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EDITORIAL

Dear readers of the WISE/NIRS Nuclear Monitor,

In this issue of the Monitor we cover:

- Serious problems at the world's only deep geological nuclear waste repository – the Waste Isolation Pilot Plant in the US – which have thrown a spotlight on patterns of systemic mismanagement and slack regulation.
- Ulrike Lerche from WISE writes about collaboration between European NGOs and African Civil Society Organisations concerned about uranium exploration and mining.
- The debate over the use of 'reactor grade' plutonium in nuclear weapons?

The Nuclear News section has reports on Small Modular Reactors; delays with nuclear power plans in Finland; small steps towards nuclear power in Kazakhstan; a setback for nuclear power in Ontario, Canada; and the latest *Nuclear Resisters* newsletter.

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:

Fire and leaks at the world's only deep geological waste repository

NM787.4393 The problem of radiation leaks at the Waste Isolation Pilot Plant (WIPP) in New Mexico, USA – the only operating deep geologic disposal repository for nuclear waste in the world – has worsened since we reported on it in Nuclear Monitor #781.[1]

Waste barrels at New Mexico's Los Alamos National Laboratory (LANL) were packed with nitrate salts and organic kitty litter different from the clay-based kitty litter previously used. It is believed the combination of materials set off a heat-generating chemical reaction that caused at least one such barrel inside the WIPP repository to fail, releasing radiation into the environment on February 14 and subjecting 22 workers to internal radiation contamination.[2] That was followed by a second, smaller radiation release on March 11.[3]

The number and location of vulnerable waste drums is unclear. More than 500 drums may be at risk. Up to 368 vulnerable drums are at WIPP; 57 at LANL; more than 100 at a temporary site in Andrews, west Texas used as a storage site since WIPP was closed in February; and some vulnerable drums may also be located LANL's northern New Mexico campus.[4]

New Mexico Environment Department (NMED) Secretary Ryan Flynn issued an order on May 19 giving LANL two days to submit a plan for securing waste containers stored at LANL, LANL's northern New Mexico campus, and Andrews.[5]

Flynn said: "Based on the evidence presented to NMED, the current handling, storage, treatment and transportation of the hazardous nitrate salt bearing waste containers at LANL may present an imminent and substantial endangerment to health or the environment."[6]

LANL said it has taken a series of measures including packing the drums into special containers, moving them under a dome with a fire protection system, and monitoring the drums for any rise in temperature.

Flynn also ordered the US Department of Energy (DOE), which operates WIPP, to submit schedules by May 30 for the expedited closure of two disposal vaults at WIPP that contain up to 368 containers of improperly packaged waste from LANL. However the DOE said it would take 100 work weeks − and possibly twice that long − to secure the vaults.[7]

Accident Investigation Board report

A DOE-appointed Accident Investigation Board released a report into the accidental radiation release on April 24.[8]

The Accident Investigation Board identified the "root cause" of the accident to be the many failings of Nuclear Waste Partnership (NWP), the contractor that operates the WIPP site, and DOE's Carlsbad Field Office. The report criticises their "failure to fully understand, characterize, and control the radiological hazard. The cumulative effect of inadequacies in ventilation system design and operability compounded by degradation of key safety management programs and safety culture resulted in the release of radioactive material from the underground to the environment, and the delayed / ineffective recognition and response to the release."

The Accident Investigation Board report concludes that the release of radioactive plutonium and americium was "preventable", and that "a thorough and conservatively considered hazard analysis, coupled with a robust, tested and well maintained HEPA [high-efficiency particulate air] filter capable exhaust ventilation system could have prevented the unfiltered above ground release that occurred on February 14, 2014."

The Accident Investigation Board identified eight "contributing causes":

1. Implementation of the NWP Conduct of Operations Program is not fully compliant with DOE's Conduct of Operations and this impacted the identification of abnormal conditions and timely response.
2. NWP does not have an effective Radiation Protection Program, including but not limited to radiological control technician training, qualification and requalification, equipment and instrumentation, and audits.
3. NWP does not have an effective maintenance program. The condition of critical equipment and components, including continuous air monitors, ventilation dampers, fans, sensors, and the primary system status display were degraded to the point where the cumulative impact on overall operational readiness and safety was not recognized or understood.
4. NWP does not have an effective Nuclear Safety Program. There has been a reduction in the conservatism in the Documented Safety Analysis hazard / accident analysis and corresponding Technical Safety Requirement controls over time. For example, 15 of 22 design basis accidents were removed from the latest revision without any clear justification, including the elimination of a roof/rib fall event in an open waste panel.
5. NWP implementation of DOE's Comprehensive Emergency Management System was ineffective. Personnel did not adequately recognize, categorize, or classify the emergency and did not implement adequate protective actions in a timely manner.
6. The current site safety culture does not fully embrace and implement the principles of DOE's Integrated Safety Management Guide. There is a lack of a questioning attitude, reluctance to bring up and document issues, and an acceptance and normalization of degraded equipment and conditions. There is a reluctance to report issues to management, indicating a chilled work environment.
7. Oversight by DOE's Carlsbad Field Office was ineffective. DOE failed to establish and implement adequate line management oversight programs and processes and hold personnel accountable.
8. DOE Headquarters line management oversight was ineffective. DOE Headquarters failed to ensure that the Carlsbad Field Office was held accountable for correcting repeated identified issues involving radiological protection, nuclear safety, Integrated Safety Management, maintenance, emergency management, work planning, and control and oversight.

