



## JRC TECHNICAL REPORT

# Continued safe operation of nuclear power generation plants during the Covid-19 pandemic

*Media and public information monitoring from 13 March – 3 April 2020*

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## **Abstract**

An important goal of any pandemic response strategy is to assure the continued reliability of the electricity grid. Electricity production and delivery, two of the most important elements of economic and social infrastructure, must remain reliable during a pandemic because many parts of the infrastructure (e.g. food supply, water, transportation, public health) cannot function without a stable, reliable supply of electricity. More than 100 nuclear power reactor units are currently in operation in the EU and their continued operation during a pandemic is essential to maintain grid stability and ensure the needed power supplies in combination with the other sources of power generation. This report provides an overview of the findings of an investigation into the pandemic preparedness and response actions of nuclear power plant operating organisations in EU and some third countries operating nuclear power reactors. The investigation has been performed by means of media monitoring and information gathering during approximately *three weeks, from 16 March – 3 April 2020*.

## **1 Introduction**

An important goal of any pandemic response strategy is to assure the continued reliability of the electricity grid. Electricity production and delivery, two of the most important elements of economic and social infrastructure, must remain reliable during a pandemic because many parts of the infrastructure (e.g. food supply, water, transportation, public health) cannot function without a stable, reliable supply of electricity. More than 100 nuclear power reactor units are currently in operation in the EU and their continued operation during a pandemic is essential to maintain grid stability and ensure the needed power supplies in combination with the other sources of power generation. Besides electricity generation, some nuclear power plants also provide other energy needs such as district heating.

The principal threat to the operation of any facility during a pandemic is the absence, for extended periods, of essential personnel, including those of critical external services. In order to continue operation of a nuclear power plant, shift staffing has to be sufficient to accomplish all functions required to safely operate the NPP as well as to respond to any events that may occur. In case those minimum levels of staffing would be unavailable, the plant should have to shut down with the consequent loss of the electricity generation normally supplied to the grid. If this would happen to several nuclear power plants grid stability and sufficiency of electricity supplies may be threatened.

## 2 Key elements of nuclear power plant operators' preparedness / response actions and related information

- *NPP operators will be forced by national regulators to shut down their plants if they cannot maintain the critical operational staff required for safe operation.*
- *Standard measures like personal hygiene, social distancing and teleworking of non-critical functions are being widely implemented at NPP operators and Nuclear Regulatory Authorities.*
- *Other ongoing measures include travel and meeting bans; frequent personal cleansing and disinfection of working areas; body temperature measurements at site entrance; separation/segregation of key operations/maintenance teams; quarantine of staff having visited high risk areas or showing symptoms.*
- *Pandemic response plans with staged implementation of progressively more severe measures depending on the pandemic severity are reported by NPP operators in most EU countries. Measures may include:*
  - *Identification of critical functions for continued safe operation of the plant and exclusion of all other staff from the site (teleworking or otherwise), including contractors/sub-contractors);*
  - *Cancellation of visits and exclusion of non-essential visitors;*
  - *Provision of a backup reserve for critical staff (quarantined reserve teams, transfer of staff between NPPs, relicensing of retired staff...);*
  - *Complete isolation of the critical staff (e.g. temporary residence at site or in requisitioned hotels).*
- *France's EdF reports being able to operate its plants for 2 weeks with up to 40% loss of staff and for 12 weeks with 25% loss.*
- *Other countries report having plans in place but specific details are not yet available.*
- *There are currently no reports of imminent expected shutdowns of NPPs as a result of the virus.*

Information and news searches are being performed manually and using EMM on a daily basis. The daily number of news reports on the topic increased during the course of week 12, but remained fairly constant throughout weeks 13 and 14, although many of the reports emerging in weeks 13 and 14 repeated the information that was already gathered during week 12. Reporting is widespread in some countries, while for others (e.g. Bulgaria, Germany, Netherlands) little information has been found to date.

DG ENER has also surveyed the national nuclear regulatory authorities that are gathered in [ENSREG](#) (the European Nuclear Safety Regulators Group). All national regulators of countries operating NPPs are members of ENSREG. The replies confirm that all nuclear operators have business continuity plans in place.

The International Atomic Energy Agency has also launched an initiative to collect feedback from NPP operating countries, through the International Reporting System for Operating Experience (IRS), about how they are ensuring sufficient personnel are available for NPPs to continue to operate through the Covid-19 pandemic [1]. The initiative is intended to help operators and regulators learn from each other's experience. The information is shared with members through the newly established Covid-19 Operational Experience Network [2], which is a pilot peer-to-peer network designed to serve as a repository for planned or implemented response actions during the crisis.

Extensive and more detailed country-by-country information, collected from various sources including recent news articles, is provided in the annex for further reference.

### 3 Outage management

Nuclear power plants need to shut down typically every 12 to 24 months, depending on their type and design, in order to refuel. A proportion of the fuel elements in the core that have reached the end of their power generating life are removed and new fuel elements are loaded into the core. There is also typically some reshuffling of fuel elements in the core to optimise the core performance. During these refuelling outages, periodic maintenance and inspection activities of the nuclear power plant that cannot be performed while the reactors are in operation are also carried out to ensure that the plant continually complies with its design and licensing basis. Regulations and licence conditions may allow some of these inspections to be delayed until a future outage, while others may not be delayed. Outages of a fleet are usually staggered in such a way that the grid does not lose too much generating capacity at the same time.

During these outages, there are typically several hundreds of additional staff on site, many of which may belong to contractors. Also significant numbers of these additional workers may be migrational workers, coming from outside the region where the plant is located and sometimes from abroad (for highly specialised tasks), which may present difficulties during pandemic confinement conditions. Consequently, such workers may be classified as essential workers in order to allow their work to continue during the application of strict confinement measures. Indeed, the electricity industry group Eurelectric, which represents the interests of the electricity industry in Europe, has called on national governments and EU institutions to ‘consider additional action or greater flexibility over guidelines and regulations where needed to allow specialised personnel to travel for inspection, operation and maintenance of critical installations and ensure that control centres and plants remain sufficiently staffed’ [3].

In Annex 1, information related to management and organisation of outages, where it has been possible to find such information, is provided under a separate sub-heading for each country.

NPP operators are taking different approaches to the continued implementation of their outages, including:

- Continuing without change to the planned date or scope of the outage.
- Stretched operation of the plant and delay of the outage, to possibly avoid the current strictest of pandemic confinement measures.
- Stop for refuelling only (without extensive maintenance/inspection activities). The regular maintenance and inspection activities are postponed until the pandemic confinement measures are lifted sufficiently.
- Performing the outage with reduced scope of maintenance and inspection activities, which are postponed to the next outage, and/or lengthening the outage duration to reduce the number of additional workers coming to the site during the outage.

In all cases operators are putting into practice a host of measures to prevent the spread of the virus between workers. In particular, measures to avoid, or limit to the strictly essential, the contact between the additional workers coming to site for the outage work and the critical staff needed for plant operation, are typically put in place.

Other issues that may potentially affect the ability to perform outages as planned are absenteeism of contractors’ staff and interruptions to the supply chain for spare parts and equipment required for the maintenance activities.

## 4 Nuclear electricity generation in the EU and its contribution to national electricity demand

There are 13 Member States of the EU with nuclear power plants on their territory supplying electricity to the national grids. The total electricity production, import and export for these countries, as well as the share of the different sources, including nuclear generation, is given in the following table (2017 figures).

	Coal	Oil	Natural Gas	Biofuels	Waste	Nuclear	Hydro	Solar PV	Wind	Other	Total Production	Imports	Exports
Belgium	2 425	165	22 908	4 790	2 370	<b>42 227</b>	1 397	3 288	6 511	528	<b>86 608</b>	14 189	8 168
	2.8%	0.2%	26.5%	5.5%	2.7%	<b>48.8%</b>	1.6%	3.8%	7.5%	0.6%			
Bulgaria	20 914	401	1 922	396		<b>15 545</b>	3 493	1 403	1 504	34	<b>45 613</b>	3 705	9 186
	45.9%	0.9%	4.2%	0.9%		<b>34.1%</b>	7.7%	3.1%	3.3%	0.1%			
Czech Republic	43 925	119	3 679	4 853	206	<b>28 340</b>	3 040	2 193	591	103	<b>87 050</b>	15 072	28 109
	50.5%	0.1%	4.2%	5.6%	0.2%	<b>32.6%</b>	3.5%	2.5%	0.7%	0.1%			
Finland	9 214	184	3 300	11 308	1 029	<b>22 477</b>	14 772	44	4 795	401	<b>67 522</b>	22 204	1 779
	13.6%	0.3%	4.9%	16.7%	1.5%	<b>33.3%</b>	21.9%	0.1%	7.1%	0.6%			
France	15 058	7 390	40 439	5 436	4 736	<b>398 359</b>	55 108	9 573	24 711	1 334	<b>562 143</b>	21 134	61 248
	2.7%	1.3%	7.2%	1.0%	0.8%	<b>70.9%</b>	9.8%	1.7%	4.4%	0.2%			
Germany	252 824	5 571	87 685	44 973	13 247	<b>76 324</b>	26 155	39 401	105 693	1 864	<b>653 737</b>	27 842	80 301
	38.7%	0.9%	13.4%	6.9%	2.0%	<b>11.7%</b>	4.0%	6.0%	16.2%	0.3%			
Hungary	5 098	85	7 838	1 980	362	<b>16 098</b>	220	349	758	83	<b>32 871</b>	19 803	6 925
	15.5%	0.3%	23.8%	6.0%	1.1%	<b>49.0%</b>	0.7%	1.1%	2.3%	0.3%			
Netherlands	34 031	1 185	59 398	2 696	3 592	<b>3 402</b>	61	2 204	10 569	122	<b>117 260</b>	22 458	18 952
	29.0%	1.0%	50.7%	2.3%	3.1%	<b>2.9%</b>	0.1%	1.9%	9.0%	0.1%			
Romania	16 857	633	10 656	525		<b>11 509</b>	14 853	1 856	7 407		<b>64 296</b>	4 842	7 735
	26.2%	1.0%	16.6%	0.8%		<b>17.9%</b>	23.1%	2.9%	11.5%				
Slovak Republic	3 540	439	1 667	1 674	47	<b>15 081</b>	4 623	506	6	155	<b>27 738</b>	15 563	12 535
	12.8%	1.6%	6.0%	6.0%	0.2%	<b>54.4%</b>	16.7%	1.8%	0.0%	0.6%			
Slovenia	4 824	14	473	290	9	<b>6 285</b>	4 141	284	6		<b>16 326</b>	9 133	9 648
	29.5%	0.1%	2.9%	1.8%	0.1%	<b>38.5%</b>	25.4%	1.7%	0.0%				
Spain	46 349	15 766	64 037	5 306	1 544	<b>58 039</b>	21 070	8 514	49 127	5 974	<b>275 726</b>	23 762	14 593
	16.8%	5.7%	23.2%	1.9%	0.6%	<b>21.0%</b>	7.6%	3.1%	17.8%	2.2%			
Sweden	1 229	290	271	10 298	3 459	<b>65 696</b>	65 168	230	17 609		<b>164 250</b>	11 896	30 888
	0.7%	0.2%	0.2%	6.3%	2.1%	<b>40.0%</b>	39.7%	0.1%	10.7%				

Figure 1. Electricity production, import and export 2017 (GWh)

Source: International Energy Agency: <https://www.iea.org/data-and-statistics/data-tables?country=WORLD>



## 5 Impact of the Covid-19 crisis on electricity demand

An important element in the assessment of the continued reliability of the electricity grid and the sufficiency of electricity supplies is the evolution of the demand for electricity during the pandemic crisis. Reduction in demand will provide some flexibility for maintaining capacity to meet demand.

On 16 March, France's grid operating company (RTE) reported that electricity consumption had fallen by around 10% compared to a normal day in March [4]. RTE also observed a drop in consumption in the morning but higher demand in the evening. The drop in demand is clearly the direct consequence of the closure of restaurants, museums, sports establishments or certain industrial sites, such as the Renault or PSA factories resulting from self-avoidance of public places by the population and from the government measures that are being introduced to deal with the crisis. As those measures were only beginning to be introduced on 16 March, there may be further falls in demand in the coming days and weeks.

By 20 March, Actu [5] reported that demand had further fallen and was 15% below normal levels.

In Hungary, a similar situation has been reported [6] after the introduction of pandemic management and confinement measures in the country. About 10 GWh decrease in the gross daily electricity consumption is observable in the period following the announcement of the pandemic emergency state in the country. This is not a drastic decrease, because it corresponds to about 7% of the average daily consumption in the preceding ("normal") period.

The Ember Think Tank has published data on the week-on-week falls in electricity demand in countries across Europe [7]. The latest available data is valid as at 23 March 2020. This shows falls ranging from 2% in Finland, Norway, UK and Greece, to 12% in Spain and 14% in France and Italy, probably reflecting the severity of the confinement measures that had already been implemented for long enough to have an effect by that date.

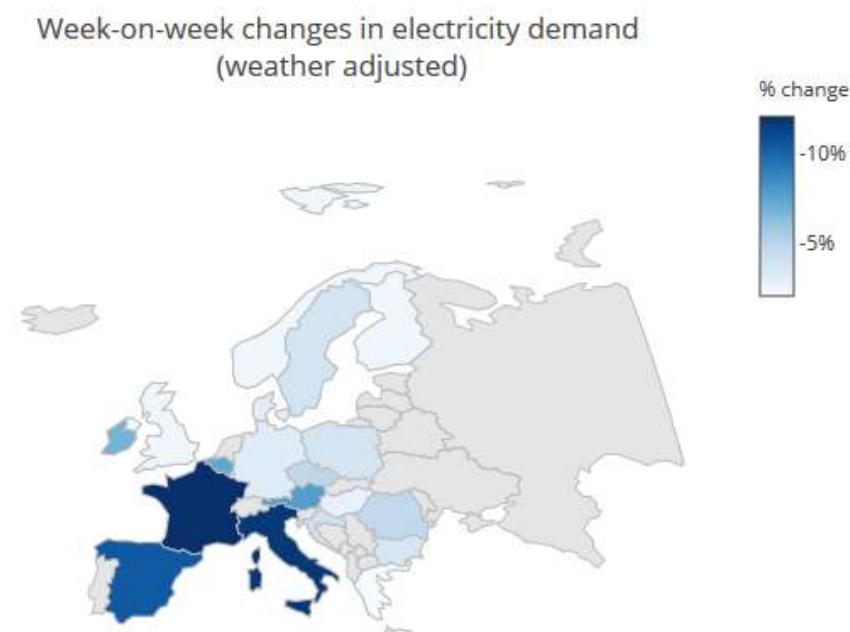


Figure 2. Week-on-week changes in electricity demand across Europe  
(Source: [https://ember-climate.org/project/coronavirus\\_electricity\\_demand/](https://ember-climate.org/project/coronavirus_electricity_demand/))

## References

1. Coronavirus / IAEA Steps Up Pandemic Support By Gathering Feedback On Staffing Levels At Nuclear Plants, NUCNET, 8 April 2020, <https://www.nucnet.org/news/iaea-steps-up-pandemic-support-by-gathering-feedback-on-staffing-levels-at-nuclear-plants-4-3-2020>.
2. COVID-19 NPP OPEX Network, IAEA, <https://www.iaea.org/resources/databases/covid-19-npp-opex>.
3. IMPACT OF COVID 19 ON CUSTOMERS AND SOCIETY: Recommendations from the European Power sector, Eurelectric, [https://cdn.eurelectric.org/media/4313/impact\\_of\\_covid\\_19\\_on\\_customers\\_and\\_society-2020-030-0216-01-e-h-B69D2078.pdf](https://cdn.eurelectric.org/media/4313/impact_of_covid_19_on_customers_and_society-2020-030-0216-01-e-h-B69D2078.pdf)
4. Coronavirus : la consommation d'électricité baisse en France (**17/03/2020** - French): [Le Parisien](#)
5. [https://actu.fr/grand-est/cattenom\\_57124/coronavirus-comment-centrale-nucleaire-cattenom-sadapte-continuer-tourner\\_32440682.html](https://actu.fr/grand-est/cattenom_57124/coronavirus-comment-centrale-nucleaire-cattenom-sadapte-continuer-tourner_32440682.html)
6. Gross daily electric energy consumption in Hungary in March 2020: <https://www.mavir.hu/web/mavir-en/consumption>
7. [https://ember-climate.org/project/coronavirus\\_electricity\\_demand/](https://ember-climate.org/project/coronavirus_electricity_demand/)

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## Annexes

### Annex 1. Country-by-country summaries of identified information on Covid-19 response in relation to NPP operation

The following sections provide the raw summaries of all the information that could be sourced on the measures taken in the EU countries operating nuclear power plants in order to protect the operation and safety of the plants through the pandemic.

