students from eight European countries protest in Retortillo against the uranium mine project

> Protesters hold road blockade to demand termination of Retortillo uranium mine project

> Berkeley obtains permit for extension of uranium exploration around Ciudad Rodrigo

> Miner Berkeley appeals to Spain's Supreme Court over nuclear watchdog nominees

> Spain-Portugal cross-border human chain held against Retortillo uranium mine project

– Bush fire near closed Quercus uranium mill

– More than 13,000 signatures against uranium exploration in area of former Cabra Alta mine

> 1,500 demonstrate against uranium exploration in area of former Cabra Alta mine

> Exploration authorization suspended for area of former Cabra Alta uranium mine

Sweden:

– Aura Energy lodges compensation claim for loss of Haeggaan mining project due to Sweden's uranium ban

United States:

– U.S. EPA reaches agreement with three mining companies to investigate impacts and possible remedies of groundwater contamination at San Mateo Creek Basin Site in New Mexico

– Centrus Energy signs contract with U.S. DOE for demonstration of high assay low-enriched uranium (HALEU) production at American Centrifuge enrichment plant (Ohio). [A military project dressed up as a contribution to the development of 'advanced' power reactors – NM.]

> U.S. DOE contracts Centrus Energy subsidiary for HALEU fuel fabrication system

> Groups raise concern over proliferation hazard from Urenco USA's High assay low enriched uranium (HALEU) project (New Mexico)

– U.S. House of Representatives passes bill for permanent uranium mining ban near Grand Canyon

> Groups call for closure of Canyon mine due to groundwater pollution hazard resulting from ongoing flooding (Arizona)

> Bill for permanent uranium mining ban near Grand Canyon passes House committee

> Tribal leaders, lawmakers push bill for permanent mining ban near Grand Canyon

> U.S. Supreme Court denies review for Canyon uranium mine near Grand Canyon

– U.S. Army Installation Command requests relaxation of environmental monitoring requirements for depleted uranium munitions test areas

> U.S. NRC approves 20-year deferral of decommissioning of DU munitions test area at Jefferson Proving Ground (Indiana)

> U.S. NRC issues Environmental Assessment on proposed 20-year deferral of decommissioning of DU munitions test area at Jefferson Proving Ground

> Utah Governor quietly allows bill that loosens state restrictions on accepting depleted uranium for disposal to become law without his signature

> Utah lawmakers finally approve bill that loosens state restrictions on accepting depleted uranium for disposal; groups ask governor for veto

– U.S. NRC denies 25% reduction of financial surety for Grants uranium mill tailings site (New Mexico)

> 12,000 gallon spill of brine from evaporation pond at Grants uranium mill tailings site

> 'Unauthorized release of impacted water' from collection pond at Grants uranium mill tailings site

> Tighter standard warranted for uranium in groundwater at Grants uranium mill tailings site, review of EPA report finds

– US$125 million settlement announced for cleanup of Nuclear Metals/Starmet DU munitions facility site in Concord (Massachusetts)

– Study finds uranium in Navajo women, babies

> U.S. EPA to award $220 million for uranium mine cleanup on Navajo Nation (New Mexico)

> Navajo sign national research agreement for study on effects of environmental exposure to uranium on babies (Arizona)

> U.S. EPA funds study on impacts of abandoned uranium mines on air quality in Cove, Arizona

– Positive results announced for Preliminary Economic Assessment of Charlie uranium project, based on uranium sales price 2.5 times current levels (Wyoming)

– Failure of criticality alarm system in downblending station for High-Enrichment Uranium at NFS Erwin nuclear fuel plant (Tennessee)

– Security violation at Urenco USA enrichment plant (New Mexico)

> Lunchbox-based security breach incident at Urenco USA enrichment plant

> U.S. NRC identifies violation at Urenco USA enrichment plant in connection with dropped cylinder containing enriched uranium

– Wyoming DEQ invites comment on Western Nuclear's request for 6-fold increase of selenium standard in groundwater at Split Rock uranium mill site (Wyoming)

– Arco demands jury trial over cleanup liability for former Jackpile uranium mine site (New Mexico)

– 'Unplanned' surface contamination found on heeled UF6 cylinders received at Framatome Richland nuclear fuel plant (Washington)

– U.S. NRC issues final interim staff guidance for conducting the Section 106 process of the National Historic Preservation Act for uranium recovery licensing actions

> Wyoming DEQ invites comment on Western Nuclear's request for 7-fold increase of nitrate standard in groundwater at Split Rock uranium mill site

