



International
Nuclear Risk
Assessment Group

Nuclear Safety and Security during a Pandemic

iNRAG Working Paper (24.04.2020)



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Frontcover illustration: Designed by Freepik

1. Introduction

The Covid-19 pandemic has impacted not just human health worldwide but also operations at many nuclear facilities. This could pose a challenge to safe and secure operations at these facilities and increase the risk of severe accidents. Should there be a severe accident, such as those at Chernobyl and Fukushima, the impact would be doubly devastating. In addition to the radiological contamination that would result from the accident, there would also be difficult challenges involved in evacuating large populations from the most contaminated zones, which is the usual way by which radiation doses have been lowered in the aftermath of previous accidents.

In response to industry pressure to maintain normal output during the Covid-19 pandemic, nuclear regulators are relaxing requirements in many areas including maintenance, inspection and work-time limitations. Our concern is that these changes might adversely affect safety margins at nuclear facilities. Ostensibly, these actions are intended to comply with social distancing recommendations from public health authorities for both plant personnel and regulatory staff. For example, in many cases, maintenance work is being delayed in order to avoid large numbers of workers crowding the sites. Unfortunately, no regulatory body has provided a current, transparent framework to justify these decisions. In the United States, for example, a licensee could request an extension justified by application of risk principles. Yet it is clear that a comprehensive assessment of the risk of greater exposure to workers and the impact on power availability is not feasible. That raises questions about the basis for deciding which activities may be safely deferred. While the pandemic continues, regulators should provide greater information about the factors used to decide whether deferring any activity is acceptable. In the long term, regulators should develop a comprehensive framework setting out the principles for determining what actions can be deferred in a pandemic.

This INRAG working paper assesses the principal impacts of the pandemic on nuclear safety and security. It provides an overview of country specific reactions and draws preliminary conclusions about the safety and security of nuclear facilities worldwide. While all kinds of nuclear facilities may be impacted, the following discussion will focus on operating Nuclear Power Plants (NPPs). Sites with permanently closed plants, construction sites and other facilities can and in some cases have already been dealt with at relatively short notice, in cases where there has been significant infection in the plant region. Some safety critical facilities like reprocessing plants have already been shut down temporarily; this is the case, for example, at the Sellafield site in the United Kingdom.¹

The current analysis further focuses on the near-term effects of the pandemic. Other possible impacts on safety and security in the longer term might stem from the severe consequence on the economies of different countries. These possible impacts will have to be assessed at a later date.

2. Impacts of a pandemic on the safety and security of nuclear facilities

A pandemic has no direct effect on technological systems like NPPs. It threatens human health. However, due to the dependency of nuclear facilities on highly skilled workers, a functioning regulatory environment and emergency services in cases of accidents, the pandemic itself and the measures taken to limit its propagation may threaten the safe and secure operation especially of NPPs, primarily due to personnel getting sick, having to stay in quarantine, or via restricted working conditions.

¹ <https://www.bbc.com/news/uk-england-cumbria-51951984>, 23.04.20

While NPPs have to consider various kinds of internal and external events,² up to now, there are no binding international regulations in place on how nuclear facilities have to prepare for cases of a pandemic. Although general aspects of industrial safety management at nuclear facilities are discussed in the International Atomic Energy Agency (IAEA) Industrial Safety Guidelines for Nuclear Facilities,³ the publication does not specifically describe programmes directed at pandemic planning. However, the IAEA's safety standards require that staffing levels be adequate to operate and shut down a reactor and maintain safety during the shutdown process. According to the Head of the IAEA's Operational Safety Section, this requires that "a core group of staff... be identified for operating the reactor safely".⁴

There are similar domestic level regulations too. All European countries with operating nuclear power plants have regulatory requirements concerning the safe operation of NPPs, including specifications for the minimum staff required at the sites. It is the responsibility of the national regulatory bodies to ensure the compliance with these requirements by the operators.⁵

The following discusses some consequences of the pandemic, and measures taken internationally to restrict its impact on the safety and security of nuclear facilities.

2.1. Workforce

As discussed above, a minimum number of personnel is required for safe operations. The categories of personnel that would be critical to the safe and secure operation of a nuclear plant are:

- personnel in the control room;
- personnel to perform operational tasks;
- security personnel;
- personnel involved in radiation protection;
- emergency response functions (some might be offsite, but some plants have internal personnel, for example, fire brigades)

Numbers in each of these categories vary from country to country and from reactor to reactor. Typically, there are more than this minimum number of people on each shift and there exist reserve shifts to take account of illness and leave during normal operation.

While all of these workers have to be qualified, and most of them have to be quite specialised, control room personnel are particularly specialised and need specific expertise and official licenses to be allowed to work at an NPP. Such personnel cannot be replaced easily or at short notice. Other on-site workers, such as security personnel, need background checks and, again, might not be easily replaceable at short notice.

² See for example IAEA NS-G-1.5, https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1159_web.pdf, NG-G-3.1, https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1126_scr.pdf.