The radiation leak at WIPP may never have happened had the government not disbanded an independent scientific body charged with oversight of the facility. Until 2004, oversight was provided by the independent Environmental Evaluation Group, a scientific body set up in 1978. But in 2004, with WIPP by then fully operational, the Environmental Evaluation Group was defunded and disbanded.[9]

February 5 fire

The February 14 leak came just nine days after a truck hauling salt caught fire at WIPP. The fire consumed the driver's compartment and the truck's large front tires. Six workers were treated at the Carlsbad hospital for smoke inhalation, another seven were treated at the site, and 86 workers were evacuated.

A March 2014 report by the DOE's Accident Investigation Board identified the root cause of the fire as NWP's "failure to adequately recognize and mitigate the hazard regarding a fire in the underground. This includes recognition and removal of the buildup of combustibles through inspections, and periodic preventative maintenance, e.g., cleaning and the decision to deactivate the automatic onboard fire suppression system."[10]

The report lists 10 contributing causes:

1. The preventative and corrective maintenance program did not prevent or correct the buildup of combustible fluids on the salt truck.
2. The fire protection program was less than adequate and there was also an accumulation of combustible materials in the underground in quantities that exceeded the limits specified in the Fire Hazard Analysis.
3. The training and qualification of the operator was inadequate to ensure proper response to a vehicle fire. He did not initially notify the Central Monitoring Room that there was a fire or describe the fire's location.
4. The Central Monitoring Room response to the fire, including evaluation and protective actions, was less than adequate.
5. Elements of the emergency preparedness and response program were ineffective.
6. A nuclear versus mine culture exists where there are significant differences in the maintenance of waste-handling versus non-waste-handling equipment.
7. The NWP Contractor Assurance System was ineffective in identifying the conditions and maintenance program inadequacies associated with the root cause of the fire.
8. DOE Carlsbad Field Office was ineffective in implementing line management oversight programs.
9. Repeat deficiencies were identified in DOE and external agencies assessments, e.g., Defense Nuclear Facility Safety Board emergency management, fire protection, maintenance, Carlsbad Field Office oversight, and work planning and control, but were allowed to remain unresolved for extended periods of time without ensuring effective site response.
10. There are elements of the Conduct of Operations program that demonstrate a lack of rigor and discipline commensurate with the operation of a Hazard Category 2 Facility.

In 2011, the Defense Nuclear Facilities Safety Board, an independent advisory board, reported that WIPP "does not adequately address the fire hazards and risks associated with underground operations."[11]

The future of WIPP

Full operations at WIPP will not resume for at least 18 months; perhaps as long as three years.[12]

On March 21, the New Mexico state government withdrew a temporary permit allowing progress towards two new disposal vaults at WIPP.[13]

Another activity at WIPP that DOE and a contractor have been developing is the Salt Disposal Investigations program. This program would create underground rooms in which heaters would be placed to assess whether or not salt is a favourable disposal medium for hot, high-level nuclear waste.[14] Disposal of such waste at WIPP is legally prohibited at present but there has been a growing lobby to dispose of high-level waste from power reactors at WIPP in the wake of the failed Yucca Mountain saga. The Salt Disposal Investigations program may proceed but the likelihood of WIPP becoming a high-level nuclear waste repository is vanishingly small as a result of the fire and leaks earlier this year and the broader patterns of systemic mismanagement and slack regulation.

The 1992 WIPP Land Withdrawal Act mandates the closure of WIPP in 2030 or sooner, and that would seem a more likely outcome than expansion.

Here are just some of the reasons that the government agencies and private contractors involved in WIPP might have considered taking their responsibilities seriously:

- protecting the health of workers and the public;
- private contractors profit when WIPP operates smoothly;
- politicians and bureaucrats stay out of trouble when WIPP operates smoothly; and
- plans to upgrade and extend the lifespan of WIPP are much more viable if WIPP runs smoothly.

But most government agencies and private contractors have taken a different approach: sloppy management and slack regulation. The WIPP problems will have major knock-on effects in the US − and to some extent globally − and those responsible have only themselves to blame.

This photo from the DOE shows damage to the slip sheet on top of a breached waste container at WIPP. www.wipp.energy.gov/wipprecovery/photo_video.html

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(Written by Nuclear Monitor editor Jim Green.)

Radiating Africa − Lobby Trajectory week with African project partners

Author: *Ulrike (Uli) Lerche, Energy Transition Campaigner at World Information Service on Energy (WISE)*

NM787.4394 The Nuclear Security Summit and Nuclear Industry Summit was prominent in the media in March 2014. Fukushima and Chernobyl were commemorated in March and April. But what about the rest of the year? And what about the “front end” of the nuclear fuel chain? Uranium exploration and mining are the starting points of the nuclear fuel chain. Who is actually taking responsibility? What impact does it have on countries in Africa and elsewhere?