> U.S. NRC investigation identifies apparent violation involving submission of inaccurate and incomplete information on groundwater situation at Split Rock uranium mill site

– CDPHE approves Removal Site Evaluation Work Plan for Trichloroethene in Groundwater and Soil at former Canon City uranium mill site (Colorado)

> CDPHE invites comment on Removal Site Evaluation Work Plan for Trichloroethene in Groundwater and Soil at former Canon City uranium mill site

– U.S. NRC identifies undisclosed safety violation at BWXT Lynchburg nuclear fuel plant (Virginia)

> U.S. NRC identifies violation of criticality safety procedures at BWXT Lynchburg nuclear fuel plant

– More than 100 vicinity properties may still contain uranium mill tailings at Durango (Colorado)

– Court orders closure and cleanup of Van 4 uranium mine that went idle 30 years ago (Colorado)

– Uranium-laden water leaks from refuse container at Westinghouse Electric Co. Columbia nuclear fuel plant (South Carolina)

> Citizens frustrated, distrusting after Westinghouse cleans up uranium contamination at Columbia nuclear fuel plant

> Groundwater not contaminated from uranium leak through floor of WEC Columbia nuclear fuel plant

> Workers at Westinghouse Electric Co. Columbia nuclear fuel plant still receive individual radiation doses twice average

> Violation of criticality rules at WEC Columbia nuclear fuel plant

> Waste drum damaged due to over pressurization at Westinghouse Electric Co. Columbia nuclear fuel plant

– County health commissioner holds public forum on neptunium found in air at school near decommissioning Portsmouth enrichment plant (Ohio)

> School closed for suspected contamination from nearby decommissioning Portsmouth enrichment plant

> No unusual radioactive material found at school closed for fear of contamination from nearby decommissioning Portsmouth enrichment plant

– U.S. President declines to set U.S. uranium production quotas, orders further review

– Natural flushing of contaminated aquifer at former Riverton uranium mill site might not be accomplished in 100-year regulatory time frame (Wyoming)

– Supreme Court upholds Virginia's ban on uranium mining

– Even improved groundwater remediation unlikely to meet remediation goal at former Monticello uranium mill tailings site (Utah)

– U.S. DOE to repair stream bank near Canonsburg uranium mill tailings disposal cell (Pennsylvania)

> No cancer cluster around former Canonsburg radium and uranium plant, study finds

> Uranium concentrations in groundwater at Canonsburg uranium mill tailings site don't decrease as expected

– Protest march to White Mesa uranium mill (Utah)

– Utah DEQ wants improvements for cover of reclaimed Lisbon Valley uranium mill tailings

– Utah DEQ issues Notice of Violation for failures at idle Shootaring Canyon uranium mill

– NX Uranium Inc. gives up on uranium, repositions itself in the cannibis industry, and renames itself Rogue Station Companies. "The Company's Board of Directors believes this name change more accurately reflects its planned activities in cannabis-oriented businesses." (Utah)

– U.S. NRC staff concurs with DOE's request for 'supplemental standards' rather than cleanup of road and trail near Moab uranium mill tailings site (Utah)

> 60% of Moab uranium mill tailings relocated at 10th anniversary of first shipment

– Presence of Technetium-99 complicates groundwater cleanup at former Kerr-McGee Cimarron nuclear fuel plant (Oklahoma)

– Uranium One requests five-year interim stabilization for Christensen Ranch in situ leach uranium mine site (Wyoming)

– U.S. NRC Board grants evidentiary hearing on stalled survey of historic, cultural, and religious sites for Dewey-Burdock in situ leach uranium mine project (South Dakota)

> In spite of appeals court ruling, U.S. NRC leaves disputed license for Dewey Burdock in situ leach uranium mine project in place

– U.S. uranium production reaches historic low

– Funding sought to speed up cleanup of Niagara Falls Storage Site (New York)

– Lawsuit filed against changes to U.S. DOE worker compensation program

– Bill again re-introduced in U.S. Congress to amend Radiation Exposure Compensation Act

– Uranium plumes in groundwater extending beyond Bluewater uranium mill tailings site remain unchanged, DOE report finds (New Mexico)

– Cameco abandons Three Crow Expansion project of Crow Butte uranium in situ leach mine (Nebraska)

– U.S. NRC announces opportunity to request a hearing and to petition for leave to intervene on proposal to place mine waste repository on top of reclaimed Church Rock uranium mill tailings deposit (New Mexico)

