Fukushima Triple Disaster

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Background on Triple Disaster

1. Earthquake

March 11, 2011. 9.0 magnitude Great East Japan Earthquake.

2. Tsunami

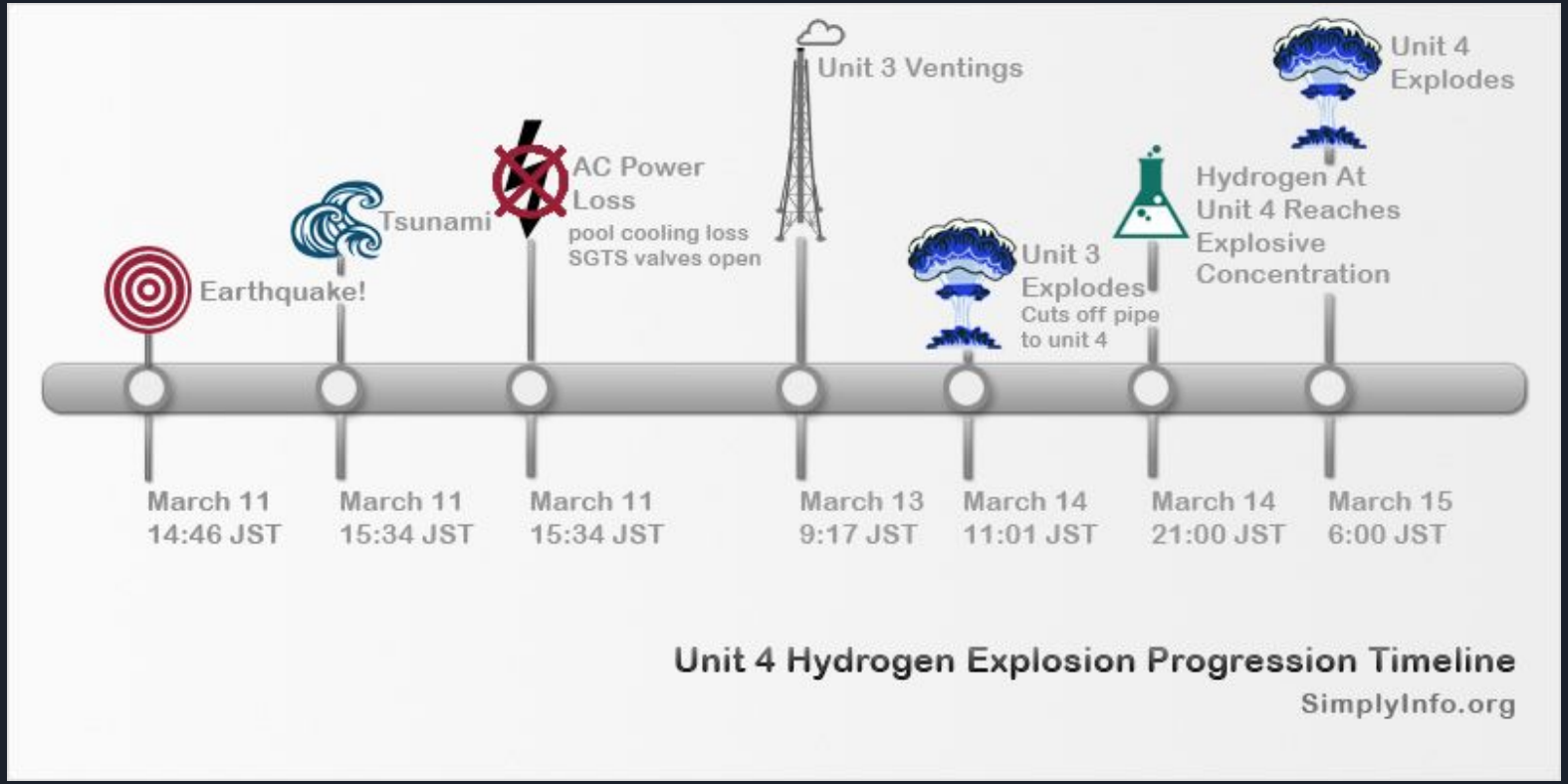
Waves struck the Fukushima Daiichi facility at 15:34 JST.