³ https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1774_web.pdf, 2018

⁴ <https://www.iaea.org/newscenter/news/iaea-steps-up-support-for-nuclear-facility-operators-during-covid-19-crisis>, 08.04.2020

⁵ <https://www.bmu.de/meldung/gewaehrleistung-der-nuklearen-sicherheit-waehrend-der-corona-krise/>, 27.03.2020

Most countries have regulatory requirements that specify the minimum number of on-site personnel for safe operation. Ideally, when such requirements can no longer be met, the plant must be shut down. Shutting down significantly reduces the required number of personnel, but still some safety related operations, such as essential reactor core cooling and spent fuel storage must be ensured for longer time periods.

Working condition for the staff at an NPP might also be regulated. Typically, there are restrictions with respect to the maximum number of daily and weekly working hours. While these restrictions can be relaxed to a certain degree and for a limited period, the safe operation of an NPP substantially depends on well-rested, alert, and focused personnel in order to avoid human error.

Plant owners have already taken numerous measures to ensure the availability of their workforce. Examples are discussed in the country specific sections below. Countries like France with lots of largely similar reactors will be able to exchange or complement resources between different sites to ensure the reactors that stay in operation are properly staffed. Small countries with no more than a handful of reactors, even if strongly dependent on nuclear energy (e.g. Armenia, Slovenia, Slovakia), may well have to shut down a plant if required staffing levels cannot be achieved. Of course, if the pandemic continues to spread, finding adequate numbers of trained operators could be a challenge even for countries like France.

2.2. Regulatory oversight

During normal operation and especially during outages, the regulatory body carries out inspections of systems, structures and components in an NPP. These require personnel from the regulatory body or its technical support organizations to visit the plant and perform inspections together with personnel of the operator.

Due to forced or preventive working restrictions arising from the pandemic, fewer or no personnel from the regulatory body may be on site, thus necessitating safety checks to be performed either based on documentation provided by the operator or postponing them altogether.

2.3. Planned Outages

Every 12 to 24 months, most nuclear power plants must be shut down for refuelling. During this planned outage, necessary safety checks and maintenance operations take place. Therefore, the workforce located at the plant increases considerably and somewhere between several hundred to a few thousand workers have to be on site. The additional workforce could be either local technicians or specialists from vendor companies travelling from plant to plant or even country to country to take part in the shutdown operations.

The numbers of reactors undergoing such outages could be considerable in countries with large nuclear fleets. For example, in the United States, 32 units are planned to be refuelled in spring 2020, and a total of 56 units this year.⁶

One way to deal with the risk of the pandemic spreading is to postpone all these activities and shut down until the Covid-19 peak passes. Some countries, such as Germany, allow for delaying refuelling for a

⁶ <https://www.utilitydive.com/news/coronavirus-could-disrupt-normal-refueling-practices-for-nuclear-facilities/574920/>, 26.03.2020

couple of months by lowering the power output of the reactor. Delayed outages do also mean that safety-important maintenance and necessary periodic inspections must take place at a later time.

Another possibility is to reduce the staffing density and have fewer workers on site. This would result in the refuelling, safety checks and other maintenance work taking longer to carry out. A lengthened refuelling period should not impact the safety of the plant, but it would mean that the NPP will not be generating electricity during that period.

In case refuelling is necessary for continued operation, shorter shutdowns just for refuelling may be considered in order to avoid the need for large workforces onsite. Again, this would lead to a postponement of necessary safety checks and refurbishments. While the required frequency of periodic inspections has some flexibility with respect to operational needs, large-scale postponements of required inspections and maintenance activities will decrease the safety level of a plant, until all work has been caught up with.

2.4. Spare parts and materials

The ability to obtain qualified replacement and spare parts for safety related components is of primary concern for the safety of nuclear installations.⁷ With utility deregulation and the need to emphasize cost efficiencies, many utilities reduced their spare parts inventories, which, because of a high degree of risk-aversion, formerly involved large volumes of expensive, relatively infrequently required parts.⁸

Given the mean age of the reactor park of more than thirty years, a considerable number of systems and pieces of equipment must be replaced to take account of aging or the need for safety upgrades.⁹ Regular maintenance, upgrades and procurement solutions are vital to sustain safe and reliable operation of the existing nuclear fleet.¹⁰

All supply chains could be potentially affected.¹¹ The present COVID-19 crisis reduces not only personnel in the nuclear facilities but also in component supply chains. Supply chains are subjected to Macro risks including diseases, in this case "COVID-19 shock to supply chains".¹² While regulated utilities are mandated to have access to adequate supplies of critical parts, components, equipment and materials for emergencies, utilities might now encounter shortages due to constrained production of supplies produced in countries highly affected by COVID-19.¹³ Thus, there is a risk that parts essential for safety are not available in a timely manner. Combined with delays to inspections, this could become critical. Although not officially documented, the situation might be exacerbated by financial difficulties suppliers are facing as a consequence of the decline in orders resulting from delays in maintenance work at nuclear installations.