## Belgium

### BELGIAN NPPs

#### Tihange nuclear power plant

The Tihange nuclear power station (CNT) is located in the town of Huy, along the right bank of the Meuse. On the site there are 3 nuclear PWR reactors (pressurized water reactor) with a total capacity of 3,008 MW. They were put into operation in the period 1975-1985. The plant represents about 15% of total electricity production capacity in Belgium.

#### Doel nuclear power plant

The Doel nuclear power station (KCD) is located in the port of Antwerp on the left bank of the Scheldt near the village of Doel. On the site there are 4 nuclear reactors PWR (pressurized water reactor) with a total capacity of 2,923 MW. They were put into operation in the period 1975-1985. The plant represents about 15% of total electricity production capacity in Belgium.

#### Corona crisis: Belgian nuclear power stations take the necessary measures

During the coronavirus crisis Electrabel is making every effort to guarantee nuclear safety and to contribute to the security of supply of the country with locally generated low-carbon electricity. Through a corona action plan and continuous monitoring it is ensuring that sufficient staff is available in all circumstances to carry out the critical activities for the nuclear power station. It is also taking the necessary measures to protect the health of the staff and to prevent and limit the spreading of the coronavirus among the staff of the Belgian nuclear power stations.

Our measures are based on the directives of the government and the ENGIE Group, but also on the expert opinion of our internal occupational service. Examples of our measures include

- Promoting teleworking for staff whose activities allow it;
- Delaying all non-urgent training, meetings and (maintenance) activities;
- An increased cleaning frequency in commonly used locations;
- Providing disinfecting hand gels and other hygiene measures;
- Permanent staffing at the internal medical service and availability of a duty nurse and doctor at any time of the day or night.
- Applying the social distancing guidelines.

The applicable preventive measures are constantly evaluated and updated. As the situation evolves, Electrabel may announce additional measures at any time. In any case, it is the intention to continuously provide the residents of Belgium with the necessary electricity in a safe manner throughout the Corona crisis and this in consultation with the competent government agencies.

<https://corporate.engie-electrabel.be/local-player/nuclear-3/tihange/>

<https://corporate.ENGIE-electrabel.be/local-player/nuclear-3/doi/>

Information related to outages

In Belgium, Tihange NPP unit 1 is currently undergoing an extended outage for plant improvements. The outage, which started in December will be completed in about a month's time. As the plant is designated as critical infrastructure, the operator has decided to continue the works and bring the plant back into operation. About 700 additional workers are on site, which has been reduced to about half of what is usual. Additional hygiene and social distancing measures are implemented to protect workers and prevent virus spreading.

[https://www.rtf.be/info/regions/detail\\_coronavirus-la-revision-de-tihange-1-se-poursuit-malgre-les-mesures-de-confinement?id=10469009](https://www.rtf.be/info/regions/detail_coronavirus-la-revision-de-tihange-1-se-poursuit-malgre-les-mesures-de-confinement?id=10469009)

## Bulgaria

The Bulgarian town of Kozloduy, site of the country's sole nuclear power plant, imposed a curfew on Wednesday (18 March) as part of its efforts to prevent the coronavirus from spreading.

The mayor of Kozloduy, Marinela Nikolova, signed an order that bars residents and visitors from leaving their homes or accommodations from 10 p.m. until 6 a.m. Exceptions would be made for shift workers and those in need of emergency medical care.

References/sources:

1. <https://www.nytimes.com/reuters/2020/03/18/world/europe/18reuters-health-coronavirus-bulgaria-nuclear.html>

## Czech Republic

Since 16 March 2020, ČEZ, the Czech power utility operator, has been taking preventive measures at its both nuclear power plants (NPP) at Dukovany and Temelín due to the coronavirus risk. The body temperature is measured for all persons entering the sites, which applies to more than 2000 staff members at both plants. Operation of all cafeterias and dining halls was modified, the working hours and the dining space were extended. Several hundreds of Dukovany and Temelín employees are working from home.

As of February 2020, visitor centres were closed, all plant visits were cancelled, and business trips were reduced. Trainings, drills and working meetings were postponed. Service buses transporting employees to the plants have been regularly disinfected.

All these preventive measures intend to limit personal contacts. Personnel meetings were reduced with the emphasis on electronic communication. No infected person has been discovered so far.

No power reductions have been reported so far.

NUCNET 23 March 2020

Coronavirus / Nuclear Industry Begins To Isolate Key Operational Staff

The operators of nuclear power plants are taking steps to minimise the impact of the Covid-19 pandemic, including isolating key staff and stockpiling items workers might need if they are unable to leave a site.

...

ČEZ, state-owned operator of the Czech Republic's nuclear fleet, said it has been applying preventive measures since the end of February. Business trips have been suspended and all information centres including those at nuclear plants, have been closed and all excursions and visits to the plants suspended. Bus services used by employees and suppliers to and from nuclear plants are being frequently disinfected.

Last week further preventive measures were applied by ČEZ at Temelin, Dukovany and other facilities that are considered critical state infrastructure. The measures include taking the temperature of everyone entering a facility and social distancing in canteens.

Personal meetings have been suspended in favour of electronic means of communication and "several hundred" employees are working from home.

"All these measures are purely preventive [and] we have not registered any case of coronavirus at the nuclear plants so far," a spokeswoman said.

**Nuclear power plants have already introduced two dozen measures due to coronavirus** (<http://www.jihoceskenovinky.cz/zpravy.php?&&id=86a13727-705b-11ea-b311-003048df98d0>)

In the second stage of the six corresponding anti-crisis plan is located significant elements of critical infrastructure – nuclear power plants Dukovany and Temelín. So far, nearly two dozen emergency measures have been put in place.

28. March 2020-07: 30

In addition to measuring body temperature, they have changed the system of shifts and are ready to tighten the isolation of strictly protected areas. From the widely known ubiquitous disinfectant, working from home and making maximum use of digital communication, through the measurement of temperature, disinfection of special buses to drape on the reactor hall and in the whole area of the power plant and create a backup of key workers. This is what safeguards look like at nuclear power plants - key elements of critical infrastructure in southern Bohemia and the Highlands.

Both (Temelin and Dukovany) nuclear plants are in the second of six stages of the crisis plan for the case, according to management. They can tighten measures in a matter of hours, among other things, they are ready to completely isolate key workers. They would live in selected facilities in the surrounding area, separated from families and the external environment. They would also reorganise work on ongoing shutdowns. Any new measures would be taken in coordination with the authorities and sanitation authorities.

**Plan for refuelling at Temelin NPP** (<https://www.prvnizpravy.cz/zpravy/regiony/v-temeline-planovane-vyvezli-z-reaktoru-jaderne-palivo/>)

...

The first (Covid-19) preventive measures were taken by ČEZ at the turn of February and March and gradually supplemented and expanded. Specifically, closed centers, strengthened hygiene, face-to-face meetings replaced by video conferences, modified operation of canteens and cafeterias, regular disinfection of buses for transport of employees or all-employee body temperature checks at the entrance to the plant. For operation, key employees work in a modified shift pattern. Instead of the original six shifts, a new four-shift rota is implemented. Two shifts remain at home as backup.

References/sources:

1. <https://oenergetice.cz/jaderne-elektrany/cez-v-temeline-i-dukovanech-zprisnil-kvuli-koronaviru-opatreni>
2. NUCNET 23/3/20, <https://www.nucnet.org/news/nuclear-industry-begins-to-isolate-key-operational-staff-3-1-2020>
3. <http://www.jihoceskenovinky.cz/zpravy.php?&&id=86a13727-705b-11ea-b311-003048df98d0>
4. <https://www.prvnizpravy.cz/zpravy/regiony/v-temeline-planovane-vyvezli-z-reaktoru-jaderne-palivo/>

## Finland

The Ministry of Economic Affairs and Employment recognises that nuclear power companies' preparedness is particularly important because of the safety criticality of the industry. The main functions to be protected relate to the safety of plant operation, safety arrangements and radiation protection.

Nuclear power plants have taken steps to limit the risks to their personnel, as it is important to make sure that qualified staff is always available. For example, TVO stated that the Group is preparing for possible coronavirus infections and taking many measures to prevent the virus from spreading on Olkiluoto Island. The challenge for the spring is the annual outages of the plants, which require about 1,000 external professionals, mostly from abroad.

Regarding the security of the electricity supply, the Ministry of Economic Affairs and Employment sees that the Nordic and Baltic common regional markets are not threatened by the virus. In addition to its own production, Finland is well supplied with electricity from the Nordic electricity market and, if necessary, from the Baltic countries and Russia.

Source: Website of the Finnish Ministry of Economic Affairs and Employment (in Finnish, visited on 18.3.) Questions and answers about energy and security of supply: <https://tem.fi/kysymyksia-ja-vastauksia-energiasta-ja-huoltovarmuudesta>

The nuclear regulatory authority, STUK, has posted the following information on its website:

Regulatory control will be targeted on the basis of risks

The situation caused by the coronavirus has effects on STUK's regulatory control activities carried out in nuclear power stations and other operators. On-site inspections will, for the time being, 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. [...] The majority of regulatory control is based on the inspection of documents. This work will continue in the normal way, carried out remotely.

STUK has also ensured that nuclear power companies have prepared for the coronavirus situation. The most significant possible consequence of the coronavirus would be the simultaneous infection of operating personnel, which would have impacts on the operations of plants. Even this kind of situation would not cause a direct safety risk. Power companies have adequate substitute arrangements for cases of illness. According to STUK's view, nuclear power plants have prepared adequately for the risks and nuclear power plants can be operated safely.

Source: Website of the Finnish nuclear regulatory authority STUK (In English): [https://urldefense.com/v3/https://www.stuk.fi/web/en/-/the-radiation-and-nuclear-safety-authority-stuk-ensures-its-operations-!D0xrgLBm!VlgxVlr6KtWVvl4qn7uby7Nnl8E6CsOQY2wONWPL\\_72BavGFEBZUWJIWoKpwkFQqwMpnhg\\$](https://urldefense.com/v3/https://www.stuk.fi/web/en/-/the-radiation-and-nuclear-safety-authority-stuk-ensures-its-operations-!D0xrgLBm!VlgxVlr6KtWVvl4qn7uby7Nnl8E6CsOQY2wONWPL_72BavGFEBZUWJIWoKpwkFQqwMpnhg$)

The Minister of Economic Affairs Mika Lintilä says the government is prepared to tackle the severe damage to the economy caused by the coronavirus by several means, and also the protection of so-called critical infrastructure.

- We have tasks such as protecting the personnel of nuclear power plant control stations and other security of supply issues, such as water, for example, says Lintilä.
- Nothing replaces the nuclear power station team, as only designated persons are authorized to enter the control room. If the power plants had to be run down, the east would, of course, have electricity, but yes, independent energy supply is key.

Source: Ilta-Sanomat newspaper 12.3. Minister of Economic Affairs Lintilä: This is how we are prepared for the corona virus in Finland - "Nuclear power plant staff cannot be replaced" (in Finnish) <https://www.is.fi/taloussanomat/art-2000006436466.html>

The TVO Group is prepared for possible coronavirus infections and takes many measures to prevent the virus from spreading on Olkiluoto Island.

Since last week, the company has been abstaining from traveling, moving to telecommuting wherever possible, restricting guests' access to TVO Group facilities, eliminating various opportunities, and transferring training to the electronic environment. There have also been traffic restrictions in the area to divide encounters into different areas and reduce contacts. The offices have also made significant efforts in the area of workplace catering and cleanliness. In addition, there has been a significant change in practices and ways of working. The Visitor Centre in Olkiluoto is closed to the public and group visits have been cancelled for the time being.

TVO has contingency plans in place for crisis and emergency situations, which are also communicated to key authorities. The TVO Group is responsible and proactive in all situations, and therefore quite large measures are taken to control the spread of coronavirus infections. Electricity production in Olkiluoto will continue normally.

Source: Website of the utility TVO (Teollisuuden Voima), operating 2 BWR units in Olkiluoto and preparing for commissioning the OL3 EPR, (in Finnish, visited on 19.3.)

<https://www.tvoy.fi/ajankohtaista/tiedotteetporssitiedotteet/2020/olkiluodossaontehtymittaviatoimenpiteitakoronavirustartuntojenleviamisenhillitsemiseksi.html>

Fortum and the Loviisa power plant follow the general recommendations of the WHO and national health authorities. The power plant is prepared for the coronavirus epidemic to ensure operational safety, emergency preparedness and safety of the nuclear power plant.

They do not currently accept guest groups for the power plant, and working visits will also be restricted. They regularly inform their staff and partners about the issue and liaise with the appropriate authorities.

Source: Website of the utility Fortum, operating 2 VVER units in Loviisa, (in Finnish, published 13.3.)

<https://www.fortum.fi/media/2020/03/fortumin-loviisan-voimalaitos-varautunut-koronavirusepidemiaan>

STUK: The supervision of existing nuclear power plants is prioritized over OL3 - Corona crisis could further delay plant start-up

The Radiation and Nuclear Safety Authority (STUK) may need to prioritize its monitoring tasks if a significant number of personnel are affected by the coronavirus. This could further delay the start-up of Olkiluoto 3 (OL3), which is nearing completion.

As priority, the operating nuclear power plants come before those under construction.

- If STUK were to be deprived of the resources to carry out all of its monitoring tasks or, for example, traveling to the plant site would become very difficult, priority would naturally be given to controlling operating nuclear power plants to ensure security of supply and plant safety.