> U.S. NRC invites comments on scoping for EIS on proposal to place mine waste repository on top of reclaimed Church Rock uranium mill tailings deposit

– Newmont Mining requests relaxed radiation cleanup standards at former Midnite uranium mine (Washington)

– U.S. EPA releases Phase 2 Groundwater Investigation report for San Mateo Creek Basin Legacy Uranium Mines Site (New Mexico)

– U.S. NRC approves Framatome's requests to postpone decommissioning of Uranyl-nitrate storage building at Richland nuclear fuel plant (Washington)

– Bills introduced in South Dakota Legislative Assembly to allow people in areas impacted by mining to have a voice in the water permitting process

– Umetco applies for reduction of groundwater monitoring at former Gas Hills uranium mill site (Wyoming)

> Interim stabilization of ANC Gas Hills uranium mill tailings completed - unresolved issues remain

– Bill introduced in Colorado Assembly to protect water quality from adverse mining impacts

– U.S. NRC requests views on whether to resume rulemaking on ground water protection at uranium in situ recovery facilities

– Depressions on cover of Mexican Hat uranium mill tailings disposal cell assumed to be result of precipitation-induced erosion (Utah)

– U.S. NRC notes violation of criticality safety requirements at NFS Erwin nuclear fuel plant (Tennessee)

– DNR demands corrective action on radiation hazard from stockpile at idle Sunday mine (Colorado)

– Wyoming uranium mining industry makes plea for 15-year tax break

– U.S. DOE wants to end groundwater remediation by active pumping at Shiprock uranium mill tailings site although remediation goals not met (New Mexico)

Elsewhere:

– Czech Republic: Project for municipal and industrial waste collection center on Mydlovary uranium mill tailings site stopped; reclamation to be completed by 2024

– Former Czech state uranium miner now turns to lithium

– Groups demand halt of nuclear fuel exports from Framatome Lingen plant to Doel nuclear power plants (Belgium), after European Court ruled that prolonging life of the ailing reactors infringed European law

– Sellafield Ltd fined GBP 380,000 for safety breaches leading to worker contamination with plutonium (UK)

– Tails de-conversion plant at Urenco Capenhurst site completed four years late at costs of almost GBP 1 billion – 2.5 times initial estimate (UK)

– Silex and Cameco to acquire GE-Hitachi's stake in GE-Hitachi Global Laser Enrichment LLC

– Will your next hard disk be made of a uranium compound?

– Lung cancer risk for uranium miners confirmed even for low radon exposures

– Rebels take control of mining town Bakouma in Central African Republic

– Jordan to train Saudis on uranium mining

– Regional Court upholds Ministry's rejection of further uranium exploration at Kuriskova site (Slovakia)

– Positive feasibility study announced for Tiris uranium mine project, assuming uranium sales price at least twice current prices (Mauritania)

– Heap leach pilot plant planned for Central Jordan uranium project

– Nuclear bill introduced in Nepal parliament to regulate uranium mining and processing

– Non-proliferation experts raise concern over lack of scrutiny on uneconomical projects, such as by-product recovery of uranium from phosphate, in UNECE's proposal on 'Redesigning the Uranium Resource Pathway'

– Group initiates referendum against proposed uranium mine in Western-Mecsek Landscape Protection Area (Hungary)

– Cleanup of Kamianske uranium mill tailings still stuck by insufficient allocation of funds and improper use of those allocated (Ukraine)

– Kazatomprom plans 20% cut to uranium production in 2019 (Kazakhstan)

Misleading claims about nuclear energy

Author: Dr. Mark Diesendorf – Honorary Associate Professor, Environment & Governance Group, University of New South Wales

This article is a reply to claims made by Prof. Gerry Thomas on national radio on the Australian Broadcasting Corporation's *Science Show* on 2 November 2019.[1] In her presentation with the theme that fear of ionising radiation and nuclear power is 'irrational', she made several misleading statements and serious omissions and at least one scientifically irrational statement. For example:

1. Chernobyl deaths

Thomas focused on rapid deaths from acute radiation exposure and only the least dangerous cancer, thyroid cancer.[2] Her prediction of about 160 cancer deaths from Chernobyl, apparently all thyroid, is dwarfed by the estimate of *all cancer deaths excluding thyroid* by a team from the International Agency for Research on Cancer (Cardis et al. 2006).[3] Their prediction covers the period up to 2065. It is made up of 14,100 (95% UI 6200-32,100) for all cancers excluding leukaemia, thyroid cancer and nonmelanoma skin cancer (Cardis, Table I) plus about 1700 from leukaemia (Cardis, p.1230).