⁷ <https://www.westinghousenuclear.com/operating-plants/nuclear-parts-operations/obsolete-parts>

⁸ <https://core.ac.uk/download/pdf/12207961.pdf>

⁹ <https://energiforskmedia.blob.core.windows.net/media/21590/replacing-obsolete-nuclear-instrumentation-and-control-equipment-energiforskrapport-2016-307.pdf>

¹⁰ <https://www.power-eng.com/2013/06/03/a-better-way-to-address-aging-and-obsolescence/>

¹¹ <https://industrie.de/arbeitswelt/auswirkungen-coronavirus-lieferketten/> 17.03.2020

¹² <https://www.pwc.com/us/en/library/covid-19/how-covid-19-is-impacting-power-and-utilities.html> 08.04.2020

¹³ <https://www.pwc.com/us/en/library/covid-19/how-covid-19-is-impacting-power-and-utilities.html> 08.04.2020

2.5. Nuclear emergencies

According to nuclear authorities around the world, they can still deal with nuclear emergencies. The IAEA recently announced that it had tested its own ability to provide assistance even in case of a nuclear emergency, arguing that the Agency needed “to be prepared for the possibility that nuclear and radiological emergencies resulting from a safety or security event could be accompanied by natural disasters, pandemics or other crises.”¹⁴ But this is easier said than done. The challenges of dealing with a severe accident are considerable.

In the case of a severe accident, external emergency measures like an evacuation of local population may become necessary. While such emergency measures will be extremely demanding even under normal conditions, they may become even more strained at times such as at present when emergency services, hospitals and the whole medical system are already working under high pressure. In turn, the movement of large populations amidst a pandemic could well lead to further outbreaks. Ensuring social distancing at evacuation centres, for example, would not be possible under current plans. Thus, a severe accident happening during a pandemic may lead to much more serious consequences.

3. Response by operators and regulators

The IAEA lists special measures implemented by operators of nuclear facilities including: reduced staffing and telecommuting; social distancing; alternative ways of communicating with control room personnel; regular medical screenings of staff; sterilization of work areas and purchase by the operator of specific personal protective equipment; travel restrictions; self-isolation; restrictions on meetings; and even asking essential staff to live at the site temporarily.¹⁵ However, the pandemic presents a substantive challenge to the Agency, who also reports that although inspectors are meeting their current goals, travel restrictions, limited commercial flight availability and self-quarantine requirements are presenting severe logistical problems. Given uncertainty about the course of the pandemic, planning ahead can be done on only a tentative basis at best.¹⁶

According to the World Nuclear Association (WNA), plant operators are applying various measures to protect the health of their workers, including enhanced hygiene procedures, and staggered shifts and lunch breaks to enable social distancing. Companies have also introduced remote-working for staff who are able to carry out their duties to the required standard from home. The number of personnel whose presence on-site is not essential to the on-going operation of the plant has been reduced, further limiting the potential of the virus to spread.¹⁷

FORATOM, the European nuclear industry trade body, stated that European operators have implemented various measures to ensure worker’s health including alternative working methods and

¹⁴ <https://www.iaea.org/newscenter/news/preparing-to-assist-in-a-nuclear-or-radiological-emergency-under-all-circumstances>, 30.03.2020

¹⁵ <https://www.iaea.org/newscenter/news/iaea-steps-up-support-for-nuclear-facility-operators-during-covid-19-crisis>, 08.04.2020

¹⁶ Nuclear intelligence Weekly (2020): IAEA: Daunting Challenges for Safeguards Inspectors, NIS, Vol. 14, No. 14, April 3, 2020: www.energyintel.com

¹⁷ <https://www.world-nuclear-news.org/Articles/Message-Nuclear-power-in-the-fight-against-COVID19?feed=feed>, 27.03.2020

limiting the number of workers, that operations were halted at some facilities and that maintenance continues as long as all conditions for ensuring the safety of employees are met.¹⁸

In response to industry pressure to maintain normal output during the Covid-19 pandemic, nuclear regulators are relaxing requirements in many areas including maintenance, inspection and work-time limitations. Ostensibly, these actions are intended to comply with social distancing recommendations from public health authorities for both plant personnel and regulatory staff. Unfortunately, no regulatory body has provided a current, transparent framework to justify these decisions. In the United States, for example, a licensee could request an extension using risk principles. Yet it is clear that a comprehensive assessment of the risk of greater exposure to workers and the impact on power availability is not feasible. This raises questions about the basis for deciding which activities may be safely deferred. While the pandemic continues, regulators should provide greater information about the factors used to decide whether any deferred activity is acceptable. In the long term, regulators should develop a comprehensive framework for determining what actions may be deferred in a pandemic.

3.1. Canada

Planned upgrade work on the Ontario Power Generation (OPG) Darlington Nuclear Generating Station's Unit 3 has been postponed. Work to enhance the safety of the plant in the context of the station's plant life extension was scheduled to start in May 2020 but is now postponed to a later date,¹⁹ "to help ensure stable electricity supplies during the Covid-19 pandemic", according to the WNA²⁰. Since the plant remains on-line, the question of continued safe operation remains potentially unresolved.