If the situation continues for a long time, the handling of Fennovoima's construction permit material could also be affected.

- In our supervision, of course, priority is given to operating nuclear power plants, confirms Janne Nevalainen, Project Manager for the Hanhikivi 1 project at STUK.

Visits to the facilities are minimized

The Radiation Authority has made various arrangements to safeguard its operations during the coronavirus epidemic.

In addition to teleworking and video conferencing, on-the-spot inspections, for example at nuclear power plants, have been reduced. These will now focus on the most important safety targets.



Monitoring will continue at the OL3 site. Due to the corona situation, there have also been inspections carried out at the equipment manufacturers' premises.

- The aim is to minimize the number of STUK inspectors traveling to the construction site, while STUK's local inspectors are responsible for most inspections, Virolainen says.

For example, the supervision of the OL3 project, which is waiting for the refuelling of fuel, has not been slowed down, so far, however. Each trip from STUK to the plant site is carefully considered, which has increased the workload of local inspectors.

- To manage this, we have demanded that TVO and the plant supplier better prepare and 'place' inspections on working days in order to carry out inspections effectively.

The nuclear power plant supervision department employs over 120 people, all of whom are involved in the OL3 project in one way or another. A full-time project focuses on a dozen or so people.

Reference: <https://www.satakunnankansa.fi/a/9172473b-0638-4d22-99d1-a3ca68680d43>

#### Information related to outages

This year's annual outage at the Olkiluoto-1 nuclear unit in Finland will be shortened from 25 days to about 14 days because of the Covid-19 pandemic. The 890-MW boiling water reactor unit will undergo a standard maintenance outage to ensure the nuclear safety and availability of plant units. Major modifications with no significance for safety or availability will be postponed. "These measures will help to ensure a successful annual outage despite the unusual situation," owner and operator Teollisuuden Voima Oyj said. The outage will start on Sunday 24 May and end on Sunday 7 June. The annual outage at the identical Olkiluoto-2 unit is a routine fuel replacement outage and will go ahead as planned. It will start on Sunday 10 May and end on Sunday 18 May.

NucNet Nuclear News Daily / 27 March 2020 /

## France

**NUCNET 20/3/20** (This key article summarises most of what is provided in the other reports in this section)

Coronavirus / EDF Implements Emergency Plan For French Nuclear Fleet

France's state utility and nuclear operator EDF has implemented an emergency plan that will make it possible to operate nuclear plants even if 40% of staff are absent during the peak of the Covid-19 epidemic.

The nuclear industry group SFEN said the "business continuity plan" had been implemented on 16 March in all power plants in France. It is the same plan that was used when the severe acute respiratory syndrome (SARS) virus was identified in 2003 and during the 2009 H1N1 swine flu pandemic.

SFEN said the plan makes it possible to cope with 40% absenteeism for two to three weeks, a period corresponding to the pandemic peak, and 25% absenteeism for 12 weeks.

EDF staff whose work can be carried out remotely have been told to work from home. Those whose activities are linked to safety, security, monitoring environmental monitoring and production are authorised to be onsite. Maintenance operations continue as long as all conditions for ensuring the safety of employees are met.

SFEN said that for several weeks now, nuclear groups such as EDF, Orano, EDF's reactor subsidiary Framatome, nuclear research organisation CEA and grid operator RTE have been preparing for "possible new operating modes".

Special nuclear teams (force d'action rapide nucléaire, or Farn), established at EDF following the 2011 Fukushima-Daiichi accident, can be mobilised if necessary to ensure the safety of installations, staff and the environment. Fuel cycle company Orano has similar teams known as force d'intervention nationale (Fina).

Between 20 and 40 Farn and Fina staff remain on call to reach a nuclear site in less than 30 minutes.

According to SFEN, a nuclear reactor operates with seven teams of around 20 people who take turns 24 hours a day, seven days a week. Taking into account those on call, between 100 and 200 people are required to operate a nuclear unit.

The London-based Nuclear Industry Association said on 20 March that EDF, which operates the UK's nuclear reactor fleet, has comprehensive contingency plans in place to maintain operations at all power stations and planned generation is not affected at any of its sites.

The UK Office of Nuclear Regulation said all nuclear 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.

Full article at: <https://www.nucnet.org/news/edf-implements-emergency-plan-for-french-nuclear-fleet-3-5-2020>

9.3.2020

**France 3 Grand Est** publish the article "Coronavirus : comment la centrale nucléaire de Fessenheim se prépare à l'évolution de l'épidémie" informing that the NPP is ready to manage the epidemic circumstances on its site, after that an employee has been found positive to the test. The employee has been sent home, and 26 people, including four service providers, who had contacts with him between the 24th and the 28th of February, have been put in the 14 days of quarantine. The article informs about the **pandemic plan, established by EDF** in coordination with the Ministry of Health and actualised in occasion of the crisis of H1N1 in 2009, and SARS in 2013. The newspaper reports EDF assurance that the NPP of Fessenheim, which has about 700 employees, plus 280 staff of partner companies, could continue its safe operation with 75% of its staff during 12 weeks, and 60% during 1 to 2 weeks, in cases of a peak in the epidemic.

The article also mentions that the plan foresees alert levels, corresponding to three stages established by the government.

Full article at <https://france3-regions.francetvinfo.fr/grand-est/haut-rhin/mulhouse/coronavirus-comment-centrale-nucleaire-fessenheim-se-prepare-tous-cas-figure-1797238.html>

15.3.2020

**L' Express:** the article « Comment les centrales nucléaires s'organisent face au coronavirus ? » informs that the energy companies have been summoned to the Ministry of the Ecological Transition to discuss the approaches to be adopted in the following weeks. The goal: to protect the employees and to ensure the electricity supply to the country. The energy companies EDF, RTE, Enedis, Engie, GDF, have the challenge of continuing the operation of the plants, the hydraulic dams, and to ensure the supply of gas and electricity.

The mentioned companies were among the participants to the meeting, called by Ms Borne, Minister charged of the energy portfolio, to discuss about the application of measures aiming at containing the epidemic propagation, and the measures aiming at guaranteeing the continuity of activities which are vital to the country.

Full article at [https://expansion.lexpress.fr/actualite-economique/comment-les-centrales-nucleaires-s-organisent-face-au-coronavirus\\_2120856.html](https://expansion.lexpress.fr/actualite-economique/comment-les-centrales-nucleaires-s-organisent-face-au-coronavirus_2120856.html)

16.3.2020,

**Le Figaro**, in its article, "EDF active le plan pandémie à Flamanville", informs that the two operating reactors of Flamanville are offline for maintenance, but their restarting, initially foreseen for the 31<sup>st</sup> of May, will be delayed because EDF has launched the pandemic response plan for the reactors 1 and 2 of Flamanville. The reason are the numerous cases of coronavirus in the Cotentin region, which affect as well the personnel of the NPP.

Le Figaro also reports that EDF spokesperson has pointed out that it has a continuity plan, which ensures the operation with a high rate of absences, and which ensures the presence on site of the staff covering essential functions for the safety and security of the site: the operating staff, the safety engineers, the staff in charge of the protection and monitoring of the environment.

The article also informs that the project for the future EPR is not concerned by these measures, and the works will continue, although a delay is foreseen. Flamanville, says Le Figaro, is for the moment the only NPP where EDF has launched this plan for the continuity of the operation.

The original article is at <https://www.lefigaro.fr/societes/edf-active-le-plan-pandemie-a-flamanville-20200316>

On the same day, **Reuters** adds that EDF will reduce staff to around 100 from 800, and that, according to the spokesperson, as a preventive measure and because it is no longer possible to carry out tests to confirm cases, EDF has decided to only keep those in charge of safety and security at site.

Original article at <https://www.reuters.com/article/health-coronavirus-france-nuclear/frances-edf-to-reduce-flamanville-nuclear-plant-staffing-over-virus-idUSFWN2B91JN>

**La Tribune** adds that EDF has had a pandemic response plan since the early 2000s, and its aim is to ensure the continuity of the electricity supply and of the safety of the NPPs. The plan has been upgraded in 2009 and in 2013, following the crises due to H1N1 and SARS. It is currently implemented at Flamanville and its implementation for the other plants has to be decided by the Executive Committee of the Company, and supported by a crisis team which has been set up at the beginning of March. The newspaper reports that since the start of the crisis, more than 10 employees of EDF have tested positive for the virus, among them at least three working in three different plants. To the absences due to sickness or quarantine, it has to be added the absence of the parents who have opted for sick leave to take care of their children.

La Tribune reports that the plan should allow the operation of the 19 French NPPs with only 60% of staff present during a period of 15 days. For limited time the NPPs could operate also with a more reduced staffing (about 120 staff for a site made of two reactors), as it was already the case in the evening and during weekends. Moreover, EDF has also other measures available, such as, for example, re-deployment of critical employees from a plant not badly affected by the virus to a plant with more serious infection rates. The ultimate resource is represented by the FARN, the Rapid Nuclear Action Force, which has been set up following the Fukushima accident in 2011, to provide rapid additional assistance in the case of a Nuclear Accident. It comprises about 100 people, and is available to step in to operate any NPP in case of serious lack of critical personnel due to the pandemic.

Concerning the electricity transport, La Tribune also reports information about the declaration of RTE, Transmission System Operator and subsidiary of EDF, which states to be able to manage in real-time the production-consumption balance. La Tribune informs that RTE has already implemented its contingency continuity plan, made of different phases, which can be implemented following the evolution of the situation. In the framework of this plan, the majority of the employees have been requested to telework, and only those performing activities which are essential to the proper functioning of the network and to the electricity supply continue to come to work.

Full article at <https://www.latribune.fr/entreprises-finance/industrie/energie-environnement/coronavirus-comment-edf-compte-assurer-le-fonctionnement-et-la-securite-des-centrales-nucleaires-842246.html>

For information about the FARN, Fast Action Force in case of Nuclear Accident [https://inis.iaea.org/collection/NCLCollectionStore/\\_Public/45/089/45089853.pdf?r=1&r=1](https://inis.iaea.org/collection/NCLCollectionStore/_Public/45/089/45089853.pdf?r=1&r=1)

An article in **Le Parisien**, highlights that a staff reduction at its Flamanville plant is facilitated by the fact that the two reactors of the second generation, 1300 MW each, are offline following request of the safety authority. Concerning the pandemic plan, the article reports that numerous measures have been implemented in the last weeks in preparation for further stepping up the measures, including: **the delivery of camp beds, hygiene and disinfection products and food rations, in particular to strengthen the teams of the FARN.**

Le Parisien also reports about supplementary action plans which foresee the functioning of certain teams in charge of the most crucial tasks, as the operation from the control room, in “submarine mode”, which means completely isolated from the external world to avoid contagion. “This mode would be set up only in case of extreme pressure of the contagion, explains a source who has worked on the development of these plans. It would allow teams to be isolated for several days or even weeks, as is the case for crews aboard our French submarines”.

Full article at <http://www.leparisien.fr/economie/coronavirus-edf-actionne-le-plan-pandemie-au-sein-de-l-epr-de-flamanville-16-03-2020-8281569.php>

17.3.2020

To be mentioned the ASN note, informing that the French Safety Authority is adapting its controls and functioning mode facing the epidemic. The note informs that, with the purpose to allow the healthcare professionals to focus on the health response to the epidemic, ASN has suspended its inspections to the medical establishments carrying out nuclear activities until further notice, with some exceptions. Moreover, to contribute to the risk reduction for its staff, ASN has declared the "red level" of its plan of continuity of activity: all its staff is now in teleworking, all exchanges of documents with those responsible for nuclear activities will be as much as possible dematerialised, the instructions will be given at distance, by means of audio supports or video-conferencing.

The note is available at <https://www.asn.fr/Informer/Actualites/Epidemie-de-Coronavirus>

18.3.2020

**Actu.fr** writes in "Coronavirus : Orano la Hague met à l'arrêt ses installations", that on Monday, the management of the Orano La Hague site had decided to continue production on UP3, one of its two plants for reprocessing spent nuclear fuels. The second, UP2-800, is currently in scheduled maintenance shutdown. It also reports that the number of employees on the site had been reduced to the minimum operating staff: 10% of on-site staff

On Tuesday, 17<sup>th</sup> of March, a new stage was reached with the decision to phase out the facilities. This shutdown will take about ten days, says the management, adding that the goal is to resume all activities as soon as possible.

On-site activities will be limited to facility safety and security, as well as "critical activities" for the nuclear park. The reception of spent fuels from EDF is maintained, as is the shipment of materials used in the Melox plant for the manufacture of Mox fuels.

Only about 400 employees of Orano and its subcontractors will remain on site, representing less than 10% of the usual total workforce.

Full article at [https://actu.fr/normandie/beamont-hague\\_50041/coronavirus-orano-hague-met-larret-installations\\_32342507.html](https://actu.fr/normandie/beamont-hague_50041/coronavirus-orano-hague-met-larret-installations_32342507.html)

19.3.2020

**France Bleu** article "Coronavirus : la centrale nucléaire de Gravelines prête à faire face", concerns the Gravelines NPP, the biggest NPP of west-Europe, with its six reactors. The article refers to the pandemic plan, which allows functioning for 12 weeks with 25% less of its staff, and, in case of exacerbation of the crisis, with 40% less, during at least two weeks. Moreover, the NPP can exempt part of the Staff, leaving them home, as reserve in case of future needs.

The goal is the continuity of the electricity production and of the programme of mandatory works on the reactors. The running of the NPP requires both operation and maintenance staff. In normal times, there are 7 teams operating in shift, which can pass to 2, in very degraded mode.

France Bleu reports as well the encouragement to Staff to telework, in particular employees in charge of support services: administration, HR. An assessment is ongoing for what concerns the technical tasks: for example, staff working on the planning of the future outages can work from home. Telework also allows staff to mind their children, and some of them have also offered to mind the children of colleagues.

Full article at <https://www.francebleu.fr/infos/economie-social/coronavirus-la-centrale-nucleaire-de-gravelines-prete-a-faire-face-1584529266>

20.3.2020

**Le Republicain Lorrain**, in the article "Covid-19 : la centrale s'adapte pour continuer de tourner", confirms that two cases of Covid-19 have been recorded at the Cattenom plant since the beginning of the epidemic, about fifteen staff with influenza symptoms are currently confined to their homes; flexible work

arrangements are implemented, as teleworking for administrative staff, half of the operational staff are on-site, whilst the other half are home, ready to intervene in case of need; the services of plant operation and site protection, usually working in 3x8 shifts, must all be present. Training has been cancelled, to be able to create a reserve of staff to mobilise in case of need. The article reiterates the EDF obligation to maintain its business continuity plan, with the aim of reconciling the health and safety of employees and service providers with electricity generation. This requires a strict application of protective measures, such as respect for safe distances between people, hand washing with hydro-alcoholic gel before entering working zones, confinement in their homes of people with influenza symptoms.