Thomas omits to mention the IARC results, which carry more scientific credibility than hers re cancers other than thyroid.[4] Instead, the listener was led to compare her claim with the *straw person* of a popular film about Chernobyl, played at the beginning of the interview. Comparing a scientific presentation with a popular one, instead of with another scientific one, misleads listeners.

The generally poor quality of health and radiation exposure data in eastern Europe entails that even a much larger number of non-thyroid cancer deaths resulting from Chernobyl would be undetectable against the much larger background of cancers due to other causes.

2. "Nuclear has far less illness associated with it [compared with renewables]"

The studies upon which this claim is based use techniques such as ignoring the vast majority of cancers induced at Chernobyl (Item 1), omitting risks with (possibly) low probability but very high impacts (see Item 5), and exaggerating the land use of renewables and minimising the land-use of nuclear (see Item 7). For example, the claims by Brook and Bradshaw[5], that nuclear is better than renewables on environmental, safety, health and land use grounds, have been refuted in three independent peer-reviewed responses including mine.[6-8]

3. Thomas' claim that 'green' electricity is mostly hydro, or hydro plus nuclear

Misleading! Denmark already generates about 50% of its electricity from wind, supplemented by some bioenergy from agricultural residues. It is on track towards its target of 100% renewable electricity and heat by 2035. It has no nuclear.

South Australia generates about 50% of its electricity from wind, balanced by gas turbines, a low-capacity interconnector to Victoria, a few large batteries and (soon) off-river pumped hydro. It is heading for 100% renewables by 2030. It has no nuclear.

Scotland generates the majority of its electricity from wind, supplemented by hydro and nuclear.

Germany and five US states each already generate over 30% of their electricity from renewables, mostly wind.

Nuclear power is a poor partner for wind and solar PV, because it is inflexible in operation. Better complements with fast responses are hydro (both once-through and pumped), batteries, concentrated solar thermal, open cycle gas turbines using renewable fuels and demand response.

4. Irrational claim: "If our bodies couldn't deal with radiation, we wouldn't be here"

This piece of simplistic pro-nuclear propaganda is bad science and reveals that Thomas' desire to campaign for radiation exposure and nuclear power sometimes overrides her scientific knowledge. She must know this is nonsense, yet she utters it. *Homo sapiens* continues to exist despite many harmful natural agents, e.g. malaria, poisonous snakes and mushrooms, arsenic contamination of groundwater.

5. Omission of the contribution of nuclear power to the proliferation of nuclear weapons

Several countries have already used nuclear power as a cloak to either develop nuclear weapons *ab initio* (India, Pakistan, North Korea, South Africa) or to supplement their military nuclear weapons stockpile (UK, France).

In addition, the following countries have attempted to use nuclear power as a cloak for developing nuclear weapons, but fortunately discontinued their programs before completion: Algeria, Argentina, Australia, Brazil, Libya, South Korea and Taiwan. In most cases they planned to use spent fuel from nuclear power stations, although in a few cases they followed the uranium enrichment pathway. This is documented in detail by the Institute for Science and International Security (ISIS) and the Nuclear Weapons Archive; for Australia in books by Richard Broinowski and by Wayne Reynolds.

A realistic perspective on proliferation is that the more countries that have nuclear power → the more countries have the capacity to develop nuclear weapons → the greater the risk of nuclear war.

A scientific approach to risk expresses it as the probability of an event multiplied by its impact. It's possible that the above probability may (or may not) be small, but the potential impact could be huge. Deaths and injuries from the blasts, firestorms and radiation exposures of a nuclear war could be counted in hundreds of millions, but deaths from Nuclear Winter's impact on global agriculture could be counted in billions.

Most proponents of nuclear power take an unscientific approach to risk by simply ignoring potential events that they want to believe have low probability, despite the enormous potential impacts of such events. The latter include major nuclear accidents as well as nuclear war resulting from proliferation of nuclear weapons.

6. Trivialising the risks of nuclear power

Thomas does this by using a true but trivial statement, namely that low-level radiation from coal-fired power stations is greater than from normally operating nuclear power stations, to deflect attention away from the principal radiation risks of nuclear power: exposure to low-, medium- and high-level radiation from nuclear accidents (see Item 1), managing high-level nuclear wastes, and the contribution of nuclear power to the proliferation of nuclear weapons and hence increased probability of nuclear war (Item 5).

