

Sharing is Caring Lessons from Fukushima Daiichi 15 years on



Description

On 11 March 2011, a magnitude 9.0 earthquake struck off the north-east coast of Japan. The earthquake triggered a tsunami that exceeded the design assumptions of the Fukushima Daiichi nuclear power plant. The tsunami flooded the site, disabled offsite power and emergency diesel generators, and led to a prolonged loss of electrical power.

Without power, cooling systems could not function as intended. Over the following days, three reactor cores suffered severe damage. Hydrogen explosions occurred in several units, and radioactive material was released. The event developed across multiple reactors simultaneously, creating a complex and escalating emergency situation.

The plant had been designed to withstand earthquakes and tsunamis based on historical records and regulatory requirements. However, the combined scale of the natural hazards went beyond those assumptions. Backup systems were available, but they were not sufficiently protected against a common external threat due to inadequate design considerations.

The accident is widely described as a Natech (natural hazards triggering technological disasters) event.

Key findings

The accident demonstrated the limits of design basis thinking. Meeting existing standards did not ensure resilience against extreme external hazards.

Redundancy did not provide protection where systems shared the same vulnerability. Flooding disabled multiple safety layers at the same time, illustrating the risk of common cause failure.

High consequence, low probability events had been considered, but their likelihood was judged to be too low. When probability estimates are low, scenarios can be considered as non-credible and therefore excluded from further assessment. In such cases investment in additional protection can be difficult to justify, even when consequences can be severe.

The event also showed how complex systems can experience rapid escalation once critical thresholds are crossed. A prolonged loss of power created conditions that were difficult to stabilise, despite multiple efforts and significant expertise on site.

Fukushima reinforced the importance of severe accident management, emergency preparedness, and questioning underlying hazard assumptions.

Why does it concern me?

Fukushima is not only relevant to the nuclear industry. Many sectors depend on assumptions about external hazards, infrastructure reliability, and the availability of utilities such as power and cooling.

Extreme weather phenomena, flooding, wildfires and seismic events increasingly affect industrial facilities, energy systems, chemical plants, transport networks and data centres. Natural hazards can quickly trigger technological disasters.

High consequence, low probability events exist across industries. When resources are limited, rare events can be deprioritised in favour of more frequent operational issues. The challenge is that less likely events can define the long-term impact on people, environment and organisational credibility.

Ask the following questions:

- Are our critical safety systems truly independent?
- What external events could disable multiple layers of protection at once?
- How do we treat scenarios that are unlikely, but not impossible?

Fifteen years on, Fukushima remains a reminder that resilience requires more than compliance. It requires continuous questioning of the boundaries we design against.