Full article at <https://www.republicain-lorrain.fr/edition-thionville-hayange/2020/03/19/covid-19-la-centrale-s-adapte-pour-continuer-de-tourner>

In the article “Électricité : comment éviter le black-out”, **Le Point** reiterates that EDF (operator), RTE (network operator) and Enedis (for distribution) have, in some cases, activated plans to deal with the epidemic for several weeks. On 1 March, a crisis unit was set up at Enedis. The electricity distributor has mobilized throughout France brigades of agents ready to intervene in emergency, especially in case of flood or storm that would add a crisis to the crisis. They also, of course, provide emergency troubleshooting on the network, seven days a week. **In the event of failure or fatigue, a second wave of reserve officers, who never meet the first, is also ready to intervene.** At Enedis, there were Tuesday, March 17 a little less than 300 agents in quarantine of 14 days, and twelve proven cases of coronavirus.

Full article at [https://www.lepoint.fr/economie/electricite-comment-eviter-le-black-out-19-03-2020-2367937\\_28.php](https://www.lepoint.fr/economie/electricite-comment-eviter-le-black-out-19-03-2020-2367937_28.php)

**In its article “French nuclear plants tighten hygiene procedures over coronavirus worries”, Reuters** reports that French utility EDF is introducing stricter hygiene procedures at its nuclear plants after walk-outs by a small number of workers who feared getting infected with coronavirus during radiation screening. After working in the radioactive areas of nuclear plants, staff have to step through narrow shower-style portals in their underwear to be checked for possible radiation exposure. Workers feared the surface areas of these portals could become a source of spreading the virus. These concerns were pointed out in particular by contractors in the nuclear plants of Fessenheim, Civaux and Chooz. Under French labor laws, staff have the right to walk off the job if they consider there is a clear and imminent threat to their health or safety.

EDF implemented measures consist in cleaning the portals twice per eight-hour shift, to increase security distances between workers and provide gloves and hand sanitizer, according to new internal rules announced on Tuesday.

For now, only staff involved with operation, maintenance and security are working on-site in EDF’s nuclear plants.

The article also reports the EDF assurance to be able to provide the country with the needed energy.

<https://www.reuters.com/article/us-health-coronavirus-france-nuclear/french-nuclear-plants-tighten-hygiene-procedures-over-coronavirus-worries-idUSKBN2172J1>

From Actu article “Coronavirus: comment la centrale nucléaire de Cattenom s’adapte pour continuer de tourner”

The nuclear power plant, which is one of the most powerful in France, had two confirmed cases of coronavirus among its staff, and must adapt its activity during this unprecedented period of confinement, for assuring its mission to supply customers with electricity.

The site management ensured that many adaptations had been made, following the country pandemic response. Furthermore, after confirmation of the two cases, identified employees in contact with them have been placed in confinement.

During the containment period, several measures are taken by the operator. First, the establishment of telework for tasks and functions that can be carried out in remote. The article report that about 35% of the

workforce, namely around 400 people, use telework. Site protection and operating personnel continue to be present on site.

The screening of employees, arriving for taking up their duties, is comparable to that of passengers at an airport before taking a flight. When they arrive, a distance of one meter is required, and hydroalcoholic gel is placed at the entrance of each building.

The article refers to EDF pandemic plan, which foresees that the plant can operate three to four months with 25% of staff absenteeism, and the mobilisation of teams. It also reports that **electricity consumption has also fallen by around 15% in France due to the economic slowdown due to the coronavirus epidemic**, and a greater export, in particular toward Germany and Spain, is registered.

Actu also highlights that the Cattenom nuclear power plant (Moselle), near Thionville, has four reactors: Two of Cattenom's four production units are currently in operation, according to EDF. The numbers 2 and 4 are in production and the 1 and 3 have been stopped since the night of March 6 due to an incident on an electrical evacuation line, i.e. the large line at high tension. The incident has been reported to the Nuclear Safety Authority.

[https://actu.fr/grand-est/cattenom\\_57124/coronavirus-comment-centrale-nucleaire-cattenom-sadapte-continuer-tourner\\_32440682.html](https://actu.fr/grand-est/cattenom_57124/coronavirus-comment-centrale-nucleaire-cattenom-sadapte-continuer-tourner_32440682.html)

NUCNET 23 March 2020

Coronavirus / Nuclear Industry Begins To Isolate Key Operational Staff

The operators of nuclear power plants are taking steps to minimise the impact of the Covid-19 pandemic, including isolating key staff and stockpiling items workers might need if they are unable to leave a site.

...

France, the world's most nuclear energy dependent nation, announced staff reductions at its Flamanville nuclear station. EDF said that due to high regional infection rates it was reducing the staff at the plant from 800 to 100. As early as 10 March, EDF reported that three workers at nuclear power plants had tested positive for the virus.

A spokesman for the Flamanville plant told Reuters that "we have decided to only keep those in charge of safety and security" working while the coronavirus crisis runs its course.

Full article at <https://www.nucnet.org/news/nuclear-industry-begins-to-isolate-key-operational-staff-3-1-2020>

NUCNET 26 March 2020

Coronavirus / France's Regulator Says 'Numerous' Nuclear Installations Have Been Closed

France's nuclear regulator said on Thursday that numerous nuclear installations whose operation is not essential have been shut down because of the Covid-19 coronavirus pandemic.

ASN said the facilities includes those operated in particular by nuclear research organisation CEA, state-controlled nuclear company Orano and Andra, the company managing France's Cigéo deep geologic repository project.

ASN said Orano has maintained activities related to the operation of EDF's nuclear fleet, including the disposal of spent fuel, reprocessing, and the supply of new fuel.

...

26.3.2020

With the article <<**Coronavirus: l'ASN a alerté EDF sur les prestataires du nucléaire**>>, **Le Figaro** informs that the Nuclear Safety Authority (ASN) announced that it alerted EDF to the situation of employees of service providers operating in French power plants, in particular to provide them with sufficient protection in the context of the coronavirus epidemic.

In this context, EDF must "clearly define which maintenance or logistics activities for which continuity is essential so that there is no ambiguity for these companies and their employees," ASN said in an information

note. The group must also "ensure that health and safety conditions are communicated and set up correctly on the sites for all employees".

ASN has also adapted its own organization to the context of the coronavirus by suspending its inspections with on-site trips, besides exceptions, and replacing them with remote controls relating in particular to the examination of documents related to the current operation of nuclear center.

EDF, for its part, favors the operation of its sites, which is essential for the supply of electricity, and is currently studying the conditions for continuing reactor maintenance activities during refueling outages.

The group had to modify the radioactivity control procedures in its power plants in mid-March after the exercise by a few employees - the vast majority of providers - of their right of withdrawal due to fear of contamination by the coronavirus.

Full article at <https://www.lefigaro.fr/flash-eco/coronavirus-l-asn-a-alerte-edf-sur-les-prestataires-du-nucleaire-20200326>

1.4.2020

The article «**La centrale nucléaire de Gravelines fonctionne avec seulement un quart de ses effectifs**» of **Le Monde** reports that to guarantee the supply of electricity to hospitals and homes in the North, a quarter of the staff at the Gravelines power station are on site every day. The other agents work remotely. In total, only 800 of the 3,000 EDF agents and service providers travel to operate the reactors.

As with other nuclear power plants in France, EDF has placed all of the Gravelines agents in support functions and engineers in telework. The employees on site are dedicated to piloting and monitoring the reactors, the officers responsible for protecting the plant, as well as those dedicated to maintenance and environmental analysis.

To maintain the supply, two steps have been taken: the suspension of part of the activity programs in order to lighten the workload and the prioritization of maintenance outages in order to allow security in the supply of electricity.

In Gravelines, five units are in operation and one is shutdown for maintenance. A shutdown that started last weekend - and is expected to last until April 27 - has long been planned to allow refuelling. The activities have been prioritised; the regulatory activities are among those continuing.

Within the plant, the working methods had to be changed due to the setting up of barriers. In addition to the requested distance of 1.5 meters between each officer, management has suspended internal public transport. On the other hand, the time allotted in the catering area (where hand washing is now compulsory on entry and exit) has been extended. Objective: avoid a high concentration of people around the tables.

In addition, the frequency of cleaning of crossing sites and equipment has been increased to six times in controlled areas. There is no question of risking large-scale contamination of agents, even if, in the department of Manche, the situation is more worrying than in Gravelines.

The pandemic plan makes it possible to operate in the power stations with 25% of the workforce absent for twelve weeks, or with 40% of those absent for three weeks

In Gravelines, they have an internal emergency plan (PUI), which foresees staying on-site seven days a week, with rotations every twelve hours with installation of camp beds, survival rations and action of the FARN, the force of nuclear rapid action. The management and staff points out their attachment to the service.

Full article at [https://www.lemonde.fr/economie/article/2020/03/31/la-centrale-nucleaire-de-gravelines-fonctionne-avec-seulement-un-quart-de-ses-effectifs\\_6035025\\_3234.html](https://www.lemonde.fr/economie/article/2020/03/31/la-centrale-nucleaire-de-gravelines-fonctionne-avec-seulement-un-quart-de-ses-effectifs_6035025_3234.html)

03.04.2020

**Actu** reports that About 40 staff members of EDF Flamanville have been infected. Of them about 20 recovered. Since the 16 March the staffing of the NPP has been reduced from 1300 to less than 300. The two reactors were already in shut down. Only the safety activities, the regulatory controls and the environmental monitoring have been assured



Full article at [https://actu.fr/societe/coronavirus/centrale-nucleaire-flamanville-une-quarantaine-dagents-contamines-par-covid-19\\_32766427.html](https://actu.fr/societe/coronavirus/centrale-nucleaire-flamanville-une-quarantaine-dagents-contamines-par-covid-19_32766427.html)

**Coronavirus and power generation** ([https://actu.fr/economie/coronavirus-comment-production-deelectricite-sadapte-tenir-coup\\_32627162.html](https://actu.fr/economie/coronavirus-comment-production-deelectricite-sadapte-tenir-coup_32627162.html))

EDF is organizing itself so that its nuclear power plants—which supply more than 70% of electricity in France – operate despite the progression of the virus. "Today, even in our most pessimistic plans, we believe we are able at any time to produce enough electricity for all French people," said Jean-Bernard Lévy, CEO of EDF, on Europe 1 recently.

"We put teams in reserve" EDF explained. If a shift team were to be contaminated, a reserve team without any contact with the previous one would take over.

At the nuclear power plants, a number of measures have been taken: abolition of internal shuttle buses, more frequent cleaning, isolation of the control room where the teams that control the reactor operate in shifts...

Information related to outages

In France, operator EdF is also studying the conditions related to performing maintenance activities during refuelling outages. The mid-April-scheduled outage at Penly NPP has been delayed by a month. For the maintenance and refuelling work, EDF uses its own employees as well as external contractors, which may not all have the same availability as usual due to the national lockdown measures.

Consequently, EdF has analysed on a national scale which outages that were scheduled to be performed during the lockdown, could be postponed. As a result of the study the outage at Penly has been delayed by one month from mid-April to 16 May 2020. Normally, the outages are scheduled to be completed before winter so that the plants can all operate through the winter months when demand is at its highest. Even if nuclear electricity generation in France is demonstrating a high resilience to the pandemic at the moment, the ability to meet the demand during the highest peaks of next winter may not be assured, if the crisis is protracted.

[https://actu.fr/economie/coronavirus-comment-production-deelectricite-sadapte-tenir-coup\\_32627162.html](https://actu.fr/economie/coronavirus-comment-production-deelectricite-sadapte-tenir-coup_32627162.html)

<https://www.lefigaro.fr/flash-eco/coronavirus-l-asn-a-alerte-edf-sur-les-prestataires-du-nucleaire-20200326>

[https://actu.fr/normandie/dieppe\\_76217/confinement-penly-larret-tranche-la-centrale-nucleaire-decale-dun-mois\\_32580506.html](https://actu.fr/normandie/dieppe_76217/confinement-penly-larret-tranche-la-centrale-nucleaire-decale-dun-mois_32580506.html)

## Germany

NUCNET 23 March 2020

Coronavirus / Nuclear Industry Begins To Isolate Key Operational Staff

The operators of nuclear power plants are taking steps to minimise the impact of the Covid-19 pandemic, including isolating key staff and stockpiling items workers might need if they are unable to leave a site.

...

Vattenfall, which owns 10 nuclear reactors in Sweden and Germany, said measures are in place to deal with the outbreak. "We are well equipped to carry out our yearly outage season and plan to continue to supply fossil-free electricity to our customers, both in the short and long term," the company told NucNet by email. "The annual maintenance is already running at Ringhals [in Sweden]."

Vattenfall said operations at its nuclear plants have not been affected by the pandemic. "We follow the recommendations from authorities in addition to our own continuity plans, and we continuously monitor the situation," the email said.



References/sources:

1. NUCNET 23/3/20, <https://www.nucnet.org/news/nuclear-industry-begins-to-isolate-key-operational-staff-3-1-2020>

## Hungary

The Government of Hungary issued an extraordinary legal order on 11<sup>th</sup> of March 2020, introducing a pandemic emergency state on the territory of the Hungarian Republic due to the appearance and spread of the coronavirus.

According to the communiqué issued on the 16<sup>th</sup> of March 2020 by Hungary's only operating nuclear power plant, Paks NPP, the NPP is prepared to manage the potential risks represented by the coronavirus. The existing pandemic action plan has been actualised according to the current epidemic situation and it has been approved by the Chief Health Officer of Hungary. The measures taken include increased hygienic arrangements for the personnel at the site, limitations related to meetings, trainings, visits and missions, as well as extensive teleworking arrangements for the staff members not involved directly in the daily operation and maintenance activities. **The safe and reliable operation of the NPP is ensured even in that case when the spread of the virus continues.** Similar measures have been implemented at other companies dealing with various parts of the critical national infrastructure, e.g. MVM Plc (Hungarian Electricity Private Limited Company), the MAVIR Ltd (Hungarian Transmission System Operator Company), the MOL Plc (Oil, gas and petrochemicals group) and others.

References/sources:

1. <http://www.telepaks.net/2020/03/16/a-paksi-atomeromu-felkeszult-a-koronavirus-okozta-veszely-kezelesere-2/>
2. <https://www.mavir.hu/web/mavir-en/mavir-ltd>

## Netherlands

19-03-2020

In the article "Measures related to the COVID19 virus", "Maatregelen in verband met het COVID19-virus", **ANVS** informs having taken appropriate measures for ensuring the continuity of the operations, and the safety and security of the supervision. The measures include teleworking from home. Telephone availability for reporting incidents will be ensured at adequate level, but for other reports there might be some delay, although they do not expect this will significantly impede the handling and processing time of reports, assessments and permit applications. Continuity in granting authorizations based on the Nuclear Energy Act that are vital for medical care is guaranteed.

Physical inspections at companies will be limited as much as possible from a safety point of view, with minimum number of people. If there are any indications of safety risks, inspection will of course be carried out on location

References/sources:

1. <https://www.autoriteitnvs.nl/actueel/nieuws/2020/03/19/maatregelen-anvs-in-verband-met-het-covid19-virus>

## Romania

In two press releases on 11 and 15 March Nuclearelectrica S.A. (operator, SNN) announced the establishment of a plan, gradually implementing various measures and adopting isolation measures for essential operating and production staff from Cernavoda NPP. No new press release is available on the SNN web site. However Romanian Ziarul Financiar reported on 8 April 2020 (in Romanian) that Chernavoda Unit 1 shutdown for planned outage between May and June is postponed (see more below).