The Canadian Nuclear Safety Commission (CNSC) requires all NPP operators to develop and implement business continuity plans to ensure their facilities continue to operate safely at all times. Some CNSC staff have been ordered to stay at home, while critical staff continue to work to ensure effective regulatory oversight, prioritizing their work to focus on the needs of those providing essential services, like nuclear power plants. CNSC's inspectors continue to have access to licensed facilities as needed to respond to safety issues.²¹

OPG has scaled back the number of staff at the local generating stations but has not planned to shut down any of its reactors; indeed, its CEO has argued for continued operations of nuclear plants: "We have a unique role to play in making our way through this pandemic. It's very important we continue to operate; it underpins long-term care facilities, hospitals, grocery stores and every essential service".²² Further, one of the units of the Darlington nuclear power plant has just completed refurbishment and reached first criticality on 14 April 2020.²³

¹⁸ <https://www.foratom.org/media/covid-19/>, last viewed 11.04.2020

¹⁹ <https://www.power-technology.com/features/impact-covid-19-power-sector/>, 27.03.2020

²⁰ <https://world-nuclear-news.org/Articles/First-refurbished-Darlington-unit-starts-up>, 14 April 2020, accessed 16 April 2020.

²¹ <https://www.nuclearsafety.gc.ca/eng/resources/emergency-management-and-safety/pandemic-preparedness.cfm>, last updated 07.04.2020

²² <https://www.durhamregion.com/news-story/9917304-lights-on-masks-up-opg-darlington-and-pickering-step-up-during-coronavirus/>, 28.03.2020

²³ <https://world-nuclear-news.org/Articles/First-refurbished-Darlington-unit-starts-up>, 14.04.2020

3.2. Finland

At the Olkiluoto NPP unit 3 currently under construction in Finland, first fuel loading into the reactor was planned for June 2020. This schedule has been postponed. The operator, Teollisuuden Voima Oyj, has applied on April 8, 2020 for a permit to load fuel, but estimates that it will take a few months to obtain the permit.²⁴

The Finnish Radiation and Nuclear Safety Authority (STUK) believes that nuclear power plants have prepared adequately for the risks and can be operated safely. STUK, however, announced that on-site inspections will “only be carried out at sites which are the most significant for safety, and the health authorities’ guidelines on avoiding close contact will be taken into account in the inspection arrangements”.²⁵ It is not clear whether the sites being inspected include all operating reactors or if some operating reactors are deemed not significant for safety.

3.3. France

The pandemic has had major impacts on France’s nuclear workforce. It is reported that of 22,500 employees of EDF’s Nuclear Production Department 15,000 are on telework.²⁶ On March 20, 2020, it was reported that EDF had “declined to comment about the level of absenteeism or the number of confirmed coronavirus infections among its staff” but had said that “its nuclear plants could operate for three months with a 25% reduction in staffing levels and for two to three weeks with 40% fewer staff.”²⁷

According to the French Nuclear Safety Authority (ASN), various responses to Covid-19 have been taken:²⁸

- A large number of nuclear installations whose functioning is not vital for the continued activity of the country, operated in particular by the CEA, Orano or Andra, have been shut down and are maintained in safe state. Activities necessary for the functioning of the EDF nuclear power plants are nevertheless maintained;
- Examination work conducted by ASN in collaboration with its technical advisory body, the Institute for Radiological Protection and Nuclear Safety (IRSN), is continuing as normal. At the same time, on-site inspections are suspended, save when judged indispensable. On-site inspections are replaced by remote verifications, particularly concerning the examination of documents relating to day-to-day operation accompanied by audio-conferences with the licensee;
- As part of the post-Fukushima safety improvements, EDF is updating its on-site emergency plans (PUI) to integrate potential difficulties in gaining access to the sites, which could render full deployment of the local emergency response teams more complicated (progressive

²⁴

<https://www.tvoy.fi/en/index/news/pressreleasesstockexchangerelases/2020/tvohassubmittedol3eprunitnuclearfuelloadingpermissionapplication.html>, 08.04.2020

²⁵ <https://www.stuk.fi/web/en/-/the-radiation-and-nuclear-safety-authority-stuk-ensures-its-operations>, 20.03.2020

²⁶ *Le Figaro*, 7 April 2020

²⁷ *Reuters*, 20 March 2020, <https://www.reuters.com/article/us-health-coronavirus-france-nuclear-idUSKBN2172J1>, accessed on 16 April 2020.

²⁸ <http://www.french-nuclear-safety.fr/Information/News-releases/Covid-19-epidemic-ASN-is-adapting-its-method-of-functioning-while-maintaining-its-rigour>, 27.03.2020

deployment of the PUI). These changes in the PUI, examined by ASN with the assistance of IRSN, have been tested in hands-on situations during unannounced exercises which provided the opportunity to check that EDF is capable of managing an on-site emergency plan in highly degraded mode, should such a situation arise.