These and many more questions were addressed during the successful, week-long Lobby Trajectory in the Netherlands. The Lobby Trajectory is part of the project “Enhancing transparency in the uranium chain and supporting responsible practices; uranium mining: a comparison of producing and near-producing countries”. WISE coordinates this project, supported by International Union for Conservation of Nature, National Committee of The Netherlands (IUCN NL), partner in the Ecosystem Alliance.

African Civil Society Organizations are the core project partners of the project: the National Commission for Justice and Peace (Service National de Justice et Paix / SNJP) of the National Episcopal Conference of Cameroon (NECC), Association Malienne pour la Conservation de la Faune et de l’Environnement (AMCFE) from Mali, and the Tanzanian organisation Civil Education is the Solution for Poverty and Environmental Management (CESOPE). Representatives from those three partner organisations came to Europe, particularly to the Netherlands, to raise awareness about their struggles and the menace of uranium mining in their countries. In Cameroon, Mali and Tanzania uranium mining is threatening environment and society. Exploration licences have been issued in many parts already.

Together with her WISE colleagues and with the support of Mark van der Wal (IUCN NL), project coordinator Ulrike Lerche organised the Lobby Trajectory and accompanied the project partners from May 10−18. The organisations and contacts visited were diverse and included the African Studies Centre in Leiden, the Ministry of Foreign Affairs, politicians including a member of the Dutch Parliament and of a governing party (visited together with Dirk Bannink from Laka Foundation, WISE and IUCN NL), media organisations, and many NGOs.

The lobby week also included an excursion to the renewable energy company Raedthuys and one of its wind farms in the Netherlands. The delegation took part in a training session on radiation measurements by Rianne Teule from Greenpeace Belgium as well and gave a joint workshop with the Dutch Network for Environmental Professionals VVM on uranium mining supply chain responsibility, transparency and environmental impacts in Africa

The delegation also visited one of the facilities of the Uranium Enrichment Company URENCO. The African project partners, WISE and IUCN NL got a guided tour of the plant in Almelo, and talked with the CEO and other employees of URENCO Nederland (Netherlands). Unfortunately the CEO of URENCO Nederland B.V. Huub Rakhorst refused to commit to more transparency about URENCO's operations. Although the visit was one of the highlights of the week taking into account that visit requests were refused before and a dialogue was possible now, the lack of moral obligation of URENCO regarding more transparency in the fuel chain was disappointing.

A public film and debate event called "Radiating Africa – the Menace of Uranium Mining" gave the finishing touch to an intense week of talks, networking and publicity. What are the impacts of uranium mining on the environment and society? The project partners from Mali, Cameroon and Tanzania took the floor and presented their cases with documentaries, discussion and images. The critical documentary "Yellow Cake" and the controversial pro-nuclear documentary "Pandora's Promise" showed different perspectives. Nuclear expert Prof. Dr. Wim Turkenburg discussed some of the issues raised in "Pandora's Promise" and contested the film's reasoning and factual accuracy. Furthermore, an interactive "fishbowl discussion" enabled the audience to debate nuclear power, climate change, the nuclear fuel chain, (corporate) social responsibility, and uranium mining.

There is a lot of potential for policy changes. Unlike some other minerals, uranium is not included in the EU Draft Guideline on responsible sourcing of minerals originating in conflict-affected and high-risk areas. This Draft Guideline proposes supply chain due-diligence self-certification by importers of tin, tantalum and tungsten, their ores, and gold originating in conflict-affected and high-risk areas ... but not uranium. Furthermore, the EU Draft Guideline does not aim at obliging companies to be more transparent, but rather promotes optional self-regulation.

As Secretary-General of the National Episcopal Conference of Cameroon Monseigneur Sébastien Mongo Behon stated when participating in the Lobby Trajectory: "Alone we don't come far, we fall. Together we are strong and stand." So let's stand up together for a more sustainable world without uranium mining and without nuclear power!

Participants of the Lobby Trajectory in the Netherlands. From left to right: Anthony Lyamunda (CESOPE, Tanzania), Uli Lerche (WISE), Mariam Traore (AMCFE, Mali), Moriba Nomoko (AMCFE, Mali), Peer de Rijk (WISE), Thessa Meijlis (WISE), Markus Schmid (WISE), Mark van der Wal (IUCN NL), Mathias Lyamunda (CESOPE, Tanzania), David Bayang (SNJP, Cameroon), Monseigneur Sébastien Mongo Behon (SNJP, Cameroon)

For further information, visit www.wiseinternational.org or contact the project coordinator Ulrike Lerche (energytransition@wiseinternational.org).

Can 'reactor grade' plutonium be used in nuclear weapons?

Author: *Jim Green − Nuclear Monitor editor*

NM787.4395 Nuclear apologists often argue that the 'reactor-grade' plutonium (RGPu) routinely produced in power reactors cannot be used in nuclear weapons. Thus the purported links between nuclear power and weapons have no basis in truth, they argue.