7. Land use

Thomas mentioned that nuclear power plants are compact in terms of land use. However, this has been achieved by failing to allow for an adequate exclusion zone to reduce the impact of major nuclear accidents. Taking an exclusion zone of radius, say, 20 km (as at post-accident Fukushima), would make nuclear power quite a large land user.[5]

Chernobyl

- Some proponents of nuclear power, who are also critics of renewable energy, exaggerate the land use by renewable energy as follows:
- They count the area of land spanned by a wind farms instead of the land actually occupied. The latter is typically 1-3% of the former. Agricultural land between wind turbines is farmed.
- They ignore the fact that a large proportion of solar systems is on rooftops and so occupies no land.

Although ground-mounted solar farms generally occupy significant land, there is a move to mount future solar farms that are built on agricultural land on higher support structures, thus allowing animals to graze beneath them.

Conclusion

Thomas' interview contains several misleading statements and serious omissions and the irrational statement that "If our bodies couldn't deal with radiation, we wouldn't be here". Therefore, it has low credibility.

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Nuclear weapons and our climate

Author: Assoc. Prof. Tilman Ruff – International Campaign to Abolish Nuclear Weapons (Australia)

What effect would nuclear war have on the climate? What has nuclear power generation got to do with nuclear proliferation? How could the massive amounts of radioactivity inside nuclear reactors, fuel and waste storages cause radiological contamination akin to nuclear weapons? Could nuclear facilities themselves be turned into weapons? This paper addresses the connections between our climate, nuclear weapons, nuclear power and the stuff that puts the 'nuclear' in nuclear weapons.

Nuclear weapons pose the greatest acute danger to earth's climate

Global warming is upon us – in overwhelming scientific evidence, increasingly palpable in our lives, impossible to ignore. It is accelerating. Most of us now understand how crucial to human and planetary health is a stable and hospitable climate and securing this is the defining challenge of our age. Human disruptions to climate are frequently discussed, yet too few of us are aware that the most acute, immediate danger to our climate comes from nuclear weapons.

Studies by some of the world's best atmospheric scientists show that less than 0.5% of the global nuclear arsenal, targeted on cities in just one region of the world, would ignite massive firestorms that would loft millions of tons of smoke high into the atmosphere, beyond the reach of rain and snow. This smoke would blanket the entire globe within a few weeks, and cool, dry and darken the world beneath for more than two decades. The dark smoke in the stratosphere and above would be warmed by the sun, heating the upper atmosphere by more than 50°C, and rapidly depleting the ozone which protects us from the Sun's harmful ultraviolet (UV) radiation.[1]

100 Hiroshima size bombs – 0.1% of the explosive power of the global nuclear arsenal – for example used in a war between India and Pakistan, would produce over 5 million tons of smoke, cooling average surface temperatures by 1.5°C, with much greater declines of 5-8°C over large land masses. The resulting sustained decline in food production worldwide would put 2 billion people at risk of starving to death.[2] The combined current arsenals of India and Pakistan – the world's most rapidly growing – now consists of 270-290 nuclear weapons of at least Hiroshima size.[3]

This abrupt nuclear famine would be exacerbated by chemical and radioactive contamination of large areas; levels of UV radiation harmful to humans as well as plants and animals on land and in the sea; disruption to transport, agricultural trade and distribution of seed, fertiliser, fuel and pesticides. Historically, large-scale famines have inevitably been accompanied by epidemics of infectious diseases, and often by conflict within and sometimes between nations, all of which would magnify the human toll and environmental impact.

The burning cities from a nuclear war using only the long-range nuclear weapons that Russia and the US keep on hair-trigger alert, ready to be launched within a few minutes, would put 50 million tons of smoke into the atmosphere. This would produce average ice age conditions, 5°C colder than present. Launch of all Russian and US long-range nuclear weapons would result in global temperatures plummeting 10°C, a severe abrupt ice age that would in all probability end human – and much other – life.[4]

Operation Crossroads, Bikini Atoll, 1946.

Nuclear weapons and unchecked climate change pose the twin existential threats to our future. They exacerbate each other and both need to be addressed. One diminishes our biosphere every day, the other could deplete it irrevocably and end human civilisation in less than a day. It is imperative for planetary and human health that we prevent both runaway global warming and an abrupt nuclear winter. The only reliable way to prevent nuclear war is to eliminate nuclear weapons before they are otherwise inevitably used again. If we do not succeed in eliminating nuclear weapons in time, achievements and aspirations in every other sphere could become tragically irrelevant in less than an hour.