From the 11 March press release:

“Considering the strategic importance of SNN in ensuring the constant energy production at the national level, under safety conditions, corroborated with the protection of the personnel and the local community, SNN has drafted the Plan for the Continuation of activity in case of an epidemic and has established an internal Working Group which will develop, coordinate and implement the prevention measures and will plan the necessary protection measures according to the evolution of the situation.

The plan for ensuring the continuity of activity is drafted in compliance with the national legislation and the measures established by the Romanian Government and is permanently updated in consideration of the international standards and experience in the nuclear field.

The plan is applied gradually, from preventive hygiene measures to measures for ensuring the availability of essential personnel, and will be applied depending on the level of the associated risk, in a pro-active mode so that the risk of contamination with coronavirus is reduced to a minimum.

In order to ensure the essential personnel for the safe operation of the installation, SNN/**Cernavoda also has plans to organize a dedicated space, with all necessary conditions, including food and transportation.** This measure can be implemented only on the basis of the legislation in force. **This measure will be applied in strict correlation with the spread of the coronavirus and aims to protect the essential personnel and ensure the continuity of operations and production.**

SNN also has established measures for all staff segments, which will be gradually applied depending on the evolution”.

From the 15 March press release:

“The initiation of additional protection measures is based on the resolution of the National Special Committee for Emergency Situations (“CNSS”) no. 9/14.03.2020, which approves the isolation measures for the essential staff of Cernavoda NPP involved in ensuring the operation of the power plant, as per the measures of the Plan for the continuation of basic activities in case of an epidemic/pandemic.

The internal plan for the protection of the staff and the assurance of operational activities continuity under safety and normal production conditions was adopted by the management of SNN as an additional measure during the COVID-19 epidemic, in compliance with international standards in the nuclear industry and national provisions on the subject.

SNN informs that all the basic processes of the company are carried out within normal parameters, the additional actions and measures being prepared and implemented in cooperation with all the competent state authorities on the matter.”

NUCNET 23 March 2020

Coronavirus / Nuclear Industry Begins To Isolate Key Operational Staff

The operators of nuclear power plants are taking steps to minimise the impact of the Covid-19 pandemic, including isolating key staff and stockpiling items workers might need if they are unable to leave a site.

...

In Europe, Nuclearelectrica, which operates the **Cernavodă nuclear power station in Romania, has already isolated about 400 essential operating and production staff** at Cernavodă. A spokeswoman

told NucNet that the measure, based on established emergency plans, will remain in place as long as necessary. **The staff are isolated in a specially designated area within the Cernavoda campus.**

Information related to outages

Ziarul Financiar 8 April 2020 (in Romanian)

Nuclearelectrica, a state-owned company with 4.4 billion lei capitalization, postpones the stopping of Unit 1 in Cernavoda due to the COVID-19 epidemic

Nuclearelectrica explained decision:

"Usually, the planned shutdowns of the nuclear units are carried out alternately, every two years for each unit, during the period May-June, for a period of about 30 days. As the preparation of a planned stop is a complex investment project through the logistic, contracting and personnel structure involved, the Board of Directors decided to postpone the stopping of Unit 1 for a period that would allow the implementation of the project without associating with the risk of contamination with COVID-19,"

"Nuclearelectrica will issue, after the internal analysis, a current report on the exact period in which the planned shutdown is to be performed. The postponement of the planned stopping of Unit 1 Cernavoda NPP does not affect the maintenance of the high level of nuclear safety and efficient operation, the production will be carried out at normal parameters".

References/sources:

1. Nuclearelectrica S.A. CEO, Adopting the measurement of isolation for the essential operating of Cernavoda NPP, March 15 2020 press releases in English, [www.nuclearelectrica.ro/2020/03/15/adopting-the-measurement-of-isolation-for-the-essential-operating-of-cernavoda-npp/?lang=en](http://www.nuclearelectrica.ro/2020/03/15/adopting-the-measurement-of-isolation-for-the-essential-operating-of-cernavoda-npp/?lang=en)
2. Nuclearelectrica S.A. CEO, Press release – protection measures Coronavirus, 11 March 2020, [www.nuclearelectrica.ro/2020/03/11/press-release-protection-measures-coronavirus/?lang=en](http://www.nuclearelectrica.ro/2020/03/11/press-release-protection-measures-coronavirus/?lang=en)
3. NUCNET 23/3/20, <https://www.nucnet.org/news/nuclear-industry-begins-to-isolate-key-operational-staff-3-1-2020>
4. Ziarul Financiar 8/4/20, [www.zf.ro/burse-fonduri-mutuale/nuclearelectrica-companie-de-stat-cu-4-4-mld-lei-capitalizare-amana-oprirea-unitatii-1-de-la-cernavoda-din-cauza-epidemieii-de-covid-19-19056941](http://www.zf.ro/burse-fonduri-mutuale/nuclearelectrica-companie-de-stat-cu-4-4-mld-lei-capitalizare-amana-oprirea-unitatii-1-de-la-cernavoda-din-cauza-epidemieii-de-covid-19-19056941), (in Romanian)

## Slovakia

Following the spread of coronavirus, Slovenské elektrárne, a.s. (SE), the operator of the Slovak nuclear power plant (NPP) at Jaslovské Bohunice, is introducing further measures to prevent the spread of infection, affecting all suppliers and persons entering SE's premises. The measures should protect the health and ensure the continuity of electricity and heat production.

Effective as of March 11, 2020, every person entering the NPP site is obliged to fill in a Declaration of Oath aimed at identifying potentially at-risk persons. One copy is handed in to the Protection and Security Staff of Slovenské elektrárne at the site main gate. The other copy is stamped and the person has to show this document at each subsequent entry.

SE is also introducing screening of symptoms (temperature above 37.5 ° C, shortness of breath or dry cough) and possible contact with people infected with coronavirus.

Plant entry is not permitted to a person who has got the symptoms of the virus or has been in a high-risk country.

Slovenské elektrárne has listed the high-risk or medium-risk countries and regions; the list is updated daily and is displayed at all entrances to the NPP site. The list is stricter than the one published by public authorities, as the NPP plays an important role in the electricity and heat generation in Slovakia.

No power reductions were reported.

#### Information related to outages

In Slovakia, the series of nuclear unit outages starts at the Mochovce NPP Unit 1 on Saturday, 28 March. The operator will execute only the most important works during the planned outage, based on approval by the Slovak Nuclear Regulatory Authority, hence minimising the number of people or their social interaction in the nuclear power plant premises. The main goal of the Mochovce nuclear power plant outage is to replace about one fifth of the fuel in the reactor and to carry out repairs and investment projects to increase the plant's safety. Works on this year's outage are reduced, but the length remains unchanged and should take less than three weeks. Working shifts of the staff were also changed from 8 to 12 hours to reduce employee rotation and thus also the risk of potential coronavirus spread.

In March, Mochovce and all other power plants of Slovenské elektrárne introduced mandatory contactless temperature measurement at the plants' entry points. After passing through the thermal camera checkpoint, each entrant must sign a declaration on clinical symptoms and his or her travel history. There are disinfection stations at all busy places of the power plant, it is obligatory to wear face masks, which are even sewn by the plant laundry employees and volunteers who work from home. The scope of the outage has been adjusted to only the necessary activities that will be ensured with in-house capacities. Conservatively, we don't plan to use all our capacities, and so having a reserve in place if we had to quarantine some employees. The Unit 1 general overhaul in Mochovce will be followed in mid-May by general overhaul of Bohunice NPP Unit 4. Bohunice Unit 3 will be shut down in the second half of June and the marathon of overhauls will be completed in September by Mochovce Unit 2 general overhaul.

<https://www.seas.sk/article/mochovce-npp-coronavirus-counter-measures-will-affect-the-planned-general-overhaul/413>

#### References/sources:

1. <https://www.seas.sk/article/koronavirus-opatrenia-na-ochranu-zdravia-a-kontinuity-vyroby/412>

## Slovenia

Krško Nuclear Power Plant (NEK) online press release, 13 March:

“At Krško NPP, considered to be the object of significant state infrastructure, we are aware of our responsibility to ensure plant safety and electricity production in all circumstances. Accordingly, we are conservatively and promptly planning measures in the power plant considering the circumstances surrounding the appearance of the new coronavirus.

With the declaration of an epidemic at the state level, we move to providing only those functions that are necessary to ensure the safe and stable operation of the power plant. This means shift control of the plant, necessary testing of safety equipment, necessary maintenance work, analytical chemistry of the cooling media, radiological monitoring within the plant and in the environment, and physical protection of the plant.

All construction sites and work sites on projects are temporarily closed, work and readiness at home are introduced for all supporting functions of the Krško NPP organization. Entrance to the power plant is only permitted to provide the services necessary for the undisturbed operation of the essential safety and operation functions.

Extreme care and attention are given to the self-protective behaviour of shift staff and to the implementation of conditions aiming at reducing the risk of infection. We insist on adhering to the instructions for reducing the

likelihood of virus transmission, self-isolation, separation and permanence of shift crews, disinfection of joint nodes, temperature control at the entrance to the power plant.

Ten days ago the following measures were taken: a ban on visits by public interest groups at the Krško NPP, a ban on business trips, a two-week quarantine for all returnees on holiday in Italy, transfer to meetings via digital links. We have given clear instructions on self-protective behaviour of employees outside working hours, i.e. at home.

The measures we have taken have secured the highest possible level of self-isolation and reduced the risk of virus infection to the lowest possible level. At the same time, we continue our safe and stable operation in new circumstances.”

The Slovenian regulatory body (URJSV/SNSA) published an online communication on 18 March about measures taken to curb the Covid19 epidemic (in Slovenian):

“The SNSA has taken measures to curb the spread of coronavirus. There is a minimal number of people at the SNSA, the rest is working from home. We try to keep our work as smooth as possible, and we ask that you follow the instructions below:

... We advise you to ask all your questions by telephone on 01 472 11 00 or via e-mail.

Requests and applications should also be emailed to [gp.ursjv@gov.si](mailto:gp.ursjv@gov.si). ...

If anyone considers it necessary to enter the SNSA premises, he / she may do so only upon prior notification and confirmation by the SNSA and subject to all NIPH measures to prevent the spread of coronavirus.

-Operation of nuclear facilities and users of radiation sources: All nuclear facilities have taken appropriate measures to ensure smooth operation. NPP Krško keeps emergency personnel out of contact with others, and takes strict measures to prevent the spread of infection, to ensure nuclear safety and smooth operation. The SNSA monitors the situation at the plant on a daily basis. The TRIGA research reactor is shut down. The central repository of radioactive waste is closed and the treatment of radioactive waste is interrupted. The Agency for Radioactive Waste (ARAO) has an organized on-call service in case any radiation source is urgently needed to be stored in the warehouse. Users of radiation sources act in accordance with their own and general instructions.”

References/sources:

1. Krško NPP press release 13 March 2020 (in Slovenian and Croatian), [www.nek.si/hr//novinarski-centar/novosti/porocilo-za-javnost](http://www.nek.si/hr//novinarski-centar/novosti/porocilo-za-javnost)
2. Sporocilo URJSV v zvezi s koronavirusom, (Coronavirus Communication from SNSA), 18 March 2020, [www.gov.si/novice/porocilo-ursjv-v-zvezi-s-koronavirusom-covid-19/](http://www.gov.si/novice/porocilo-ursjv-v-zvezi-s-koronavirusom-covid-19/)

## Spain

CSN. Nuclear Safety Council. REGULATOR

19.03.2020

In accordance with RD 463/2020 of March 14, which declares the state of alarm for the management of the health crisis caused by COVID-19, the CSN has adopted various measures in addition to the temporary suspension of activities in its offices, decided on March 13.

Listed below are other exceptional actions taken:

### 1.- Implementation of telework

The presence of the minimum number of people essential to guarantee the operation of the organization has been planned, including:

Three people from the surveillance service, 24 hours a shift established by the Security manager.

An officer and a technician from the Emergency Room, 24 hours shift established by the head of the Emergency Activities Coordination Area. The Emergency Response Organization (ORE) has procedures in case of activation.

A 24-hour maintenance technician with own CSN and contract personnel, on shifts established by the head of the General Affairs Service, coordinated by the head of the Coordination and General Affairs Area.

A technician from the Information Technology Subdirectorate (STI), during office hours, complemented by another checkpoint technician at his home. Shifts and retention technician activation will be established by the STI Deputy Director.

A person in charge of managing the electronic registry and a person who will go to the CSN once a week for the physical care of the CSN registry.

The rest of the staff will maintain their activity in the teleworking modality. To this end, numerous portable computers with remote connection (VPN) and connectivity tools have been assigned to conduct videoconferences from platforms such as TIXEO or Skype. Furthermore, the CSN is working on equipment acquisition and / or rental formulas.

To go exceptionally to the CSN offices, a prior authorization procedure has been established.

## 2.- Management of the registry for the official reception and issuance of documentation

The authorization of a telematic registry has been managed by assigning the registration data to the documentation generated internally and using the internal self-signature application.

The attendance of a person for the physical care of the registry is scheduled once a week.

## 3.- The Plenary of the CSN will maintain its activity

This week the last plenary session was held physically at the CSN headquarters. From then on it has been decided:

- To hold weekly meetings with the technical directions, the plenary preparatory meeting with the advisers and the plenary meeting.
- Every day there will be virtual work meetings and monitoring of the situation.
- The Plenary will be informed daily by the doctor of the situation of the house workers.

## 4.- Cleaning and sanitation

During the past weekend the headquarters have been disinfected and the services have been contracted for a weekly disinfection.

## 5.- Information to staff

Various communications have been issued for staff, using the means of communication available to the CSN (intranet, web, email, internal newsletter, etc.).

Internal communications will be updated, being of interest to reinforce the feeling of normality in the work of the CSN. For this, the use of videoconferences at all levels is recommended.

Priority activities will be defined, in order to optimize the activity of the Technical Directorates.

## 6.- Interruption of access to CSN facilities for the general public and other measures

One of the first measures implemented, given the unfavourable evolution of the epidemic observed in the previous week, was the interruption of visits to the Information Center.

Other measures implemented were the suspension of trips not considered essential to locations outside the Community of Madrid.

Likewise the risk groups have been identified which were the first to be evacuated from the CSN.

The order to suspend administrative deadlines for processing procedures affects the specific competition for the provision of jobs (BOE No. 292, of December 5, 2019) and the announcement of training scholarships for specialization in nuclear safety and radiological protection (BOE nº 279, of November 20, 2019). Two notifications have been issued for your communication.

Likewise, the inventory of material of various types and sizes available in the CSN offices has been communicated to the Ministry of Health so that it can be made available for cleaning and disinfection.

13.03.2020

Following the recommendations issued by the Government of Spain in relation to COVID-19, the Nuclear Safety Council (CSN) has decided to temporarily suspend in-person activities at its headquarters, guaranteeing, in any case, the operation of the organization.

This means that the regulatory body will carry out its daily activities by teleworking. And as usual, the guard retainer will continue to function normally in the event of any eventuality.