The documentation requested by the French regulator has been reduced to a minimum. ASN's Chief Inspector Christophe Quintin stated: "In general, we are requesting to see a great number of documents. Currently, we know that EDF's teams work in a just-in-time mode. Therefore, we are going to the essential."²⁹

On April 15, 2020, Orano announced the progressive restart of the UP3 reprocessing plant at La Hague.³⁰ That increases the workforce on-site by about 200 in addition to the 1,000-1,200 essential workers that had remained of the usual 5,000 staff. Every worker entering the site will be given two surgical masks and social distancing measures are in place, according to Orano.³¹

Coming to specific locations, work at the Flamanville site in France, where two reactors are in operation and one is under construction, has been impeded, and EDF reduced its staff level from 800 to 100 on the site. Only people in charge of safety and security remain on-site. The two operating reactors at the site have been in outage since January 2019 and September 2019 respectively with major maintenance, repair and upgrade work underway.³² Construction work at the third reactor at the site has been reduced.³³

With one unit in operation and another one in decennial outage, the Chooz NPP has reduced the number of workers on-site from 2,200 to 850.³⁴

The French grid operator RTE expects nuclear availability to stay 3.6 GW below the 2015 to 2019 average as well predicting a national drop in electricity demand.³⁵

3.4. Germany

According to the Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMU) nuclear oversight by the responsible ministries continues to the extent necessary. German operators of NPPs have pandemic plans in operation, which are adapted to the development of the pandemic in Germany. These include, for example, enhanced hygiene measures, stricter access control to the plant to identify possible infected personnel and rearrangement of working procedures to reduce working contacts to the minimum necessary.³⁶

²⁹ *Le Figaro*, 7 April 2020

³⁰ The site has two large reprocessing plants, UP2-800 and UP3.

³¹ *Aljazeera*, 13 April 2020

³² https://www.lepoint.fr/societe/nucleaire-le-redemarrage-de-flamanville-a-nouveau-repousse-03-03-2020-2365495_23.php, 23.04.2020

³³ <https://www.reuters.com/article/us-health-coronavirus-france-nuclear/frances-edf-to-reduce-flamanville-nuclear-plant-staffing-over-virus-idUSKBN21322Q>, 16.03.2020

³⁴ *L'Union*, 15 April 2020

³⁵ <https://www.power-technology.com/features/impact-covid-19-power-sector/>, 17.03.2020

³⁶ <https://www.bmu.de/meldung/gewaehrleistung-der-nuklearen-sicherheit-waehrend-der-corona-krise/>, 27.03.2020

Until 2009, no clear regulation with respect to the minimum workforce necessary at NPPs in Germany was in place. After an event in a German NPP, during which personnel from the control room had to perform duties in their secondary function in the fire-fighting brigade, the German Reactor Safety Commission (RSK) issued recommendations with respect to the determination of the minimum workforce needed for safe operation.³⁷ According to these recommendations, not including security staff, a minimum number of eight people have to be available on site at all times, five of which are control room staff. The determination of the minimum workforce required must take into account all plant states, including severe accidents. As internal emergency measures for severe accidents are to a large degree plant specific, a different minimum number of shift personnel may be needed, which has to be determined by a plant specific analysis taking into account actions needed during emergencies. A corresponding requirement to determine the minimum workforce are since 2012 also included in German safety requirements for NPPs.³⁸ No general number on the required security staff can be given, but an average number of about 15 persons is estimated in an appendix to the German requirements for the object protection service.³⁹

Major outages for NPPs in Germany were planned for April and May. The German regulatory authority has forbidden the maintenance and refuelling outage of the nuclear power plant Grohnde as originally planned. The shutdown and related activities would have necessitated about 1,500 staff for a period of two weeks at the plant site. The outage is now planned to take an additional four weeks, while restricting the necessary workforce to a maximum of 250. It is expected that the schedule of planned outages at other plants will also change accordingly.⁴⁰

Transports of highly radioactive wastes from the Sellafield reprocessing plant in the U.K., planned for the spring of this year, have been postponed, as the required corresponding police operation was not feasible.⁴¹

3.5. Russia

On March 26, 2020, the Russian state-owned nuclear group ROSATOM issued a statement on its Covid-19 response: “At present, we have introduced additional measures at all of Russia’s nuclear power plants, including regular health check-ups of our personnel. We have arranged for as many employees as possible to work remotely and purchased personal protective equipment and hygiene-related products in bulk; we are constantly disinfecting our production facilities and vehicles and have essentially cancelled all business trips. We are monitoring our employees’ health in close cooperation with local authorities across our areas of operation. We have developed a number of additional contingency plans for various scenarios of the coronavirus pandemic that may have an effect on the health of our NPP employees.”⁴²

³⁷ <http://www.rskonline.de/sites/default/files/reports/epanlagersk417hp.pdf>, 18.06.2009

³⁸ https://www.base.bund.de/SharedDocs/Downloads/BASE/EN/hns/a1-english/A1-03-15-SiAnf.pdf?__blob=publicationFile&v=1, 03.03.2015, §6 (1) g)

³⁹ http://www.verwaltungsvorschriften-im-internet.de/bsvwvbund_04072008_RSI613151617.htm, 04.07.2008

⁴⁰ https://www.ndr.de/nachrichten/niedersachsen/hannover_weser-leinegebiet/Revision-im-AKW-Weniger-Personal-wegen-Corona.coronavirus1152.html, 03.04.2020

⁴¹ <https://www.bmu.de/meldung/gewaehrleistung-der-nuklearen-sicherheit-waehrend-der-corona-krise/>, 27.03.2020

⁴² <https://rosatom.ru/en/press-centre/news/rosatom-director-general-makes-statement-on-covid-19-situation/>, 26 March 2020, accessed 16 April 2020.