A climate-stressed world is an even more dangerous place for nuclear weapons

"[A]fter nuclear war, human induced global warming is the greatest threat to human life on the planet." – Admiral Chris Barrie, AC RAN Retired, Chief of the Australian Defence Force 1998-2002.[5]

The world's most senior diplomat, UN Secretary-General Antonio Guterres, has said: "We are living in dangerous times. … We are on the brink of a new cold war" and described "a resurgence of civil conflict, after more than two decades of decline."[6]

Military and security establishments worldwide assess that global warming is a pre-eminent and accelerating threat to security that amplifies other threats. The United States intelligence community annual assessment of worldwide threats provided to the US Congress on 29 January 2019 warned that the effects of climate change and environmental degradation increase stress on communities around the world and intensify global instability and the likelihood of conflict, causing the danger of nuclear war to grow.[7]

The number of violent conflicts worldwide which are internationalised, involving at least one state outside the area of direct conflict, has increased sharply, from no more than 6 per year in the two decades prior to 2010, to 20 per year by 2017.[8] Growing food and water insecurity and other stresses exacerbated by climate change are helping to drive this upsurge in armed conflict, and contributing to the highest ever number of people forcibly displaced worldwide – reaching 70.8 million at end-2018.[9]

Nuclear power fuels nuclear proliferation

It was recognised by the Ranger Uranium Environmental Inquiry in 1977, which preceded the expansion of commercial uranium mining in Australia, that nuclear power contributes to an increased risk of nuclear war, and that "this is the most serious hazard associated with the industry."[10]

Any uranium enrichment plant can be used to produce not only reactor grade uranium, but weapons grade uranium. Currently 14 nations have such plants.[11] Laser enrichment technology initially developed in Australia could make enriching uranium more compact and concealable.[12] Highly enriched uranium (HEU, containing >20% U-235) is one of the two fissile materials used to build nuclear weapons. The other is plutonium, inevitably produced inside nuclear reactors as uranium atoms absorb neutrons. Plutonium contained in spent nuclear fuel can then be chemically extracted at some future time.

South Africa, Pakistan and North Korea primarily used the HEU route to build nuclear weapons; India and Israel primarily used a plutonium route. All used facilities and fuel that were ostensibly for peaceful purposes. Both France and the UK have used reactors which also produced electricity to produce plutonium and tritium for nuclear weapons.[13]

Australian history underscores the inseparable 'Trojan horse' connections. The government of PM John Gorton commenced construction of Australia's first nuclear power reactor at Jervis Bay in NSW in the late 1960s largely to accelerate Australia's capacity to build its own nuclear weapons. Australian Atomic Energy Commission chair J.P. Baxter spoke of "the indissoluble connection between the peaceful and military uses of nuclear materials". A briefing to the Minister for the Interior in 1969 stated: "From discussions with the AAEC officers it is understood that in establishing the Australian nuclear power industry it is desired to provide for the possibility of producing nuclear weapons …". The same year Gorton ally minister WC Wentworth MP wrote to then Defence Minister Malcom Fraser: "… everything we do must be capable of presentation as a normal move in peaceful atomic industry. In this way we can hope to get a 'short-term nuclear option' without giving open offence, and then, at some future date, if events require it, take up the option without giving this offence time to accumulate …".[14]

Nuclear weapons, depending on their size and technical sophistication, contain several kg of plutonium, and/or about 3 times as much HEU. US nuclear weapons on average contain 4 kg of plutonium and 12 kg of HEU.[15] Current global stockpiles of fissile materials – 1340 tons of HEU and 520 tons of separated plutonium[16] – are sufficient to build around 200,000 nuclear weapons. Thus ending production of fissile materials, keeping current stocks extremely securely, preferably under international control, and eliminating these materials wherever possible will be crucial to achieving and sustaining a world free of nuclear weapons.

The twin concurrent existential threats that confront us, climate disruption and nuclear war, demand win-win solutions. Promotion of nuclear power as a claimed climate friendly energy source is a lose-lose proposition.