These guidelines adopted by the CSN are in accordance with the recommendations of both the Ministry of Spatial Planning and Public Function and the Ministry of Health, Consumption and Social Welfare.

ASCO' - VANDELLOS NPP WEBSITE

19.03.2020

Given the need to face the current health emergency situation, ANAV has implemented a series of measures and means that aim at guaranteeing the health of people and the safety of the operation and facilities, as fundamental premises in taking decisions.

In close collaboration with the Nuclear Safety Council and the different administrations, ANAV has established in its facilities the preventive and hygiene measures necessary to preserve the health of people while they are in the workplace, as well as an organization in teams, which allows to promote the distances between people and preserve human resources.

While this situation continues, intensive work is being done in the planning, management and execution of all the necessary tasks to guarantee the safe operation of the Ascó and Vandellós II nuclear power plants.

ANAV professionals are working to contribute as much as possible to this collective challenge that we must face, with all our individual responsibility as professionals and with the collective commitment of the entire organization.

TRILLO-ALMARAZ NPP WEBSITE

24.03.2020

Due to the pandemic caused by the COVID 19 coronavirus, Almaraz-Trillo Nuclear Power Plants (CNAT) has launched a series of measures, going beyond what is established by the authorities health and public administrations, in order to protect the health of people who work in its facilities and that of its family environments, minimizing possible infections and guaranteeing the safe and reliable operation of the Power Plants.

These are control, contingency, prevention and time flexibility and conciliation measures.

They include the protocol for medical services for workers with symptoms compatible with COVID 19, reinforced cleaning programs in plants, restrictions on meetings and displacements, the comprehensive control of personnel at the Plant, critical business continuity plans including possible reinforcements of the operating personnel or work organization by teams or shifts to minimize the number of people present at each site and the implementation of flexible work from home.

These measures will be complemented by additional ones to reinforce the safety of professionals and of the installation during the scheduled short stop to refuel in Unit I of CN

Almaraz that will start in mid-April.

All these actions have been promptly reported to both the Nuclear Safety Council and the regional and local administrations and health authorities with whom permanent contact is maintained.

Almaraz-Trillo Nuclear Power Plant wants to transmit a message of solidarity and support to all affected by this pandemic and reaffirm its commitment to support and collaborate with the authorities to meet this collective challenge.

#### COFRENTES NPP WEBSITE

24.03.2020

Iberdrola electrical utility (owner of Cofrentes NPP) guarantees the electricity supply and activates its action plan to prevent the progression of the coronavirus.

The group, which provides an essential service for the population, reinforces the normal operation of its facilities and critical and strategic activities with a plan of 65 concrete measures. The group's president has informed the staff of the measures adopted and has appealed to the great sense of responsibility always shown by Iberdrola workers to prevent the service from being affected. Iberdrola, the first energy company in Spain, has launched its plan for global action against the coronavirus, COVID-19, in accordance with the recommendations of the competent health authorities.

In this context, the company has implemented 65 measures that will help guarantee operations while protecting the health and safety of its workers and facilitates the reconciliation of their personal and work life.

The company has enabled telework systems for its employees in affected areas. At the same time, they have an interdiction on national and international travel, meetings and training courses, except in special situations.

Likewise, the measures include extraordinary protocols for critical groups of the businesses, eventual mobility schemes and temporary relocation of workers from facilities or essential functions in the generation, distribution and electricity supply to end customers.

#### NEWSPAPERS:

ALL PLANTS

20.03.2020

Army and Guardia Civil 'take over' nuclear power plants to avoid sabotage during the coronavirus

At the request of the Ministry of the Interior, the Armed Forces will have to collaborate with the Guardia Civil to provide security at these nuclear power plants. The aim is to maintain, as far as possible, the normality of these three locations in collaboration with the Benemérita (Guardia Civil) throughout the coming weeks. During the time span of the military deployment.

Throughout the week, those responsible for the Trillo plant began to adopt flexibility measures for their workers in the face of the coronavirus outbreak caused by COVID-19 disease. Although the outbreak is not affecting production at the centre, control and contingency measures are being implemented to deal with the situation.

The fundamental objective, assure the managers of the plant, is none other than the safety of its workers. For this reason, a part of its workers is already working from home. They are those who occupy positions "not essential for production". Work shifts have been established for the rest of the workforce, especially those that are, they say, essential for production to continue.

#### ALMARAZ NPP

20.03.2020



The Almaraz Nuclear Power Plant postpones the start of outage of its unit I, scheduled for March 29.

The Almaraz Nuclear Power Plant has decided to postpone outage number 27 of its Unit I, which was scheduled to start on March 29, due to the state of alarm in the country for the coronavirus pandemic.

In this way, the recharging of Unit I is delayed "at the moment that the socio-sanitary conditions of the country allow it," according to sources from the Almaraz Nuclear Power Plant to Europa Press.

Thus, they point out that it will try to limit the scope of this stop as much as possible, in such a way that the Almaraz Nuclear Power Plant has scheduled for next April 14 a "shorter range stop" to refuel Unit I.

To carry out these refuelling works, the nuclear power plant has established a series of additional measures to reinforce the safety of professionals and the facility, depending on the alert situation in the country.

#### ASCO'-VANDELLOS NPPs

20.03.2020

Ascó and Vandellòs take measures to guarantee nuclear production.

The teams are organized taking into account the necessary distance between workers.

The three nuclear power plants in the Tarragona district, Ascó I and II in Ribera d'Ebre and Vandellòs II in Baix Camp, maintain their activity to guarantee the power production. "As long as this coronavirus health emergency situation continues, we are working intensively on the planning, management and execution of all the tasks necessary to guarantee the safe operation of the plants," said a spokesperson of the Ascó-Vandellòs Nuclear Association (ANAV), the management company of the three plants.

Thus, the necessary hygiene and prevention measures have been established in the facilities "to preserve people's health while they are in the workplace."

Teleworking for employees with dispatch tasks has been launched.

In this sense, the current organization of work teams allows distances between people, to prevent possible infections and preserve human resources.

All measures have been implemented, they say, in close collaboration with the Nuclear Safety Council (CSN) and the different competent administrations.

Among other measures, teleworking has also been facilitated for employees with dispatch tasks that allow it, according to sources from the company.

"Given the need to face the current health emergency situation, the Ascó Vandellòs Nuclear Association has implemented a series of measures and means that prioritises the health of people and the safety of the operation and facilities".

#### COFRENTES NPP

19.03.2020

The Spanish Guardia Civil is not only enforcing the movement restrictions imposed by the alarm decree, whose main purpose is to protect the population and try to contain the rapid expansion of COVID-19. In addition, the corps is reinforcing the security and protection of buildings and spaces considered as critical or sensitive infrastructure. Thus, they have increased the number of guards to protect the security of the Cofrentes nuclear power plant, various electrical stations and critical points that guarantee telecommunications at a time when they are even more essential.

#### TRILLO NPP

19.03.2020

The Trillo nuclear power plant (Guadalajara) has ensured that the coronavirus outbreak "does not affect production" in the centre, although the plant has adopted time flexibility, control and contingency measures to deal with the situation.

This has been confirmed to Europa Press by sources close to this nuclear plant, the only one currently operating in the region, from which they have assured that the "fundamental objective" of the plant "is the protection of workers", hence the fact that it has also adopted conciliation and preventive measures.

These measures include shifting part of the staff to teleworking, specifically in "non-essential for production" positions, and work shifts have also been established in essential production positions.

The Trillo nuclear power plant is the last nuclear plant to be built in Spain, it is located in the Alcarreña town of Trillo and although for a time it coexisted with the oldest in the country, that of Zorita, the latter is in its final process of dismantling.

NUCNET 23 March 2020

Coronavirus / Nuclear Industry Begins To Isolate Key Operational Staff

The operators of nuclear power plants are taking steps to minimise the impact of the Covid-19 pandemic, including isolating key staff and stockpiling items workers might need if they are unable to leave a site.

...

Madrid-based industry group Foro Nuclear said Spain's seven commercial nuclear units remain in operation and operators are focused on the security of workers. They have implemented, in conjunction with the regulatory body, measures to protect workers including flexible working hours and remote working in positions that allow it.

**Almaraz begins to take the temperature to his employees**  
([https://www.elperiodicoextremadura.com/noticias/extremadura/almaraz-empieza-tomar-temperatura-sus-empleados\\_1227137.html](https://www.elperiodicoextremadura.com/noticias/extremadura/almaraz-empieza-tomar-temperatura-sus-empleados_1227137.html))

Given the evolution of the covid-19 pandemic, CNAT management has decided to strengthen the measures already established with the implementation of daily temperature measurement from 30 March to all those who will access the plants. This control shall be performed by employees trained using non-contact thermometers." This has been reported from the management of the Almaraz nuclear power plant.

They add: "persons with a temperature above 37.3 degrees, considered the maximum acceptable level for medical services, will not be able to access the sites and will be referred to their primary care physicians"

The Almaraz nuclear power plant will recharge fuel during the state of alarm: the Government considers it "essential"

6 April 2020

The extension of the state of alarm does not alter the plans of the Almaraz (Cáceres) nuclear power plant to carry out a rapid refuelling of fuel next week with the approval of the Government, which considers its activity "essential".

On March 20, six days after the Government decreed the state of alarm, the Almaraz management reported that it had decided to delay the start of recharge number 27 of its Unit I, initially scheduled for March 29, "at moment in which the socio-sanitary conditions of the country allow it ". Instead, a shorter-range shutdown would be performed, just to replenish the fuel and without the preventive and corrective maintenance tasks involved in conventional recharging.

According to plant sources, the chosen date, April 14, when in theory the alarm state would no longer be in force, is maintained, after Pedro Sánchez confirmed on Saturday that the alarm state will be extended until at least April 26. Almaraz will carry out this rapid recharge and then, foreseeably in the autumn, it will stop again for a thorough inspection, according to industry sources. With this, the plant (whose largest shareholder is Iberdrola with 53%) will avoid an indefinite shutdown once it runs out of fuel, with the million-dollar losses that this implies. Rapid recharging, being shorter than usual (about two weeks), will limit the plant's unavailability time and reduce the risk of contagion in a region (Extremadura) that this Monday exceeded

2,000 confirmed cases of COVID-19, with 21 new positives, the lowest number since the health crisis began, and a total of 218 deaths.

The express recharge will require significantly fewer additional workers, only about 200, mainly from the Community of Madrid, compared to the more than 1,000 that a normal recharge requires, an operation that requires bringing from other countries (such as the United States) a highly specialized professional who today cannot enter Spain.

Power reduction:

To be able to operate until the middle of the month, Almaraz has already started to reduce its power in order to optimize the remaining fuel. On Friday, it was operating at 91.8% of its capacity and the forecast is to reach the stop at around 85%. To minimize the risk of contagion, the plant operates with a personal reduction of 70%. Only personnel considered essential remain in the plant. From the owner it is stressed that it will carry a reinforcement of prevention measures during the recharge with respect to those initially planned.

According to sources from the Ministry for Ecological Transition, the fast recharge will be carried out from April 16 and is carried out because it is essential for the plant to continue operating. The ministry recalls that the generation of electricity "is an essential service and therefore outage is also", so it is exempt from the hibernation of the economy that the Government plans to gradually lift in the coming days for some sectors.

"In order to carry out this reduced recharge, Almaraz has had to send a request that will justifiably include proposals for exemptions to the Technical Operating Specifications (TS), as well as other requirements and prior commitments that could not be carried out", indicates the ministry. The possibility of these exemptions is foreseen in the Ministerial Orders authorizing the operation of nuclear power plants. They establish that the Nuclear Safety Council (CSN) "may temporarily exempt compliance with any section of the documents mentioned in the previous paragraph (in this case, the Technical Specifications for Operation), informing the Directorate General for Energy Policy and Mines of the start and end of the exemption."

Rejection of Ecologists:

The person in charge of Ecologists in Action, who stresses "the risk assumed by taking people from contagious areas to others that do not have it," stresses that "there are very few technical teams" dedicated to recharging nuclear power, because it deals with highly qualified personnel, and "one of the problems that may exist is that the recharging cycles of the plants overlap." Ascó, who had planned its recharge for April 18, has delayed it to the 28. In May the Trillo plant (Guadalajara) has to carry out its own.

Border with Portugal:

While the plenary session of the CSN last week discussed the work plan for the work on the renewal report of the authorization for the exploitation of the Almaraz license, which expires this year, the situation of the Extremadura plant in the current context of health crisis is followed closely to the other side of the border. According to Expresso a few days ago, the Portuguese Environment Agency "is closely accompanying issues related to nuclear power plants in Spain, and in particular that of Almaraz," the closest to the Portuguese border. The neighbouring country, with no nuclear power plants in its territory, recorded on Monday the first rise in its demand for electricity in three weeks. Portugal has 311 deaths and 11,730 confirmed cases of coronavirus across the country.

[https://www.eldiario.es/economia/Almaraz-recargara-combustible-Gobierno-considera\\_0\\_1013849469.html](https://www.eldiario.es/economia/Almaraz-recargara-combustible-Gobierno-considera_0_1013849469.html)

References/sources:

1. [https://www.csn.es/noticias-csn/2020/-/asset\\_publisher/7wHne5sV6dgf/content/el-csn-garantiza-el-funcionamiento-minimo-de-su-organizacion-ante-la-actual-situacion-del-covid-19](https://www.csn.es/noticias-csn/2020/-/asset_publisher/7wHne5sV6dgf/content/el-csn-garantiza-el-funcionamiento-minimo-de-su-organizacion-ante-la-actual-situacion-del-covid-19)
2. <http://www.anav.es/es/news/>
3. <https://www.elindependiente.com/economia/2020/03/20/el-ejercito-asume-la-seguridad-de-todas-las-nucleares-menos-de-las-dos-catalanas/>
4. <https://www.lasprovincias.es/valencia/ejercito-sustituye-guardia-20200320152418-nt.html>
5. [https://www.elespanol.com/espana/20200320/ejercito-guardia-civil-nucleares-evitar-sabotajes-coronavirus/475954297\\_0.html](https://www.elespanol.com/espana/20200320/ejercito-guardia-civil-nucleares-evitar-sabotajes-coronavirus/475954297_0.html)
6. <https://www.hoy.es/extremadura/brigada-extremadura-despliega-20200318130413-nt.html>

7. <http://www.diarosigloxxi.com/texto-ep/mostrar/20200320164256/central-nuclear-almazar-aplaza-inicio-recarga-unidad-i-prevista-29-marzo>
8. <https://www.diaridetarragona.com/ebre/Asco-y-Vandells-toman-medidas-para-garantizar-la-produccion-nuclear-20200320-0015.html>
9. <https://www.levante-emv.com/comunitat-valenciana/2020/03/18/guardia-civil-refuerza-vigilancia-cofrentes/1990809.html>
10. <https://objetivocastillalamancha.es/contenidos/guadalajara/central-nuclear-trillo-adopta-medidas-contingencia-flexibilidad-mantiene-produccion>
11. NUCNET 23/3/20, <https://www.nucnet.org/news/nuclear-industry-begins-to-isolate-key-operational-staff-3-1-2020>
12. <https://www.cnat.es/notpdf/NI%20CNAT%20ANTE%20%20COVID19%20.pdf>
13. [http://www.cncofrentes.es/wcofrnts/gc/prod/es\\_ES/conteni/docs/Comunicado%20\(2020-03-11\)%20Iberdrola%20garantiza%20el%20suministro%20electrico%20y%20activa%20su%20plan%20de%20accion.CNC.pdf](http://www.cncofrentes.es/wcofrnts/gc/prod/es_ES/conteni/docs/Comunicado%20(2020-03-11)%20Iberdrola%20garantiza%20el%20suministro%20electrico%20y%20activa%20su%20plan%20de%20accion.CNC.pdf)
14. [https://www.elperiodicoextremadura.com/noticias/extremadura/almazar-empieza-tomar-temperatura-sus-empleados\\_1227137.html](https://www.elperiodicoextremadura.com/noticias/extremadura/almazar-empieza-tomar-temperatura-sus-empleados_1227137.html)

#### Information related to outages

In Spain, the operators of Almaraz NPP decided to postpone by about 2 weeks the refuelling outage originally planned to start on 29 March and to perform only refuelling in order that the plant can continue to operate. The regular maintenance activities that would normally be carried out along with the refuelling, are postponed until later, when the state of emergency will be lifted and the health situation in the country permits. This will allow reducing the outage duration from over a month to 2 weeks and more importantly reducing the number of additional workers needed on site from more than 1000, including some workers from the US, to about 200 from companies based in Madrid. A similar plan is under consideration for Asco NPP Unit 1, which was originally scheduled to start its outage on 18 April. A decision on how to handle the next scheduled outage, at Trillo NPP scheduled for 9 May, will be made nearer the time when the actual situation of the pandemic will be clearer both in Spain and in the countries from where some of the workers will come, including Germany.