The premise is false − RGPu *can* be used in weapons. Moreover, the links between nuclear power (and civil nuclear programs more generally) and weapons proliferation go well beyond the use of RGPu in weapons. Ostensibly civil nuclear materials and facilities can be used in support of weapons programs in many ways:

- Production of plutonium in power or research reactors followed by separation of plutonium from irradiated material in reprocessing facilities (or smaller facilities, sometimes called hot cells).
- Production of radionuclides other than plutonium for use in weapons, e.g. tritium, which is used to initiate or boost nuclear weapons.
- Diversion of fresh highly enriched uranium (HEU) research reactor fuel or extraction of HEU from spent fuel.
- Nuclear weapons-related research.
- Development of expertise for parallel or later use in a weapons program.
- Nuclear power programs justifying the acquisition of other facilities capable of being used in support of a nuclear weapons program, such as enrichment or reprocessing facilities.

A nuclear power reactor (1000 MWe LWR) typically produces 250−300 kilograms of plutonium each year, sufficient for 25−30 weapons. Total global production of plutonium in power reactors is about 70 tonnes per year. Over 2,000 tonnes of plutonium have been produced in power reactors around the world, hence the importance of the debate over the use of RGPu in weapons.

The problem is exacerbated by the separation and stockpiling of plutonium produced in power reactors, such that it can be used directly in weapons. Stockpiles of separated civil plutonium amount to around 270 tonnes and are continuing to grow − that is arguably the most dangerous and asinine of all the dangerous and asinine practices of the nuclear power industry.

Plutonium grades

For weapons manufacture, plutonium ideally contains a very high proportion of plutonium-239. As neutron irradiation of uranium-238 proceeds, the greater the quantity of isotopes such as plutonium-240, plutonium-241, plutonium-242 and americium-241, and the greater the quantity of plutonium-238 formed (indirectly) from uranium-235. These unwanted isotopes make it more difficult and dangerous to produce nuclear weapons.

Definitions of plutonium usually refer to the level of the unwanted plutonium-240 isotope:

- Weapon grade plutonium contains less than 7% plutonium-240.
- Fuel grade plutonium contains 7-18% plutonium-240
- RGPu contains over 18% plutonium-240.

Although somewhat imprecise, it is also useful to distinguish low burn-up plutonium (high in plutonium-239, including weapon grade plutonium and some or all fuel grade plutonium) from high burn-up plutonium (including RGPu and possibly some fuel grade plutonium).

According to Australia's Uranium Information Centre (2002), plutonium in spent fuel removed from a commercial power reactor (burn-up of 42 GWd/t) consists of about 55% Pu-239, 23% Pu-240, 12% Pu-241 and lesser quantities of the other isotopes, including 2% of Pu-238 which is the main source of heat and radioactivity.

The scientific consensus regarding RGPu

With the exception of a few contrarians (mostly from within the nuclear industry or funded by it), there is general agreement that RGPu can be used to produce weapons, though the process is more difficult and dangerous than the use of weapon grade plutonium (see Gorwitz, 1998 for discussion and references).

A report from the US Department of Energy (1997) puts the following view:

"Virtually any combination of plutonium isotopes − the different forms of an element having different numbers of neutrons in their nuclei − can be used to make a nuclear weapon. ...
The only isotopic mix of plutonium which cannot realistically be used for nuclear weapons is nearly pure plutonium-238, which generates so much heat that the weapon would not be stable. ...
At the lowest level of sophistication, a potential proliferating state or subnational group using designs and technologies no more sophisticated than those used in first-generation nuclear weapons could build a nuclear weapon from reactor-grade plutonium that would have an assured, reliable yield of one or a few kilotons (and a probable yield significantly higher than that). ...
Proliferating states using designs of intermediate sophistication could produce weapons with assured yields substantially higher than the kiloton-range possible with a simple, first-generation nuclear device. ...
The disadvantage of reactor-grade plutonium is not so much in the effectiveness of the nuclear weapons that can be made from it as in the increased complexity in designing, fabricating, and handling them. The possibility that either a state or a sub-national group would choose to use reactor-grade plutonium, should sufficient stocks of weapon-grade plutonium not be readily available, cannot be discounted. In short, reactor-grade plutonium is weapons-usable, whether by unsophisticated proliferators or by advanced nuclear weapon states."

According to Hans Blix, then IAEA Director General: "On the basis of advice provided to it by its Member States and by the Standing Advisory Group on Safeguards Implementation (SAGSI), the Agency considers high burn-up reactor-grade plutonium and in general plutonium of any isotopic composition with the exception of plutonium containing more than 80 percent Pu-238 to be capable of use in a nuclear explosive device. There is no debate on the matter in the Agency's Department of Safeguards." (Blix, 1990; see also Anon., 1990).

The IAEA Department of Safeguards has stated that "even highly burned reactor-grade plutonium can be used for the manufacture of nuclear weapons capable of very substantial explosive yields." (Shea and Chitumbo, 1993.)

With the exception of plutonium comprising 80% or more of the isotope plutonium-238, all plutonium is defined by the IAEA as a "direct use" material, that is, "nuclear material that can be used for the manufacture of nuclear explosives components without transmutation or further enrichment", and is subject to equal levels of safeguards.