As noted in 2010 by the Board of the *Bulletin of the Atomic Scientists* in setting the hands of the Doomsday Clock – an authoritative indicator of our global proximity to existential peril, "Nuclear war is a terrible trade for slowing the pace of climate change."[17]

As the costs of nuclear power have risen to become more than twice as expensive as either wind or solar power with storage, the motivation of some governments to maintain civilian nuclear infrastructure and workforce expertise in order to support their nuclear weapons programs has become increasingly obvious, including in France, Russia, UK and US.[18]

Nuclear reactors create enormous radiological hazards

Nuclear reactors and their spent fuel pools contain large amounts of radioactivity which is more long-lived than that produced by nuclear weapons. Both require continuous cooling. Unlike the several layers of engineered containment around nuclear reactors, spent fuel pools have no containment other than a simple roof over them. At the Fukushima Daiichi plant severely damaged in the 2011 nuclear disaster, 70% of the total radioactivity at the site was in the spent fuel pools.

Nuclear physicist and Nobel Peace Laureate Joseph Rotblat wrote in 1981 about nuclear reactors with remarkable prescience in his book *Nuclear radiation in warfare*:[19]

"But despite this heavy protection, modern precision-guided bombardment with conventional weapons could succeed in rupturing the containment vessel as well as the pressure vessel. Alternatively, the task might be achieved in a commando raid, as was carried out on a heavy water plant during World War II. … In a pressurised water reactor the melt-down of the core could occur within less than one minute after the loss of coolant; with other types of reactor it might take a few minutes. … If a group took over a reactor they would not need to blow up the heavy biological shield of the pressure vessel; all they would have to do would be to cut off the supply of cooling water to bring about core melt-down."

What happened in Fukushima because of poor design and a large earthquake and tsunami could equally happen because of commandos or terrorists disrupting the power or cooling water supply for reactors and/or spent fuel pools for long enough to cause meltdown and/or explosions. Such an event could also occur because of cyberattack; or as a result of electricity supply and electronic equipment failure caused by the electromagnetic pulse (EMP) generated by a single high-altitude nuclear explosion, which could simultaneously disrupt nuclear reactors across a whole continent.

Rotblat further showed that nuclear attack on nuclear reactors or spent fuel storages would massively increase the resulting radioactive fallout. A 1 megaton (Mt) nuclear detonation would typically blanket an area of 2000 km2 with a (sizable) radiation dose of 1 Gray between 1 month and 1 year afterwards. The area so contaminated following a 1 Mt nuclear explosion on a typical 1 GW power reactor would be 34,000 km2, and 61,000 km2 were a spent fuel storage tank targeted. While radioactive releases from nuclear reactors subject to attack have not been documented, this is largely fortuitous, and a number of attacks on nuclear reactors have taken place These include multiple attacks between Iran and Iraq during their 1980-8 war, Israel's destruction through airstrikes of nuclear reactors under construction in Iraq (1981) and Syria (2007), the South African ANC attack on the Koeberg nuclear power plant with mines while it was under construction, 1991 US attacks on various Iraqi nuclear facilities and Iraq's firing of Scud missiles at Israel's Dimona nuclear reactor.

Thus each of the 413 operating nuclear power reactors in 31 countries, spent fuel storage facilities, reprocessing plants and other large nuclear facilities are effectively large pre-positioned radiological weapons. Many are located in or near large population centres. While attacks on or other disruption of these would not produce nuclear explosions, they could cause severe and extensive radioactive contamination requiring the long-term evacuation of large areas.

Peace Boat in Australian waters, 2018.

Conclusion

The web of links between nuclear weapons, nuclear reactors, and the materials that power both are deep and inextricable. Nuclear power cannot solve our climate crisis, and aggravates the existential danger posed by nuclear weapons. Out of the climate crisis frying pan and into the fire of radioactive incineration, nuclear ice age and famine is a lose-lose dance with extinction. Our understanding of our climate crisis challenge needs to broaden to include the jeopardy of abrupt nuclear winter. A healthy and sustainable future for all life on Earth requires that we act to rapidly transition to renewable energy systems and net zero carbon emissions, and that we prohibit and eliminate nuclear weapons, with the utmost urgency demanded of us.

The most effective way for Australia and all nations to lift the nuclear threat and build security for their own and all people is to join and implement the historic UN Treaty on the Prohibition of Nuclear Weapons.[20] The Treaty recognises the incontrovertible evidence: "that the catastrophic consequences of nuclear weapons cannot be adequately addressed, transcend national borders, pose grave implications for human survival, the environment, socioeconomic development, the global economy, food security and the health of current and future generations, and have a disproportionate impact on women and girls, including as a result of ionizing radiation."