However, central management leaves broader decisions about staff quarantines up to local authorities both in the Russian regions where Rosatom operates facilities as well as in other countries.

On April 1, 2020, Rosatom announced that four of its employees tested positive for the Covid-19.⁴³ At the Beloyarsk NPP, after one worker's wife fell ill, all employees were asked to move to special dispensaries and commute from there.

ROSATOM is engaged in several new build projects worldwide. On April 6, 2020, it recalled 178 of its employees from the construction site in Bangladesh. As more than 4,000 people are working at the site, ROSATOM assumes no impact on the planned schedule for the project because of the temporary relocation of its employees. It further cites enhanced health care measures to protect people at the construction site, like measuring employees' temperatures, special disinfection of all office space and the issuing of masks to all employees.⁴⁴ But the withdrawal of nearly 200 Russian employees, many of whom can be presumed to be working at relatively higher levels of the organization, means that there could be questions about how safely construction is being carried out.

3.6. United Kingdom

The Sellafield Magnox reprocessing plant in the U.K. was shut down, after more than 1,000 of the Sellafield staff had begun self-isolation. The Sellafield complex has approximately 11,500 staff. According to the operator, "given the nature of our work many of you will need to continue to attend your workplace – either because your work directly impacts nuclear safety or security, or because you provide a business continuity or support function and are unable to work remotely."⁴⁵

At the Hinkley Point C construction site, the workforce has been halved to 2,000.⁴⁶

According to the U.K. Office for Nuclear Regulation (ONR)⁴⁷

- all sites have minimum staffing levels, and contingency plans should they fall below these levels, to enable them to remain in control of activities that could impact on nuclear safety under all foreseeable circumstances, including pandemic disease;
- The oversight work of ONR continues, while a number of inspectors will continue to travel to sites where required, but we will carry out as much of our business as possible via phone, email and Skype.

The ONR assumes that these measures will not have a severe impact on the effectiveness of its regulation of the nuclear industry.

⁴³ <https://bellona.org/news/nuclear-issues/2020-04-some-russian-nuclear-workers-isolated-as-rosatom-steps-up-coronavirus-response>

⁴⁴ <https://www.rosatom.ru/en/press-centre/news/rosatom-arranged-the-return-of-178-employees-from-construction-site-of-rooppur-npp-bangladesh-to-rus/>, 07.04.2020

⁴⁵ <https://www.theguardian.com/business/2020/mar/18/sellafield-nuclear-waste-plant-close-coronavirus-staff>, 18.03.2020

⁴⁶ <https://www.power-technology.com/features/impact-covid-19-power-sector/>, 30.03.2020

⁴⁷ <http://news.onr.org.uk/2020/03/coronavirus-covid-19-onr-position/>, updated 26.03.2020

3.7. United States

U.S. operators take several measures to ensure safety of their workers. These include separating some control centre personnel to other locations from which they can perform their work, additional worker screening measures, such as temperature checks and remote working for all non-essential workers.⁴⁸

While nuclear operators have identified some tasks that can be done remotely or be postponed, some employees must still come to nuclear power plants on a daily basis because many computers are not connected to the internet (what is sometimes called an air-gap). This is a cybersecurity measure required in operations by the NRC in order to prevent hackers from accessing critical computer systems.⁴⁹

Based on pandemic plans established a decade ago, nuclear plants have cots, blankets, chemical toilets and enough personal care items to sustain the operating crews at a plant should such measures be necessary.⁵⁰ Officials in the United States have suggested they might isolate critical technicians at the country's nuclear power plants and ask them to live onsite to avoid exposure to the virus.⁵¹

The U.S. Nuclear Regulatory Commission (NRC) has changed its *modus operandi* in response to Covid-19, including⁵²:

- Resident inspectors are required to do remote work and to remain in a ready status, prepared to respond immediately should there be developing safety issues. The resident inspectors make regular visits to operating nuclear power reactor sites and monitor plant data systems, meetings and other information. Back-up inspectors are available from regional offices or headquarters should they be necessary to maintain oversight.
- Communicating regularly with nuclear plants to discuss current activities and future plans including plant staffing, medical screening, reductions in non-essential maintenance work, and other matters. NRC regulations set minimum reactor operator and security staffing requirements. Nuclear power plants also have plans to maintain appropriate staffing under adverse conditions. If necessary, the NRC is prepared to consider temporary relaxation of select staffing levels and work hour limits if power plant operators can satisfy the agency that they will maintain safe operations. The NRC will require plants to shut down if they cannot appropriately staff their facilities.
- Re-evaluating scheduled routine inspections of materials licensees, decommissioning reactor sites and stand-alone spent fuel storage facilities to ensure the safety of NRC and licensee personnel.