An expert committee drawn from the major US nuclear laboratories concluded a report by noting: "Although weapons-grade plutonium is preferable for the development and fabrication of nuclear weapons and nuclear explosive devices, reactor grade plutonium can be used." (Hinton et al., 1996.)

According to Robert Seldon (1976) of the Lawrence Livermore Laboratory: "All plutonium can be used directly in nuclear explosives. The concept of ... plutonium which is not suitable for explosives is fallacious. A high content of the plutonium 240 isotope (reactor-grade plutonium) is a complication, but not a preventative."

According to J. Carson Mark (1993), former director of the Theoretical Division at Los Alamos National Laboratory: "Reactor-grade plutonium with any level of irradiation is a potentially explosive material. The difficulties of developing an effective design of the most straightforward type are not appreciably greater with reactor-grade plutonium than with those that have to be met for the use of weapons-grade plutonium."

According to Matthew Bunn (1997), chair of the US National Academy of Sciences' analysis of options for the disposal of plutonium from nuclear weapons: "For an unsophisticated proliferator, making a crude bomb with a reliable, assured yield of a kiloton or more − and hence a destructive radius about one-third to one-half that of the Hiroshima bomb − from reactor-grade plutonium would require no more sophistication than making a bomb from weapon-grade plutonium. ... Indeed, one Russian weapon-designer who has focused on this issue in detail criticized the information declassified by the US Department of Energy for failing to point out that in some respects if would actually be easier for an unsophisticated proliferator to make a bomb from reactor-grade plutonium (as no neutron generator would be required)."

According to Prof. Marvin Miller, from the MIT Defense and Arms Control Studies Program: "[W]ith an amount on the order of 10 kilograms, it is now possible for a small group, conceivably even a single 'nuclear unibomber' working alone, to 'reinvent' a simplified version of the Trinity bomb in which the use of reactor-grade rather than weapon-grade plutonium is an advantage." (Quoted in Dolley, 1997.)

According to the Office of Arms Control and Nonproliferation, US Department of Energy: "There is clear scientific evidence behind the assertion that nuclear weapons can be made from weapons-grade and reactor-grade plutonium." (Quoted in Dolley, 1997.)

According to Steve Fetter (1999) from Stanford University's Centre for International Security and Cooperation: "All nuclear fuel cycles involve fuels that contain weapon-usable materials that can be obtained through a relatively straightforward chemical separation process. ... In fact, any group that could make a nuclear explosive with weapon-grade plutonium would be able to make an effective device with reactor-grade plutonium."

Nuclear tests using below weapon grade plutonium

The US government has acknowledged that a successful test using 'reactor grade' plutonium was carried out at the Nevada Test Site in 1962 (US Department of Energy, 1994). The information was declassified in July 1977. The yield of the blast was less than 20 kilotons.

The US Department of Energy (1994) states: "The test confirmed that reactor-grade plutonium could be used to make a nuclear explosive. ... The United States maintains an extensive nuclear test data base and predictive capabilities. This information, combined with the results of this low yield test, reveals that weapons can be constructed with reactor-grade plutonium."

The US Department of Energy (1994) makes the connection to debates over reprocessing, stating that: "The release of additional information was deemed important to enhance public awareness of nuclear proliferation issues associated with reactor-grade plutonium that can be separated during reprocessing of spent commercial reactor fuel."

The exact isotopic composition of the plutonium used in the 1962 test remains classified. It has been suggested (e.g. by Carlson et al., 1997) that because of changing classification systems, the plutonium used in the 1962 test may have been fuel grade plutonium using current classifications. De Volpi (1996) is sceptical that the plutonium used in 1962 the test would be classed as reactor grade using current classifications, but states that it was below weapon grade, i.e. he believes it was fuel grade plutonium.

India Today reported that one or more of the 1998 tests in India used RGPu (Anon., 1998) and the UK and North Korea may have tested bombs using RGPu or fuel grade plutonium (Jackson, 2009).

Limitations of RGPu

The difficulties associated with the use of RGPu in weapons are as follows.

If the starting point is spent reactor fuel, the hazards of managing that spent fuel must be addressed and there must be the capacity to separate plutonium from spent fuel. Spent fuel from power reactors running on a normal operating cycle will be considerably more radioactive and much hotter than low burn-up spent fuel. Thus the high burn-up spent fuel (and the separated RGPu) are more hazardous − though it is not difficult to envisage scenarios whereby proliferators place little emphasis on worker safety. It may also be more time-consuming and expensive to separate plutonium from high burn-up spent fuel than from low burn-up spent fuel.

Weapons with RGPu are likely to be inferior in relation to reliability and yield when compared to weapon grade plutonium. Emission of fission neutrons from plutonium-240 may begin the chain reaction too early to achieve full explosive yield. However, devastating nuclear weapons could still be produced. Radiation and heat levels could diminish reliability through their effects on weapons components such as high explosives and electronics.