[https://www.eldiario.es/economia/recargas-combustible-centrales-nucleares-espanolas\\_0\\_1008949825.html](https://www.eldiario.es/economia/recargas-combustible-centrales-nucleares-espanolas_0_1008949825.html)

<https://www.20minutos.es/noticia/4204763/0/el-75-de-los-operarios-de-la-nuclear-de-trillo-hacen-teletrabajo-sin-que-afecte-a-la-produccion/>

## Sweden

On 13/03/2020 a regional newspaper reports [1] that all three Swedish NPPs, Forsmark, Ringhals and Oskarshamn, which together produce about 40% of SE electricity, have heightened the attention due to the situation with COVID-19.

One employee at Ringhals is known to be infected, another one at Forsmark, who became infected abroad, but never returned to work. No staff was reported infected at Oskarshamn.

Both Forsmark and Ringhals are referring to an established pandemic planning, in line with the owner company Vattenfall, which addresses how to deal with the situation in which significant numbers of staff could be absent. The objective being to assure security of supply.

A spokesperson for Forsmark said the heightened attention is unprecedented. However, the operator currently sees no risk for production.

Vattenfall press release from 13/03/2020 [2]:

“Ringhals NPP and Forsmark NPP are following Vattenfall (the parent company) and the authorities' guidelines and work actively to limit the spread of the COVID-19 coronavirus. Actions are taken to ensure our ability to safely produce electricity in both short and long term.

The revision at Ringhals 1 starts March 15 and is carried out as planned.”

Vattenfall press release from 20/03/2020 [3]:

Vattenfall informs that its activities are currently unaffected. Plans for production and distribution of electricity in emergency situations are in place. Vattenfall have followed the development of the situation for weeks, following its own continuity plans that are put into action in extraordinary situations, such as with the COVID-19, the purpose being to assure staffing and security of supply.

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...

Vattenfall, which owns 10 nuclear reactors in Sweden and Germany, said measures are in place to deal with the outbreak. “We are well equipped to carry out our yearly outage season and plan to continue to supply fossil-free electricity to our customers, both in the short and long term,” the company told NucNet by email. “The annual maintenance is already running at Ringhals [in Sweden].”

Vattenfall said operations at its nuclear plants have not been affected by the pandemic. “We follow the recommendations from authorities in addition to our own continuity plans, and we continuously monitor the situation,” the email said.

The email confirmed that one employee at Ringhals has tested positive for the virus. The case has been handled according to procedures established by health authorities and our internal protocol. “There has been no impact on safe and stable operations at Ringhals from this.”

References/sources:

1. <https://www.gp.se/nyheter/vastsverige/karnkraftverk-i-stabslage-efter-coronaviruset-1.25376313>
2. <https://group.vattenfall.com/se/nyheter-och-press/nyheter-pressmeddelanden/nyheter/2020/ringhals-riktlinjer-om-covid-19?>
3. <https://group.vattenfall.com/se/nyheter-och-press/nyheter-pressmeddelanden/nyheter/2020/vattenfalls-verksamheter-val-forberedda-i-krisen?>
4. NUCNET 23/3/20, <https://www.nucnet.org/news/nuclear-industry-begins-to-isolate-key-operational-staff-3-1-2020>

## **Annex 2. Additional items of news from outside the EU on the Covid-19 response in relation to NPP operation**

The following sections provide the latest updates on the measures taken in some nuclear power generating countries outside the EU in order to protect the operation and safety of the plants through the pandemic.

Brazil

13.3.2020

Coronavirus reduces projections of energy load in Brazil in 2020

The article reports that, due to the spreading of coronavirus, analysts have reduced their estimates for the country's energy load in 2020, expanding cuts that were already on the radar after demand was below expectations in the beginning of the year. Electricity trader Esfera Energia originally estimated a 3.1% rise in energy load this year, against 4.2% in official government projections at the end of 2019. With the coronavirus, the company further reduced its estimated increase to 2.4%.

This projection still takes into account that governments would be successful in controlling the epidemic that has spread throughout the world, with the expectation a recovery would start in September. If that perspective does not materialize, however, the load could grow by only 0.5%.

The article also reports that many companies are sending employees to work from home, which will also impact consumption.

Full article at <https://economia.uol.com.br/noticias/reuters/2020/03/13/coronavirus-reduz-projecoes-de-carga-de-energia-do-brasil-em-2020.htm>

17.3.2020

Eletronuclear reported about the adopted protocol with measures to prevent coronavirus, protecting its employees and ensuring the continued operation of Angra NPP. The measures foresee the reduced presence of employees and contractors on-site, in particular the more risky groups.

Eletronuclear also informs that the essential employees involved in the operation of Angra 1 and 2, the maintenance of Angra 3 construction site, and the implementation of the supplementary dry storage unit for Spent Fuel (UAS) will remain working in the company. The institution of remote work is also a way of protecting these professionals.

The adopted protocol follows the recommendations of the Ministry of Health, and of the World Health Organisation (WHO). The company points out that, so far, there is no confirmed case of Covid-19 among the company's employees.

Full article at <http://www.eletronuclear.gov.br/Imprensa-e-Midias/Paginas/Eletronuclear-adota-medidas-de-preven%C3%A7%C3%A3o-ao-coronav%C3%ADrus.aspx>

19.3.2020

Eletronuclear clarifies that-even after the municipality of Angra dos Reis has declared a state of emergency as a result of the new coronavirus Pandemic, Angra 1 and 2 plants are functioning normally without any

abnormality. Furthermore, Eletronuclear has taken steps to preserve the health of its employees and ensure the continued operation of its plants, including the adoption of a protocol with measures to prevent coronavirus: the reduction on-site of the presence of employees and contractors to those carrying out essential activities, such as plant operators and maintenance teams. Remote work is being adopted whenever possible.

Eletronuclear reaffirmed its commitment for safety first, both of its employees and of its facilities. And highlighted the fundamental contribution of the operation of the nuclear power plant, with more than 2,000 MW of power, to the security of electricity supply of the country at this time of great challenges.

<http://www.eletronuclear.gov.br/Imprensa-e-Midias/Paginas/Esclarecimento-da-Eletronuclear-sobre-decreto-de-estado-de-emerg%C3%Aancia-em-Angra-devido-%C3%A0-pandemia-do-coronav%C3%ADrus.aspx>

The Brazilian Comissão Nacional de Energia Nuclear (CNEN – the nuclear regulatory authority) has published a note from its president, Paulo Roberto Pertusi: “[\*\*A CNEN FRENTE À PANDEMIA DO NOVO CORONAVÍRUS \(COVID-19\) - mensagem do presidente, Paulo Roberto Pertusi\*\*](#)”

The note informs that CNEN has recently established emergency measures to prevent contagion and preserve the health of its members. Labor activities are being carried out remotely in all possible cases, and face-to-face work was maintained, in the different Units, only when indispensable for the continuity of essential services. It provides some details of the implemented telework guidelines.

Together with the safety of its employees, CNEN seeks to assure to society an adequate supply of products and services in the nuclear area and the maintenance of licensing and inspection activities, which are essential for the safety of the sector.

<http://www.cnen.gov.br/ultimas-noticias/665-a-cnen-frente-a-pandemia-do-novo-coronavirus-covid-19-mensagem-do-presidente-paulo-roberto-pertusi>

## Canada

The largest nuclear operator in Canada, Ontario Power Generation, has provided an online public statement of their CEO about measures they are taking in relation to COVID-19.

He first emphasised the importance of the OPG for Ontario because hospitals, care facilities, clinics and communities need reliable power supply. Then he describes measures taken to minimise the risk of infection for non-critical workers and assurances for operation. Teleworking is required for all non-critical employees.

Operationally, they have activated their Crisis Management Communications Centre, which provides executive level oversight, their Infectious Disease Incident Response Team and their robust business continuity plans. They note that these plans are well documented and practiced on a regular basis and are currently running smoothly. They are emphasising confidence in their culture of safety, preparedness and planning which has positioned them to manage this unprecedented challenge.

All their generating units are operating normally, refurbishment of Darlington Nuclear Unit 2 is continuing as planned.

Finally, the CEO is promising updates on the situation as it evolves.

The Canadian Nuclear Safety Commission published an update on the Pandemic Preparedness:

### **13 March** (selected parts):

“... the CNSC is monitoring the situation at all nuclear facilities to ensure the public and the environment are protected.

Nuclear operators, as CNSC licensees, are required to develop and implement a business continuity plan to ensure their facilities continue to operate safely at all times, including during a pandemic. Business continuity plans address how to deal with possible labour disruptions while maintaining key staffing positions. These plans can be activated during any interruption of normal operation, and include ways to ensure safe facility operation, even during widespread absenteeism.

As a regulator, the CNSC also has a business continuity plan to ensure our strong and effective regulatory oversight.”

**16 March Update** (selected part):

“During the current COVID-19 pandemic, we’re doing our part and heeding guidance from medical officials to help reduce the spread of the virus. As such, effective March 16, 2020, CNSC staff have been directed to stay home, while critical staff continue to work to ensure effective regulatory oversight.

We remain actively engaged with licensees to ensure the protection of the public and the environment and will continue to provide updates as required.”

Canadian uranium operations suspended in response to COVID-19, 24 March 2020

World Nuclear News (WNN) reported: “Cameco is temporarily suspending production at its Cigar Lake uranium mine in northern Saskatchewan and placing the facility in safe care and maintenance mode during the COVID-19 pandemic. In consultation with Cameco, Orano Canada Inc is suspending production at its McClean Lake uranium mill, where ore from Cigar Lake is processed. The suspensions at both operations are expected to last at least four weeks.”

“There are as yet no confirmed cases of the virus at either of the operations, the companies said.”

“At full production, there are typically around 300 people at a time working across the Cigar Lake operation.”

“Cameco said it is “closely monitoring” operations at its Fuel Services Division in Ontario, and will continue to operate them for as long as it remains safe to do so in order to continue a reliable supply of nuclear fuel.”

Employee at Pickering nuclear plant tests positive for COVID-19, 31 March

TORONTO -- An employee at the Pickering Nuclear Generating Station has tested positive for the novel coronavirus. The Ontario Power Generation (OPG) said on Monday the employee was sent home immediately upon experiencing symptoms of the virus and is now at home self-isolating. The employee's last day at work was March 19 and the person received a positive test result on March 28.

A spokesperson for OPG said they have carried out deep cleaning at the facility and notified anyone who had been in contact with the employee.

There are now 10 employees who are now at home in self-isolation, OPG said.

“We are keeping in contact with this employee to ensure they have the resources they need during this difficult time,” OPG said. “We are telling employees who are sick or experiencing any symptoms of COVID-19, please do not come into work.”

As of Monday morning, there were more than 1,700 confirmed cases of COVID-19 in Ontario, including 23 deaths.

References/sources:

1. Ontario Power Generation, A Message from Ken Hartwick President and CEO of OPG, March 17 2020, [www.opg.com/news/update-on-opgs-response-to-covid-19-pandemic/](http://www.opg.com/news/update-on-opgs-response-to-covid-19-pandemic/)
2. Canadian Nuclear Safety Commission, Pandemic Preparedness, 13 and 16 March 2020, [www.nuclearsafety.gc.ca/eng/resources/emergency-management-and-safety/pandemic-preparedness.cfm](http://www.nuclearsafety.gc.ca/eng/resources/emergency-management-and-safety/pandemic-preparedness.cfm)
3. Canadian uranium operations suspended in response to COVID-19, 24/3/20, [world-nuclear-news.org/Articles/Canadian-uranium-operations-suspended-in-COVID-19](http://world-nuclear-news.org/Articles/Canadian-uranium-operations-suspended-in-COVID-19)
4. Employee at Pickering nuclear plant tests positive for COVID-19, 30/3/20, [toronto.ctvnews.ca/employee-at-pickering-nuclear-plant-tests-positive-for-covid-19-1.4874299](http://toronto.ctvnews.ca/employee-at-pickering-nuclear-plant-tests-positive-for-covid-19-1.4874299)

United Kingdom



NUCNET 23 March 2020

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...

Also in the UK, authorities announced they are shutting down a nuclear fuel reprocessing site at Sellafield after 8% of its 11,500-strong staff were forced to self-isolate. The move came after an employee tested positive for the coronavirus and will lead to a gradual shutdown of the site's Magnox facility, which is scheduled to close permanently later this year.

The UK's nuclear regulator said it is "actively engaged" with all its nuclear sites to ensure that appropriate contingency plans are in place, given the developing national and international situation.

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.

NUCNET 31 March 2020

The UK's nuclear regulator said on 31 March that in response to government guidelines its staff are working from home, although a limited number of inspectors can, as designated key workers, continue to travel to nuclear sites for urgent and essential regulatory inspections. The Office for Nuclear Regulation said all licensed nuclear sites in the UK are required to determine minimum staffing levels to ensure safe and secure operations and contingency arrangements in the event that these levels are not met. This condition is specifically designed to ensure the industry can manage and control activities that could affect nuclear safety and security under all foreseeable circumstances, including pandemics. "In due course, we will work with industry to re-plan activity for when operations return to normal," a statement said.

References/sources:

1. NUCNET 23/3/20, <https://www.nucnet.org/news/nuclear-industry-begins-to-isolate-key-operational-staff-3-1-2020>
2. NucNet Nuclear News Daily / 31 March 2020

United States

The US nuclear regulator, USNRC, is taking a variety of measures to ensure the health and safety of employees while maintaining its important safety and security mission despite the challenges posed by the coronavirus.