⁴⁸ <https://bellona.org/news/nuclear-issues/2020-03-covid-19-could-cause-staff-shortages-in-the-nuclear-power-industry>, 20.03.2020

⁴⁹ <https://www.utilitydive.com/news/coronavirus-could-disrupt-normal-refueling-practices-for-nuclear-facilities/574920/>, 26.03.2020; For an example of a cyber attack on a nuclear power plant, see <https://www.theindiaforum.in/article/computer-infection-kudankulam-and-its-implications>, 10.01.2020

⁵⁰ <https://www.utilitydive.com/news/coronavirus-could-disrupt-normal-refueling-practices-for-nuclear-facilities/574920/>, 26.03.2020

⁵¹ <https://bellona.org/news/nuclear-issues/2020-03-covid-19-could-cause-staff-shortages-in-the-nuclear-power-industry>, 20.03.2020

⁵² <https://www.nrc.gov/reading-rm/doc-collections/faq/coronavirus.html>, Last Reviewed/Updated Monday, April 06, 2020

- Deferring most travel and inspections conducted by region-based inspectors, although preparations for some region-based inspections continue remotely as inspectors review documents and have remote discussions with plant personnel.

The Nuclear Energy Institute (NEI) claims that safety protocols have anticipated instances where important inspections might need to be postponed. "Current requirements contain provisions that permit utilities to reschedule work under limited circumstances, typically until the next refuelling outage, provided a sound technical justification ensures safety is not compromised."⁵³

An example of such a revision of requirements, discussed at a public meeting held by the NRC, would be inspections of steam generator tubes for cracks and other defects, which takes place during outages.⁵⁴

NRC has furthermore relaxed restrictions on working hours of plant personnel, and owners of plants who believe they cannot meet the work hour limits can apply for a 60-day exemption.⁵⁵ NRC officials have "increased its 72-hour weekly limit for plant workers to 86 hours to cover for any Covid-19-related worker absences" and allow operators "to delay certain inspections scheduled to take place during refuelling this year until the next ones, typically 18 months away".⁵⁶ Although NRC claims that operators have to make a strong case for being allowed these changes, NRC has left it up to the operator to decide what counts as a strong case. Industry observers point out that this "suggests that a certain amount of guesswork -- and subjectivity -- will be involved in decision-making, with outside observers and critics left mostly in the dark about how decisions are being made".⁵⁷

Further, as the pandemic moves into an acute stage in the US, a number of inconsistencies in the response to Covid-19 by both regulators and operators may be evolving, including lack of assessment as to whether emergency plans would suffice to limit the spread of radiation after a severe accident. NRC guidance to plant operators also remains silent on certain required procedures that could be extending the spread of Covid-19; it is also not making efforts to use its status as a federal regulator to coordinate health and safety or other measures - such as delayed and staggered refuelling.⁵⁸ And it should be noted that while US nuclear utilities emphasise the importance of worker health and safety, they nevertheless remain determined to keep their plants running at full power, which in some cases may imply the shortening of refuelling outages by requesting NRC exemptions for scheduled and necessary repairs.⁵⁹

⁵³ <https://www.utilitydive.com/news/nuclear-regulators-ease-some-power-reactor-regs-in-response-to-covid-19/575000/>, 31.03.2020

⁵⁴ <https://www.utilitydive.com/news/nuclear-regulators-ease-some-power-reactor-regs-in-response-to-covid-19/575000/>, 31.03.2020

⁵⁵ <https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML20087P237>, 28.03.2020

⁵⁶ http://www.energyintel.com/pages/eig_article.aspx?DocId=1068608, 03.04.2020

⁵⁷ http://www.energyintel.com/pages/eig_article.aspx?DocId=1068608, 03.04.2020

⁵⁸ Nuclear intelligence Weekly (2020): A Patchwork Response to Covid-19 Cases at Nuclear Plants, NIS, Vol. 14, No. 15: www.energyintel.com April 9, 2020

⁵⁹ Nuclear intelligence Weekly (2020): US NRC to Ease Regulatory Burdens During Pandemic, NIS, Vol. 14, No. 14, April 3, 2020: www.energyintel.com

4. Role of Nuclear Power and the Electricity Market

There are two considerations that help us think about the role of nuclear power under these circumstances. One is the importance of NPPs to continue operation to meet electricity demand. This is especially the case in statements put out by the nuclear industry. For example, WNA Director General Agneta Rising stated that the huge efforts of medical staff worldwide depend on the ventilators, the monitors and all the other electrical equipment that is proving so vital to giving people the chance to recover from this disease and she claims nuclear energy is crucial to ensure a 24/7 electricity supply in countries with NPPs.⁶⁰ Along the same line, the U.S. NEI claimed that the nuclear industry would be fundamental to minimising the pandemic's effects on electricity supply.⁶¹

The second consideration is that electricity demand has significantly reduced due to the pandemic. For example, IHS Markit finds French demand and power prices have reduced by 20% - 25%.⁶² According to another source, nuclear power generation from France's state-controlled utility EDF for March 2020 was down by 13.8% compared to March 2019 "while output since the start of the year was down 9.5%".⁶³ Such reductions in demand mean that at least some nuclear power plants can be shut down without significantly affecting the ability to meet demand.