The Treaty provides a categorical and comprehensive prohibition of nuclear weapons. It further provides a path that all nations, with and without nuclear weapons, can take to fulfil their binding obligation to eliminate the world's worst weapons of mass destruction. It is the only internationally defined path towards a world freed from nuclear weapons. The Treaty builds on the substantial progress made to control biological and chemical weapons, landmines and cluster munitions. A treaty codifying rejection of the weapon and providing one standard for all nations has been key to progress for every indiscriminate and inhumane weapon. Indeed no unacceptable weapon has been controlled without a treaty proscribing it. Australia needs to get on the right side of history and join this Treaty, soon.

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World Nuclear Waste Report

The final disposal of high-level radioactive waste presents governments worldwide with major challenges that have not yet been addressed, and entails incalculable technical, logistical, and financial risks. This is the conclusion of the first "World Nuclear Waste Report – Focus Europe" launched in Berlin in November.

The World Nuclear Waste Report (WNWR) is a project by a group of renowned international experts who want to draw more attention to radioactive waste as a significant and growing challenge with no long-term solutions yet available. The project was initiated by Rebecca Harms, and the original outline was produced by Wolfgang Neumann, Mycle Schneider (coordinator of the annual World Nuclear Industry Status Reports) and Gordon MacKerron. Numerous experts have contributed to the first edition of the WNWR (including former US Nuclear Regulatory Commission chair Allison Macfarlane).

The WNWR aims to make a substantial contribution to understanding nuclear waste challenges for countries around the world. It does so by describing national and international classification systems, the risks posed by specific radioactive waste forms, generated and estimated future waste quantities, the waste management and disposal strategies of governments and their financing mechanisms.

According to the WNWR, over 60,000 tons of spent nuclear fuel alone are stored in interim storage facilities across Europe (excluding Russia and Slovakia). Spent fuel rods are highly radioactive waste. To date, no country in the world has a repository for high-level waste from nuclear power in operation. Within the EU, France accounts for 25 percent of the current spent nuclear fuel, followed by Germany (15 percent) and the United Kingdom (14 percent).

In addition, more than 2.5 million cubic metres of low- and intermediate-level waste has been generated in Europe (excluding Slovakia and Russia). Over its lifetime, the European nuclear reactor fleet will produce an estimated 6.6 million cubic metres of nuclear waste. Four countries are responsible for most of this waste: France (30 percent), the UK (20 percent), the Ukraine (18 percent) and Germany (8 percent).

According to the WNWR, many governments underestimate the costs of interim and final storage. No country has a consistent financing model to date in places. This poses further financial risk for taxpayers.

A float highlighting the danger of the Asse nuclear waste repository in Germany. UN COP23 climate conference, Bonn, Nov. 2017.

Marcos Buser, a Swiss geologist and co-author of the report, said: "Increasing amounts of high level waste have to be interim stored for ever longer periods of time, as no country in the world has yet commissioned a deep geological repository for such waste. The problem is that interim storage facilities have not been designed for such long-term use."

The Swiss nuclear expert warned that the storage facilities are already reaching the limits of their capacities. For example, storage capacity for spent fuel in Finland has already reached 93 percent saturation. Sweden's decentralized storage facility CLAB is at 80 percent saturation. "The shutdown and decommissioning of many nuclear power plants will again drastically increase the quantities of nuclear waste," warns Buser.

In addition to the safety aspects, the report identifies the enormous costs of interim storage and final disposal as another risk. "National governments and operators often significantly underestimate the costs of decommissioning, storage, and disposal of nuclear waste," said Ben Wealer, co-author of the study and industrial engineer at the Technical University of Berlin.

In many countries there is a large gap between the expected costs and the financial resources earmarked for them. The problem would be exacerbated by the fact that final disposal also involves incalculable risks, which could lead to enormous cost increases, as the German government experiences with the Asse repository illustrate.

Nearly every government claims to apply the polluter-pays-principle, which makes operators liable for the costs of managing, storing, and disposing of nuclear waste. In reality, however, governments fail to apply the polluter-pays-principle consistently. "No country in Europe has taken sufficient precautions to finance the costs of the final disposal of nuclear waste. There is a threat that the real, massive costs will ultimately be borne by the taxpayers," Wealer warned.

Ellen Ueberschär, President of the Heinrich-Böll-Stiftung, said: "The numerous unsolved problems in dealing with nuclear waste show that nuclear power has no future. At the same time, the report makes clear that phasing out nuclear power is not enough. Insufficient financial provisions for disposing of nuclear waste must not undermine the care and safety of decisions for interim storage and final disposal. The search for a suitable final repository needs greater public attention. The report is intended to facilitate a qualified international debate."

World Nuclear Waste Report https://worldnuclearwastereport.org/

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