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Extreme cold:
Anticipate possible load-shedding events and the loss of electrical utility

Periods of cold weather are characterised by low temperatures, sometimes combined with snowfall and/or wind. Synonymous with high electricity consumption and technical incidents, they are often the cause of power failures and can disrupt telecommunication networks.
The health crisis in the spring of 2020 resulted in maintenance delays at French nuclear reactors and the winter of 2020-2021 will be subject to particular vigilance. The provisional balance between electricity supply and demand should also remain tight, especially from late November through to late December in case of an early cold snap.
If energy demand exceeds production, the electricity transmission network manager (RTE, Réseau de Transport d'Électricité) may implement load shedding.

In the event of early onset of cold weather with below-normal temperatures for the season, certain periods of the day may be considered critical for the supply of electricity in France. Various measures are in place to alleviate these difficulties, such as shifting the power consumption of private households on a voluntary basis or rapid power cuts among major industrial customers (contractual outages). However, if these measures prove to be inefficient, RTE implements load shedding, i.e. temporary targeted and controlled outages, on private households and industrial customers.
Whatever their nature, prior preparation is essential as an outage can result in property damage and significant operating losses, particularly if a continuous process stops suddenly (e.g., glass factory) and if all the back-up facilities are not operational.

ARIA 49142 – 16/01/2017 – LOIRE-ATLANTIQUE
Neighbours next to a chemical packaging company detected **a smell of chlorine emanating** from the wastewater systems […]
The chlorine leak occurred following a shutdown of the site's **automatic treatment plant**. The facility's control board was out of order following **the malfunction of the UPS** supplying it with electrical power. The UPS system shut down following a **period of extreme cold** which caused the batteries **to overheat** and fail.
The operator was able to connect the processing plant to another power source and resume treatment of the free chlorine-rich effluent. The UPS was replaced and installed in a **heated cabinet to protect it from freezing temperatures.**

ARIA 50477 – 01/10/2017 – PAS-DE-CALAIS
A **gas leak** occurred following an **electrical outage** in an electrical cable manufacturing company. The 51 employees were evacuated. The release of silicon and germanium tetrachloride gas caused discomfort in 3 employees who were then taken to the hospital. […]
The machines stopped, along with their supply of silicon and germanium tetrachloride gas. A supply of neutral gas was switched on. The electrical power supply was switched over to **an emergency battery backup power supply for 20 minutes** ensuring that the **gas treatment system was operating**. After 20 minutes, the systems shut down and the **gas** that was still present in the machines and up to the treatment system **was returned to the workshops**.

Load shedding in France

Load shedding, or load reduction, involves switching off customers' power to prevent saturation of the network. It notably occurs:

- When the order is given, to accommodate peaks in consumption;
- If a power or electrical current threshold is exceeded;
- When there is a deviation in the frequency of the supplied voltage;
- When power consumption exceeds that in the subscription contract.

Energy consumption rises significantly during extremely cold weather, while impairing safety margins needed to cope with peak demand. Additional problems can arise, such as the availability of power generation facilities that are likely to be shut down for maintenance activities. Strong winds can also damage overhead power transmission lines.


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ARIA 53010 – 23/01/2019 – OISE

At 1:25 pm, a **power outage on the public electricity** distribution network **caused a wind farm to shut down**. Following this, one of the 2 wind turbines began to rotate at **excess speed**.[…]. This situation lasted 40 minutes and resulted in the **delamination of a blade** (longitudinal shearing across the thickness of the blade). The resulting imbalance **folded the** 66-m mast in two at around 2:40 pm. Debris **was thrown** over a **300** m radius. The firemen set up a **500 m safety perimeter.**

The wind turbine can be withdrawn from operation by rotating the blades 90° on themselves. Only a single blade needs to be rotated in order to stop the turbine. A **motor** at the base of each blade, inside the rotor, controls the rotation. In the event of a power outage, **a set of 18 lead batteries**, connected in series for each blade, powers these motors. The battery sets are autonomous. The inspections conducted following the accident revealed that:

- the charged batteries did not have the **necessary power** […];
- the **maximum service life** of the batteries was **exceeded** […];
- the **low voltage alarm threshold,** set at 150 V, was too **low** […].

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ARIA 53187 – 30/01/2019 – LOIRET

A **power outage** occurred in the workshop of an armaments factory where tolite-based cast-iron explosives were being loaded. The power outage caused **the heating system on the loading tank to shut down** and resulted in the **solidification of part of the explosive material in the tank** (solidification temperature: 80 °C). […]

Following the event, a **procedure was drawn up for rapidly emptying the tank** in the event of a power outage.

ARIA 53326 – 08/03/2019 – BOUCHE-DU-RHÔNE

At around 10 am, a **power outage** led to the **emergency shutdown of several establishments** operating at a petrochemical platform. According to the safety procedures, the products being manufactured on the platform are **burned off by flares** operated by one of the companies. As the platform's steam production facility was also affected**, the flaring operation was not optimal** and **large plumes of smoke were visible** from outside the site. The operator **initiated its internal contingency plan** at 10:30 am. The **personnel at a neighbouring site were confined indoors**. […]

The Classified Facilities Inspection authorities were present at the Prefecture, where a crisis unit had been set up to manage the situation. It was established that the **type and volume of the atmospheric emissions** associated with the event were **unusual**. […]

The region's air quality monitoring association reported that several people had experienced **health symptoms**: eye and nose irritations, headaches, etc. The association set up specific means to monitor the air quality around the site for 3 days. The analyses performed made it possible to determine that **the local residents had indeed been affected** (particularly olfactory effects), sometimes accompanied by symptoms.

Re-establishing **power to the networks** was hampered by **a lack of network identification.**

Feedback from the consequences of power outages on industrial facilities, particularly during extremely cold weather, has provided the following valuable lessons:

✓ **It is important to identify all the site's electrical equipment and utility networks**. The equipment's information must be updated when changes are made to the installations and must also take into account their dependence on the power supply and the consequences of stopping and restarting power supply. The other utility networks (such as the supply of steam and compressed air) should not be overlooked as they are usually dependent on the power grid;

✓ **Identify the direct effects** (e.g.: shutdown of compressors and flare usage, shutdown of lift pumps and overflowing) and **unforeseen and delayed effects** (e.g.: equipment shutdowns, restarting of installations) of a power outage;

✓ **Ensure that installations are safe and secure** in the event of a power outage and, if necessary, implement compensatory measures (e.g., generator set). One must not forget that a power outage can make a facility's defence system unusable (e.g. firefighting);

✓ **Prioritise the installations** within the site that are dependent on electrical power in order to **assign** the residual electrical power, **if necessary**. A decision must sometimes be made to place some installations in standby mode while others are shutdown. Such a decision is subject to keeping the units safe and keeping effluent processing operational;

✓ **Supervise the possible use of generators,** and consider the possibility of carbon monoxide poisoning (due, for example, to increased use or the stoppage of ventilation). Also take into account the **duration of compensatory measures** (e.g., batteries);

✓ **Implement a dedicated organisation** that is activated as soon as an extreme cold weather warning is issued;

✓ **Conduct periodic exercises** in order to detect anomalies during the implementation of compensatory measures to offset a power failure.