Nuclear researcher, regulator and adviser Ian Jackson (2009) states: "As well as poor efficiency, reactor grade plutonium does have some practical drawbacks from heating effects which can damage weapon components. Reactor-grade plutonium contains plutonium-238, which is self-heating. (In fact, plutonium-238 heat sources are used to power satellites and deep-space probes.) An 8 kilogram plutonium weapon core would generate about the same heat output as a 100W light bulb. This, of course, would be in close contact with the HE lenses surrounding the core, and might melt or distort their shape. Self-heating might also cause metallurgical phase changes in the granular structure of the plutonium core, damaging its perfectly spherical geometry. Because of these heating difficulties, once assembled, a reactor-grade plutonium bomb would need to be continuously cooled. The design of the weapon might also need to be modified to incorporate heat shunts that would help mitigate self-heating problems caused by plutonium-238."

According to Leventhal and Dolley (1999), the high rate of neutron generation from plutonium-240 can be turned to advantage as it "eliminates the need to include a neutron initiator in the weapon, considerably simplifying the task of designing and producing such a weapon".

Weapon grade plutonium and fuel grade plutonium from power reactors

In addition to the potential to use plutonium produced in a normal power reactor operating cycle in weapons, there is the option of using power or research reactors to irradiate uranium for a much shorter period of time to produce plutonium ideally suited to weapons manufacture − weapon grade plutonium. It is sometimes argued that short irradiation times would adversely effect the commercial operation of a power reactor, but that would probably be of minimal concern to a would-be proliferator.

Gilinsky, Miller and Hubbard (2004) note that the debate over the potential use of RGPu in weapons diverts attention from the potential to use power reactors to produce large quantities of weapon grade and near-weapon grade plutonium from partially irradiated spent fuel. They write: “For example, if the operator of a newly operating LWR unloaded the entire core after 8 months or so the contained plutonium would be weapons-grade with a plutonium-239 content of about 90 percent. The amount of plutonium produced would be about 2 kilograms per ton of uranium, or about 150 kilograms per 8 month cycle. This comes to about 30 bombs’ worth. Does a would-be nuclear weapon state need more? If the short refueling cycles were continued the annual output of weapons-grade plutonium would be about 200 kilograms (allowing for refueling time), but this would require a large amount of fresh fuel.”

Mian and Ramana (2006) state that a typical 220-megawatt pressurized heavy-water reactor could produce 150−200 kilograms per year of weapon grade plutonium when operated at 60-80%.

During a normal reactor operating cycle (in which fuel typically remains in the reactor for 3-4 years), a large majority of the plutonium formed is RGPu. However, the grade of the plutonium varies depending on the position of the particular fuel elements in the reactor. Carlson et al. (1997) note that: “Even though fuel assemblies are moved around during refuelling, some parts of fuel rods will have a plutonium isotope composition closer to that of [weapon grade plutonium].”

Weapon grade plutonium can be inadvertently produced in power reactors. Carlson et al. (1997) cite the example of leaking fuel rods in a reactor in the US in the 1970s, leading the utility to discharge the entire initial reactor core containing a few hundred kilograms of plutonium with 89-95% Pu-239.

Fuel grade plutonium is produced in some nuclear reactors. It is often produced in tritium production reactors, and can also be produced in power reactors in initial core loads and in damaged fuel discharged from the reactor earlier than normal (Carlson et al., 1997).

Carlson et al. (1997) note the normal operation of on-load refuelling reactors (e.g. certain gas-graphite and heavy water reactors) can result in some low burn-up plutonium.

The development of fast breeder technology has the potential to result in large-scale production of weapon grade plutonium (Carlson et al., 1997).

Carlson et al. (1997) note that at least five tonnes of civil plutonium under IAEA safeguards is in the upper range of fuel grade plutonium or weapon grade plutonium.

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NUCLEAR NEWS

Small Modular Reactors under scrutiny

Investments in small modular reactors (SMR) could come at the expense of funding for wind and solar, according to a new report from Dr Mark Cooper, Senior Fellow for Economic Analysis at the Institute for Energy and the Environment, Vermont Law School.

The report reviews the prospects for nuclear technology in light of the past and present performance of nuclear power; assesses the economic and safety challenges that SMR technology faces when confronting the alternatives that are available today; and assesses the trends that are transforming the electricity sector.

It finds that nuclear power is among the least attractive climate change policy options (too costly, too slow, and too uncertain) and is likely to remain so for the foreseeable future. Worse still, pursuing nuclear power diverts economic resources from efforts to accelerate the deployment of less costly, less risky, more environmentally benign solutions. Cooper notes that in the US, the nuclear industry has sought to slow the growth of alternatives with vigorous attacks on the policies that have enabled renewable resources to grow at record levels.

SMR technology represents a particularly challenging leap in nuclear technology that is likely to suffer greatly form the historic problems of nuclear power. SMR technology will suffer disproportionately from material cost increases because they use more material per MW of capacity. Higher costs will result from: lost economies of scale; higher operating costs; and higher decommissioning costs. Cost estimates that assume quick design approval and deployment are certain to prove to be wildly optimistic.

