

Fukushima Daiichi Nuclear Plant Event Summary

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LLW Repository Ltd

Event Summary

- Background
- What happened at Fukushima
- UK response
- Relevance to LLWR

Note – Response to the event is still ongoing and serious, information in this presentation is from publicly available sources, details may change when the full facts are investigated.

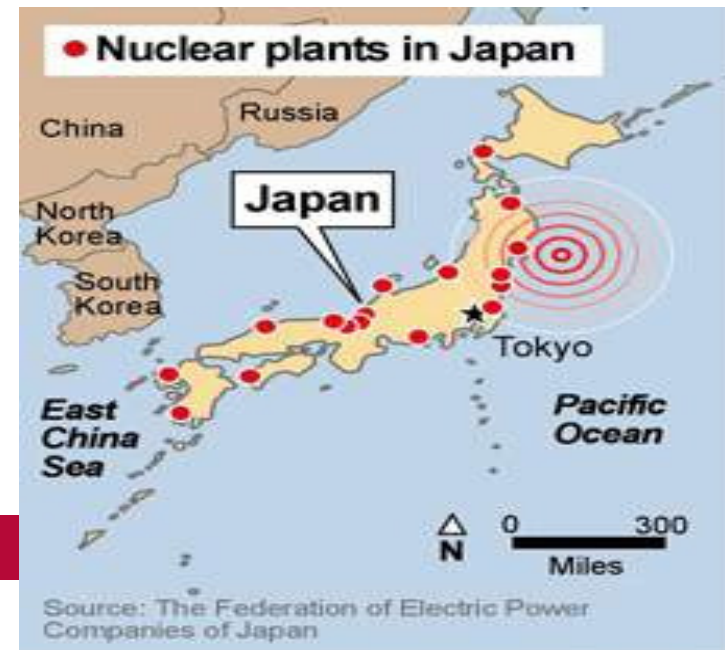
Fukushima Daiichi Nuclear Station

- Six Boiling Water Reactors (BWR)
- Built 1970-1979
- 3 running at the time
- 3 in outage



Earthquake

- 11 March 2011
- Magnitude 9.0
- ~100 miles offshore
- Largest ever in Japan
- One of the 10 largest in history
- Coastline shifted down ~ 1m



By Janet Loehrke, USA TODAY

Impact on Site

- Prior to earthquake Fukushima I Units 1,2, and 3 were operating at full power.
- Nuclear reactors were shutdown automatically. Within seconds the control rods were inserted into core and nuclear chain reaction stopped.
- Cooling systems were placed in operation to remove the residual heat. The residual heat load is about 3% of the heat load under normal operating conditions.
- Earthquake resulted in the loss of offsite power which is the normal supply to plant.
- Emergency Diesel Generators started and powered station emergency cooling systems.

Tsunami

- Inundated 420 miles of eastern coast of Japan
- Arrived ~ 60 minutes after earthquake
- Height approximately 14m
- Well beyond what the plant was designed to withstand



Impact on Site

- The tsunami was larger than the plant was designed for.
- The tsunami took out all multiple sets of the backup emergency diesel generators.
- Damage done to many other structures.
- Reactor operators were able to utilize emergency battery power to provide power for cooling the core for 8 hours.

Enormous non-nuclear impact

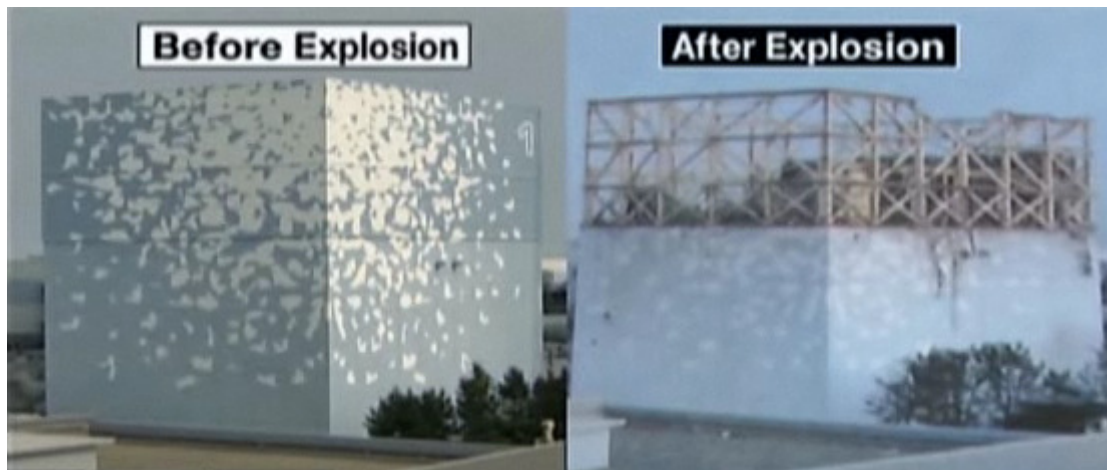
- 14,000 Dead
- 10,000 Missing
- 300,00 homeless
- Entire towns levelled or washed into the ocean



Impact on Site

- Offsite power could not be restored and delays occurred obtaining and connecting portable generators.
- After the batteries ran out, residual heat could not be carried away any more.
- Operators working with no power, limited instruments and communications.
- Reactor temperatures increased and water levels in the reactor decreased.
- Hydrogen was produced from reactions in the reactor.
- Over the next few days several large hydrogen explosions occurred causing breach of containment and contaminated water leakage to sea.

Hydrogen Detonation at Unit 1



Current Situation

- A degree of control now in place with supply of fresh water cooling established
- Large uncontrolled releases have been stopped
- 20km evacuation zone in place
- Extensive monitoring in place
- Some food restrictions in place
- Plan in place for recovery of reactors
- Radiation to workforce of 100 – 250 mSv

Typical Radiation exposures from activities

135g bag of Brazil nuts	0.01 mSv
Chest X-ray	0.02 mSv
Transatlantic flight	0.07 mSv
LLWR worker highest annual exposure	1.0 mSv
UK average annual radiation dose	2.7 mSv
Average annual radon dose to people in Cornwall	7.8 mSv
Whole body CT scan	10 mSv
Annual exposure limit for nuclear industry employees	20 mSv
Level at which changes in blood cells can be readily observed	100 mSv
Acute radiation effects (nausea, etc)	1000 mSv
Dose of radiation which would kill about half of those receiving it in a month	5000 mSv

UK Response

- Secretary of State requested HM Chief inspector of Nuclear Installations to examine the circumstances and consider what lessons should be learned.
- Initial Report issued in May 2011
- Full report planned for September 2011

Interim Report

- Recognises significant differences between Japan and UK
- Concludes no reason to curtail operation of any UK nuclear activities.
- Initial review has not revealed any gaps in UK safety assessments or licensing regime.
- Likely to be considerable learning relevant to contingency planning for severe accidents once all facts are known.
- 26 recommendations made – on Government, the Regulator and Nuclear Site operators.

UK Situation

- UK > 1000 miles from nearest tectonic plate boundary
- Largest credible earthquake far smaller
 - Biggest in history 6.1
 - Largest anticipated 6.5
- UK plants designed against 1 in 10,000 yr event
- UK maximum credible tsunami 1-2 m

LLWR Response

- Supported ONR in their review.
- Reviewed the Site safety cases around earthquakes and other extreme events.
- Generally LLWR plant is 'passively safe'
 - No requirement for cooling water to remain safe
 - No potential for significant hydrogen build up.
- We will respond to the interim review actions relevant to a LLW site.
- We will learn the lessons relevant to LLWR as further information becomes available.

Questions