NRC actions include, among others, communicating regularly with nuclear plants to ensure they are meeting their site-specific minimum technical staff requirements. NRC regulations set basic technical and security staffing guidelines. Nuclear power plants must also have plans in place to maintain appropriate staffing under any adverse conditions. The NRC will require plants to shut down if they cannot appropriately staff their facilities.

NUCNET 20/3/20

#### Coronavirus / US Nuclear Operators May Isolate Core Groups to Run Plants

Operators of some of the US's nearly 96 commercial nuclear power plants are considering measures to isolate a core group to run the plant, Maria Korsnick, president of the Washington-based Nuclear Energy Institute, said.

Ms Korsnick did not mention specific operators or plants, but said nuclear operators were stockpiling ready-to-eat meals and disposable tableware, laundry supplies and personal care items.

Media reports said the US electric industry may ask essential staff to live onsite at power plants and control centres to keep operations running if the coronavirus outbreak worsens.

The contingency plans, if enacted, would mark an unprecedented step by power providers to keep their workers healthy as both private industry and governments scramble to minimise the impact of the global pandemic that has infected more than 227,000 people worldwide.

“The focus needs to be on things that keep the lights on and the gas flowing,” said Scott Aaronson, vice-president of security and preparedness at the Edison Electric Institute, the nation’s biggest power industry association. He said that some “companies are already either sequestering a healthy group of their essential employees or are considering doing that and are identifying appropriate protocols to do that.”

Nuclear reactors are considered critical infrastructure by the federal government. The US Department of Homeland Security is charged with coordinating plans to keep them operational during an emergency.

NUCNET 23 March 2020

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The operators of nuclear power plants are taking steps to minimise the impact of the Covid-19 pandemic, including isolating key staff and stockpiling items workers might need if they are unable to leave a site.

...

Maria Korsnick, president of the Washington-based Nuclear Energy Institute, said last week that operators of some of the 96 commercial nuclear power plants in the US are considering measures to isolate a core group to run plants.

Ms Korsnick did not mention specific operators or plants, but said nuclear operators were stockpiling ready-to-eat meals and disposable tableware, laundry supplies and personal care items.

Some press reports have suggested that should isolating staff fail to stem the pandemic’s effect on the nuclear workforce, the US Nuclear Regulatory Commission will shut down plants that cannot be appropriately staffed.

**Covid-19 could cause staff shortages in the nuclear power industry** (<https://bellona.org/news/nuclear-issues/2020-03-covid-19-could-cause-staff-shortages-in-the-nuclear-power-industry>)

...

Officials in the United States, for instance, 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. Many operators say they have been stockpiling beds, blankets and food to support staff for that purpose.

... . Operation and maintenance of nuclear power plants draw on a small group of highly specialized technicians and engineers.” Because of that very level of specialization, some in the US nuclear industry are considering simply isolating nuclear plant technicians onsite in a sort of preventative quarantine.

Maria Korsnick, head of the Washington-based Nuclear Energy Institute told the New York Times that plants are “considering measures to isolate a core group to run the plant, stockpiling ready-to-eat meals and disposable tableware, laundry supplies and personal care items.”

To keep the lights on, utilities and power plant operators might have to consider keeping staff onsite for the long term.

“These operators have a license to operate, they’re highly skilled, highly trained. They have to be certified”. “These individuals need to be on the job, they need to be healthy. They have a big obligation to the public.”

Reuters contacted a dozen other power providers, all of whom said they were implementing plans to moderate risks to their employees and to ensure continuity of service, but who declined to comment on whether sequestering staff was a possibility.

**Coronavirus could disrupt normal refueling practices for nuclear facilities as staffing concerns grow** (<https://www.utilitydive.com/news/coronavirus-could-disrupt-normal-refueling-practices-for-nuclear-facilities/574920/>)

...

"NRC licenses cannot be acquired by employees in a short time, which makes the limited amount of nuclear operators potentially challenging". "It's not something you can do in a couple of weeks".

NEI sent guidance to its members to locate people who have let their NRC licenses lapse, from career changes or recent retirements, and get those licenses requalified.

...

Some plants have considered keeping operators on base to prevent contagion. 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.

...

References/sources:

1. NRC COVID-19 Update, <https://www.nrc.gov/reading-rm/doc-collections/faq/coronavirus.html>
2. NUCNET, <https://www.nucnet.org/news/us-nuclear-operators-may-isolate-core-groups-to-run-plants-3-5-2020>
3. NUCNET 23/3/20, <https://www.nucnet.org/news/nuclear-industry-begins-to-isolate-key-operational-staff-3-1-2020>
4. <https://bellona.org/news/nuclear-issues/2020-03-covid-19-could-cause-staff-shortages-in-the-nuclear-power-industry>
5. <https://www.utilitydive.com/news/coronavirus-could-disrupt-normal-refueling-practices-for-nuclear-facilities/574920/>

Information related to outages

Several sites must plan for an influx of 100 or more workers for the cyclical nuclear refueling process scheduled during the spring and fall when demand is lower. As travel is restricted or discouraged and more "non-essential" businesses close down or restrict their hours, utilities are considering the potential limitations of proceeding with refueling outages.

Maintenance workers routinely travel around the United States, either as contractors or independent workers, to carry out intensive shifts at individual power plants, before moving on again. Refueling work can last two to three weeks. For instance, plants stagger refueling outages between different units to prevent multiple outages in one service territory. Several planned outages were already underway by the time the spread of the novel coronavirus became a greater concern in the U.S.

Duke has two plants in refueling right now and resources were already in place to house the workers coming to the site. The craft workers specializing in refueling outages receive the same daily screening as other employees to enter the premises. "Scheduled maintenance or refueling is all being looked at very carefully.

Exelon has "medical professionals staffing our outage facilities around-the-clock to closely monitor employee health". For its spring refueling outages, Exelon is self-screening employees and contractors for signs of fever or respiratory issues.

Many plants are trying to continue operations under their pandemic plans while adhering to the schedules for refueling outages, but many refuelings are scheduled as self-isolation practices are expected to tighten.

TVA has decided to delay the scheduled refuelings for units at two Tennessee plants this spring by two weeks. These adjustments allow TVA to "mitigate potential risks to our employees, contractors or the general public and support nationwide recommendations due to the coronavirus pandemic".

Sequoyah's outage start date moved from March 28 to April 11 and Watts Bar's outage start date moved from April 24 to May 8. "TVA checked with vendors to ensure a two-week delay to start would still allow needed resources to be available".

Delays are unusual with the preplanned outages, but the plants can continue to burn the fuel they have "for a couple more months" and will ramp down in power to prepare for the coming outage. Fuel is delivered weeks or months in advance, and fabricated early on based on the refueling schedule, but the nuclear supply chain, including the refueling workers, need to receive support and be recognized as essential workers.

Other utilities have also announced changes to the refueling procedures. Arizona Public Service revised the scope for its Palo Verde routine refueling and maintenance outage to limit activity to refueling work that is "absolutely required" to reliably operate the plant for the summers of 2020 and 2021 to meet peak demand. "Work requiring the employment of a significant number of temporary contractors has been removed from the outage scope, and deferring that work will not compromise reliability".

Similar changes to planned refuelings can happen at other plants. "Should workforce limitations impact a plant in a refueling outage, the scope of activities may be adjusted based on the specific conditions of the plant".

Duke is "certainly looking at" the timing for other refueling scheduled this spring, but has not reached a point to defer or change aspects of the planned outage,

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

Challenged by the COVID-19 pandemic, the U.S. nuclear industry has asked the Trump administration to ensure nuclear workers, suppliers, and vendors will have access to nuclear plants and personal protective equipment (PPE) during the 2020 spring and fall refueling outage seasons and beyond. All but two of the nation's nuclear plants had scheduled planned outages this year, work that the generators consider crucial to keep the lights on.

In a March 20 letter to Energy Secretary Dan Brouillette, Nuclear Energy Institute (NEI) President and CEO Maria Korsnick noted nuclear reactors have a "unique requirement" to load a fresh batch of fuel once every 18 to 24 months. The event necessitates a shut down for two to four weeks during which intense work occurs, including critical maintenance.

"Each plant typically brings in several hundred specialized workers for this work over a typical period of 30-60 days, which includes activities in advance of and following the outage. These workers typically stay in hotels or board with local families, and eat in restaurants," Korsnick wrote. In the course of performing outages and in routine operations, nuclear plant workers also use PPE and supplies for radiological protection. As the COVID-19 pandemic intensifies, the industry will also require medical PPE and supplies to minimize its spread, she said.

The NEI said that across the nuclear fleet precautions are being taken to limit the risks of COVID-19. Among the actions are:

- Directing employees who don't feel well to stay home, encouraging them to seek medical attention, and asking for a report on their condition;
- Excluding personnel who have recently been in countries impacted by the virus;
- Screening of employees, contractors, and any necessary visitors at the plant gate and, at some plants, taking their temperature;
- Disinfecting surfaces more often;
- Closing or limiting access to cafeterias and other places employees congregate; and
- Increasing the number of hand-washing facilities.

Because refueling outages are so critical to the safe and reliable operations of nuclear power plants, the Trump administration should consider several actions that would immediately benefit nuclear owners, operators, and vendors, Korsnick said.

For one, she urged Brouillette to ensure that federal designation of essential workers include workers that support nuclear operations. The Trump administration's March 19-issued initial list of "essential critical

infrastructure workers” broadly includes “workers needed for safe and secure operations at nuclear generation,” but it does not specify whether the extensive list of specialized contract workers needed for outage work are qualified.

Korsnick also urged the administration to allow “unfettered” travel to plants for the performance of essential outage activities. Noting that the workforce is sometimes sourced abroad, she also asked it to “permit international workers who perform highly specialized functions to travel into the U.S. and establish protocols immediately to enable their safe entry.”

To accommodate workers, she also urged the administration to keep open hotel and food services. Finally, she asked for priority for PPE, specifically asking for surgeons’ gloves, sanitized wipes, dust masks, and disposable thermometers—as well as COVID-19 testing kits, and necessary radiological and medical protective equipment and supplies for nuclear workers.

At Byron 1 in Illinois, more than 1,200 supplemental workers joined the 800 Exelon Generation employees in prepping the facility for another reliable run, the company said. Workers arrived several weeks before the outage and some will remain when it is complete. At Nine Mile 1 in New York, 1,300 workers arrived onsite “from outside the area.” About 1,000 additional workers were onsite at Calvert Cliffs 1 in Maryland, and another 1,000 workers went to LaSalle 1 southwest of Chicago.

“We are closely following CDC guidance at all our generating facilities to prevent the spread of germs and viruses. We are also limiting travel; minimizing personal contact; encouraging remote-enabled employees to work from home, encouraging frequent hand washing and scheduling additional facility cleanings,” Exelon said.

However, it is also working to ensure employees and contractors supporting the projects “are subject to additional precautions due to the number of people required to support refueling outage and maintenance activities.”

Exelon said that prior to entry, “each person must complete a rigorous self-screening for signs of fever or respiratory issues before reporting to work. Any employees and contractors that experience any flu-like symptoms, are being instructed not to enter our facilities and to seek offsite medical evaluation. We also have medical professionals staffing our outage facilities around-the-clock to closely monitor employee health.”

<https://www.powermag.com/covid-19-threatens-outages-scheduled-at-97-of-u-s-nuclear-plants-in-2020/>

The Nuclear Energy Institute said 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 refueling outage, provided a sound technical justification ensures safety is not compromised”. “Such technical justification is based on plant and component specific information and benefit from analyses and knowledge accumulated over decades of operating experience.”

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

Exelon says the outage at Limerick NPP, officially called the, Spring Refueling Outage, must go on. If not, they say they’ll have to close, and that means millions lose power, including local hospitals.

Exelon released this statement to Action News:

“Limerick’s clean and reliable power is vital to the region’s hospitals and health care facilities; federal, state and local response centers and over a million homes and essential businesses as they respond to the COVID - 19 pandemic and the station’s spring refueling outage is critical to ensuring that power will continue to be available to the region as the weather becomes warmer and electricity demand increases. We have strict procedures in place to keep the public, our employees and contractors safe during the outage, and we will continue to share updates with federal, state and county officials. As part of Limerick’s comprehensive COVID-19 safety precautions, all workers must pass a symptom screening and body temperature check prior to entry every shift. We’re also requiring social distancing, remote work where possible, frequent hand washing, and increased facility cleaning and disinfection.”

The company says they're screening workers for symptoms before they can enter, which includes a temperature check.

They've also brought three nurses on-site and retained three local doctors to tend to any potential sick employees.

<https://6abc.com/business/officials-question-social-distancing-at-limerick-nuclear-plant/6067085/>

SENECA — A scheduled refueling of Oconee Nuclear Station's No. 3 reactor will go on as scheduled starting next week with approximately 1,000 out-of-town workers, a Duke Energy spokeswoman confirmed Thursday.

"We are following CDC recommendations and industry best practices to prevent the potential spread of COVID-19," Mikayla Kreuzberger with Duke Energy's corporate communications office said. "We take our actions very seriously, and we expect all teammates to do the same."

Across the nuclear power industry, refueling outages typically bring in roughly 1,000 workers.

"I can't provide specifics to Oconee, but I can say that the numbers are similar," Kreuzberger said of the outage, which is set to begin April 11.

Kreuzberger added that all of the workers who come on the site will be screened with a series of questions and temperature checks. Duke Energy is also using phone calls and virtual meeting technology, with Kreuzberger adding, "we have increased social distancing expectations."

Oconee Nuclear Station, which is one of the largest nuclear power plants in the United States, has three reactors that produce enough electricity to power 2 million homes. Every 24 months, a reactor is taken offline and refueled.

"They may be coming, traveling from other places. Some of them may be through a contract organization," Kreuzberger said of the workers. "Our workforce is comprised of local men and women in our community, workers from across our Duke Energy nuclear fleet and skilled workers who may travel from other places, who may work for Duke Energy or for one of our contractors."

While at Oconee Nuclear Station, Kreuzberger said they will follow "current and ongoing guidance from federal and state agencies regarding travel for essential services."

Asked if the out-of-town workers would be quarantined when they arrive in Oconee County, Kreuzberger said, "I can just say that they're following the federal and state agencies regarding travel for essential services like an electric utility. We continue to monitor the situation ... as needed. We're working with our contract companies during this process. I don't have that specific information."

Refueling a nuclear power plant is part of its routine maintenance and upkeep. Kreuzberger said Duke Energy just completed one at another power plant and is about to complete a second one in the Carolinas.

"Refueling our reactor is critical so that we can continue to provide electricity to our customers and community," she said. "Now more than ever, our communities are depending on us to continue providing reliable electricity to our region."

The use of out-of-town contract workers is typical during a refueling, Kreuzberger said.

"Scheduled work during our refueling outage does require additional workers who specialize in critical work," she said. "These are dedicated men and women who understand the importance of safety. They're used to following nuclear procedures. They understand our policies."

Kreuzberger said the refueling of the No. 3 reactor is expected to take a few weeks.

<https://upstatetoday.com/2020/04/03/nuclear-station-outage-still-a-go/>

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