The novel design characteristics of SMRs pose even more of a challenge than the failed 'nuclear renaissance' technology. The untested design and the aggressive deployment strategy for SMR technology raise important safety questions.

The technology is already failing the market test: two US corporations are pulling out of SMR development because they cannot find customers (Westinghouse) or major investors (Babcock and Wilcox).

Advocates argue that smaller reactors are more attractive than large reactors because they are more flexible, requiring smaller capital commitments and shorter construction times. But by these same criteria, non-nuclear alternatives are more attractive – smaller, less costly, quicker to market, and already scalable. The alternatives also do not possess the security and proliferation risks and environmental problems that attach to nuclear power. Moreover, giving nuclear power a central role in climate change policy would undermine the effort to create the physical and institutional infrastructure needed to support the emerging electricity systems based on renewables, distributed generation and intensive system and demand management.

Dr Cooper's May 2014 report, 'The Economic Failure of Nuclear Power and the Development of a Low-Carbon Electricity Future: Why Small Modular Reactors Are Part of the Problem, Not the Solution', is posted at:

www.nirs.org/reactorwatch/newreactors/cooper-smrsaretheproblemnotthesolution.pdf

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Kazakhstan moves towards nuclear power

On May 29, KazAtomProm and Rosatom signed a cooperation deal on nuclear power, as well as a memorandum of understanding (MoU) on a new nuclear power plant. According to Rosatom the MoU lays out steps towards the design, construction, commissioning, operation and decommissioning.

Financing for the plant is to be agreed in a bilateral agreement later this year. Drafting the project documentation for the construction of the plant and identifying its investment may take up to 18 months, Rosatom's CEO Sergei Kirienko said.

The power level of the plant is cited as between 300−1200 MWe. Plans for small (300 MWe) reactors date from 2006, if not earlier. Kazatomprom announced that it planned to start construction of two 300 MWe reactors (with extensive Russian involvement) in 2011 for commissioning of the first unit in 2016 and the second in 2017 at Aktau. The project stalled over funding and apparent Russian reluctance to transfer intellectual property rights.

Siting of the proposed nuclear plant is uncertain. In April, a government official cited Ulken village close to Balkhash lake as a preferred site. He added that the town of Kurchatov in the east of the country, and the city of Aktau city, are also being considered. Earlier this year the Mangistau provincial government opposed the siting of a nuclear power plant near Aktau.

Kazakhstan's experience with nuclear power is limited to a single Russian BN-350 fast neutron power reactor which operated from 1972 to 1999, generating electricity and for desalination. The plant produced up to 135 MWe of electricity and 80,000 m3/day of potable water over 27 years.

As well as being the world's largest uranium producer, Kazakhstan has conversion and fuel fabrication facilities (but no enrichment plants).

www.world-nuclear-news.org/NN-Russia-helps-Kazakh-nuclear-power-plans-3005141.html

http://en.ria.ru/russia/20140529/190222679/Russia-to-Help-Kazakhstan-Build-Nuclear-Power-Plant.html

http://en.tengrinews.kz/markets/Balkhash-lake-named-best-place-for-nuclear-power-plant-in-Kazakhstan-253106/

www.world-nuclear.org/info/Country-Profiles/Countries-G-N/Kazakhstan/

Nuclear resisters

The May 2014 issue of the *Nuclear Resister* is out now, with information about anti-nuclear and anti-war related arrests and peace prisoner support. Stories featured in the latest issue include:

- Four members of a Cape Cod-based activist group were arrested on Sunday, May 11 for walking onto Pilgrim nuclear power plant property to plant flowers.
- Activists from Ground Zero Center for Nonviolent Action in Poulsbo, Washington staged a tea party on May 10 at the main gate of Naval Base Kitsap-Bangor, the West Coast home port for the U.S. nuclear ballistic missile submarine fleet. Eight protesters walked onto the roadway, briefly blocking the entrance. Officers escorted them from the roadway and cited them for walking on the roadway where prohibited.
- In pouring rain, Code Pink's Medea Benjamin joined the Shut It Down Affinity Group on May 9 to block the gate at Entergy Corporation's Vermont Yankee nuclear power plant. Police arrested twelve women for unlawful trespass.
- Two people entered the Air National Guard facility, Wisconsin, during the open house on May 17. When the pair refused to stop handing out the leaflets, they were arrested.
- After getting no response to a letter to the director of the National Security Agency, 20 activists went to Fort Meade, Maryland on May 3 to seek a meeting. The activists headed to the guard station to seek a meeting with someone in a policy-making role. NSA police arrested three people when they refused to leave the roadway outside the base's gates.
- Since 2007, activists in South Korea's Jeju Island have risked arrests, imprisonment, heavy fines and wildly excessive use of police force to resist the desecration caused as mega-corporations like Samsung and Daelim build a base to accommodate US nuclear-powered aircraft carriers and submarines for their missions throughout Asia.

www.nukeresister.org

To receive the Nuclear Resister e-bulletin, visit: www.nukeresister.org/email-updates

Meanwhile, protesters blockaded the Atomic Weapons Establishment (AWE) site in Burghfield, UK on May 19. Eight campaigners from ActionAWE handcuffed themselves together to block the entrance of a construction site. Catherine Bann, a mother of two from Todmorden, said: "The money we would spend renewing Trident could pay for all accident and emergency hospital departments in the country for the next 40 years!"

www.readingchronicle.co.uk/news/roundup/articles/2014/05/19/100383-protestors-blockade-nuclear-weapons-manufacture-in-burghfield/

www.ekklesia.co.uk/node/20502

Finland: More delays with nuclear power plans

Teollisuuden Voima (TVO) announced on May 20 that it will request an extension to the in-principle decision granted for the construction of a fourth reactor at the Olkiluoto nuclear plant in Finland, as well as a new time limit for filing the building permit application.