In the longer term, the impact Covid-19 is already having on electric utilities is also of safety concern. Electricity demand has fallen sharply since lock-downs were imposed and the economic recession that now seems inevitable means that demand is unlikely to recover quickly even when lock-downs are relaxed. For example, the UK's authoritative National Institute of Economic and Social Research predicted that the UK economy could contract by 15-25% in the second quarter of 2020, the largest contraction in economic activity since 1921.⁶⁴ This has caused a 'double hit' for utilities with generators selling fewer kWh and at a lower unit price. Many utilities, notably EDF, which is in the throes of a major government-led financial rescue, Opération Hercule, were in poor financial shape before the pandemic.⁶⁵ There will be strong pressures within utilities to cut costs to ensure their survival and, if this extends to nuclear plants, this is likely to increase the risk of serious accidents. Some organisations, such as the WNA, have suggested maintaining as many reactors in operation as possible was vital to ensure security of supply. This suggestion was clearly misconceived. Demand fell by about 15-20% in France following the lockdown and power exchange prices were negative at times in power exchanges across Europe.⁶⁶ In the UK, there are expected to be substantial periods this summer when demand will be insufficient to use all the potential wind output – consumers are contractually obliged to still pay for this unused output. The overwhelming majority of reactors are in the northern hemisphere, and spring demand is lower than other seasons in any year. For more southerly regions, peak demand is in the summer, usually July, while in more northerly regions their peak demand is not till December. So peak demand is 3-8 months away and recession will mean this peak is likely to be significantly lower than in previous years. So from a

⁶⁰ <https://www.world-nuclear-news.org/Articles/Message-Nuclear-power-in-the-fight-against-COVID19?feed=feed>, 27.03.2020

⁶¹ <https://www.power-technology.com/features/impact-covid-19-power-sector/>, 17.03.2020

⁶² Nuclear intelligence Weekly (2020): EDF's Long-Hated Arenh Suddenly a Firewall, NIS, Vol. 14, No. 15: April 9, 2020

⁶³ <https://www.reuters.com/article/us-edf-targets-idUSKCN21W0N6>, 14.04.2020

⁶⁴ <https://www.niesr.ac.uk/media/press-release-monthly-gdp-tracker-gdp-could-contract-15-25-cent-second-quarter-14198>

⁶⁵ On April 22, Reuters reported that EDF sources expected it would need a large capital injection before end 2020. <https://af.reuters.com/article/energyOilNews/idAFL8N2C86HQ>

⁶⁶ Power in Europe, April 20, 2020, p 27

supply security point of view, it is highly unlikely that there will be any justification for returning reactors to service or maintaining them in service if normal standards of safety cannot be maintained.

5. Conclusions and Recommendations

While nuclear utilities emphasise the importance of worker health and safety, they nevertheless remain determined to keep their plants running, which, as discussed, implies shortening refuelling outages by requesting regulatory exemptions for scheduled and necessary repairs.

In this context, our key concern is that the reductions in staffing, inspections, outages and necessary maintenance being implemented in many countries in response to the pandemic will adversely affect safety margins at nuclear facilities, potentially leading to a serious accident. This is being done with approval by regulators. However, no regulatory body has provided a current, transparent framework to justify these kinds of decisions. Thus, regulators should provide greater information about the factors used to decide whether any deferred activity is acceptable and transparently share whether these are being strictly adhered to. For example, the minimum workforce needed for the safe operation of nuclear facilities including during incidents and accidents, should be publicly specified. Once this minimum workforce is no longer guaranteed, plants must be shut down. In the longer term, the adequacy of these standards for periods such as this and their implementation should be openly debated.

A severe nuclear accident under pandemic conditions would inevitably exacerbate the inevitable highly adverse consequences. In addition to the radiological contamination, the task of evacuating large numbers of people from the most contaminated areas may prove an almost insurmountable challenge. The ongoing forest fires around Chernobyl are a reminder that a major nuclear accident can lead to widespread contamination that remains hazardous for many decades. High vigilance is needed in order to make sure at all times that the sanitary, social and economic crisis of the Covid-19 pandemic is not exacerbated by a serious nuclear safety or security failure.

Although electricity demand is plunging due to the pandemic, countries with a very high dependence on nuclear power generation may eventually be impacted if NPPs must be shut down for safety and security reasons. While meeting electricity demand is important under the circumstances of a pandemic, the measures to continue NPP operation that we have described above might well impact the safety and security level of nuclear power plants, enhance the risk for safety related incidents to occur, and may reduce the likelihood that an evolving event could be effectively controlled. We emphasize that any nuclear accident evolving during the time of a pandemic will put a severe and additional burden on national emergency systems already under pressure to deal with the immediate effects of the pandemic.

Claims about need for nuclear power to ensure electricity service security should also be balanced with the fact that demand for electricity has fallen everywhere and this has affected nuclear power generation. Given this scenario, the justification for imposing the potential for nuclear accidents has to be weighed with extreme care.

To summarize, the pandemic must not lead to any reduction in nuclear safety standards. That requires international and national regulators to determine, publicise, rigorously enforce and maintain safety and security standards.

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