TVO CEO Jorma Tanhua said: "Olkiluoto 3 has been delayed to the extent that we can't make any big decisions on Olkiluoto 4. All the conditions and grounds for Olkiluoto 4 remain intact. It's only a question of timing." Under the current in-principle decision, TVO must apply for a building permit for Olkiluoto 4 by the end of June 2015; TVO has asked for the time limit to be extended by five years.

Analysts say that new electrical generating capacity appears less necessary than a few years ago because of Finland's economic problems and a decline in its energy-hungry industries.

The Olkiluoto 3 European Pressurized Reactor (EPR) has been subject to spectacular cost overruns and delays. When the contract was signed in 2003, completion was anticipated in 2009. Now, TVO refuses to provide an estimated start-up date while Finnish daily Kauppalehti cited sources from the project who estimate start-up in 2018 − nine years behind schedule. The cost has blown-out from €3.2 billion (US$4.4b) to around €8.5 billion (US$11.6b).

Meanwhile, Fennovoima's plan for a nuclear power reactor have been pushed back. Economic Affairs Minister Jan Vapaavuori says the government isn't likely to make a decision on the construction of the reactor before August. He said the planned reactor would need to have substantial majority Finnish ownership. Russia's Rosatom is pencilled in as the supplier as well as 34% part-owner of the planned reactor. The Green League has threatened to quit the governing coalition if Fennovoima's application is approved.

As reported in Nuclear Monitor #774, around half of all shareholders in the Fennovoima project have withdrawn in recent years − one-quarter of them last year alone. More withdrawals may be on the cards.

Etelä-Savon Energia Oy, a small firm that sold its 1% interest in the Fennovoima project, has announced plans to develop a pilot solar power scheme and is aiming to develop solar energy markets in the region of South Savo.

www.helsinkitimes.fi/finland/finland-news/domestic/10691-government-faces-two-in-principle-decisions-on-nuclear-power.html

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www.pv-tech.org/news/finnish_utility_eyes_solar_pilot_scheme_after_nuclear_withdrawal

Canada: Court setback for nuclear power in Ontario

Canada's Federal Court has sent Ontario Power Generation back to do more work on its proposal to build new reactors at its Darlington nuclear station. In a May 14 ruling, the court agreed with environmental groups that a federal environmental review panel contravened the Canadian Environmental Assessment Act by recommending approval of OPG's proposal to build up to four new reactors at the Darlington without first examining the environmental effects of radioactive fuel waste, serious accidents, and hazardous emissions. Lawyers from Ecojustice and CELA represented Lake Ontario Waterkeeper, Northwatch, CELA and Greenpeace, all of whom participated in the federal environmental review process since 2006.

Among other issues, the court found that:

- No real consideration was given to long-term disposal of spent fuel from low enriched uranium fuel.
- OPG did not present a cumulative effects analysis for "common cause" severe accidents affecting multiple reactors in the event of a Fukushima-type disaster.
- There was a lack of analysis of hazardous substance emissions, in particular liquid effluent and stormwater run-off from the proposed reactors and for the sources, types and quantities of non-radioactive wastes to be generated by the project.

If OPG wishes to proceed with new reactors, the court ruling requires that the review panel reconvene or a new review panel will need to be formed and properly consider the environmental effects of radioactive waste, accidents and emissions. The court also ruled that a preliminary site-preparation licence issued to OPG in 2012 by the Canadian Nuclear Safety Commission is now invalid. It had been the first preparatory permit for new reactors in Canada in 30 years.

Plans for new reactors at Darlington were deferred indefinitely in October 2013, but without the court ruling the deficient assessment and licence could have been used to revive the project at any time over the next decade. In 2009 the Ontario government announced plans to build up to four additional reactors at the Darlington site, but later balked at the estimated C$15−26 billion cost. Over the past decade increased energy efficiency and the changing economy have reduced Ontario's electricity demand, and the province expects to be able to offset nearly all of the expected growth in electricity demand to 2032 using efficiency and conservation measures.

Ontario has 18 operating power reactors at three plants − Darlington, Bruce and Pickering.

www.thestar.com/business/economy/2014/05/15/new_reactor_plan_needs_more_work_court_tells_opg.html

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www.ottawacitizen.com/business/Court+decision+sidetracks+future+nuclear+reactors+Ontario/9844151/story.html

www.world-nuclear-news.org/NP-Ontario-relies-on-current-nuclear-capacity-0312137.html

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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