3. Nuclear Crisis

Station Blackout: Total loss of AC power.

Led to reactor cooling failure and core meltdowns.

Timeline


Earthquake!
March 11
14:46 JST
Tsunami
March 11
15:34 JST
AC Power
Loss
pool cooling loss
SGTS valves open
March 11
15:34 JST
Unit 3 Ventings
March 13
9:17 JST
Unit 3
Explodes
Cuts off pipe
to unit 4
March 14
11:01 JST
Hydrogen At
Unit 4 Reaches
Explosive
Concentration
March 14
21:00 JST
Unit 4
Explodes
March 15
6:00 JST
Unit 4 Hydrogen Explosion Progression Timeline
SimplyInfo.org


NHK

Guiding Question

When disaster compounds, how does a nation’s preparedness, coordination and decision making determine the difference between survival & systemic failure?

Impact Summary: 2011 Great East Japan Earthquake

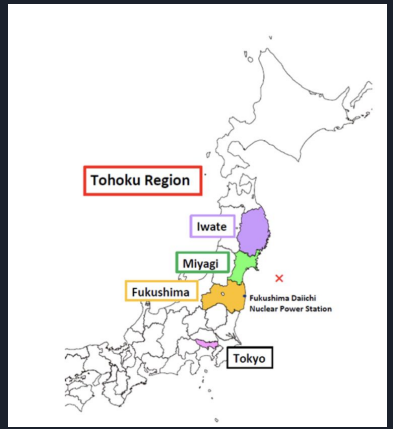
20,000
Approx. Lives Lost

2,500+
Reported Missing

470,000
People Evacuated

Key Observations

- Largest earthquake ever recorded in Japan's history.
- Over 6,000 suffered non-fatal injuries.
- Catastrophic damage to infrastructure: roads, railways, and airports in the Tohoku Region.



The Great East Japan Earthquake and Tsunami

Rapid Impact

Earthquake caused tsunami within 30 mins.

Max wave height: ~40m (130ft).

Nuclear Crisis

Triggered the nuclear accident at Fukushima Daiichi Power Station.

Economic Toll

Estimated at $220 billion USD in Japan alone.

Most expensive natural disaster in history.

A Truly Global Event

Caused $31M damage in Hawaii and $100M in California. Impacts also reported in French Polynesia, Galapagos, Peru, and Chile.

Nuclear Disaster Begins

Station Blackout

With both external power and backup generators gone, the plant entered a Station Blackout, leaving operators in the dark without instrumentation.

Cooling & Pressure Failure

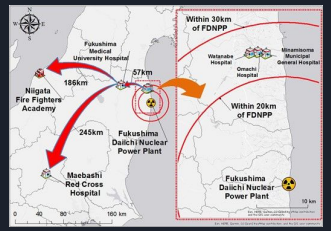
The loss of power caused the cooling pumps to stop, and Standby Gas Treatment System (SGTS) valves were forced open, complicating pressure management.

Nuclear Meltdown

- Without active cooling, the water levels in the reactor pressure vessels dropped, exposing the nuclear fuel rods.
- The extreme heat caused the fuel's zirconium cladding to react with steam, generating massive amounts of hydrogen gas.
- The buildup of pressure and hydrogen eventually led to the structural explosions seen in Units 1, 3, and 4.

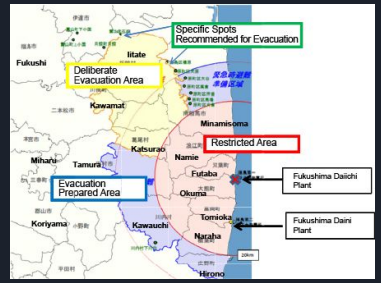
What went wrong

1. Event Complexity
    a. Japan has extensive community level training & investment in disaster preparedness
    b. They didn't expect nor prepared for the severe demands of the triple disaster. A combo of nuclear disaster & a natural disaster occured at the same location and time.
2. Information on plant status went offline
    a. Lack of reliable and real time info on the affected power plant.
    b. Because of the Tsunami, the monitoring and control systems in the nuclear plant were not functional. This created tension on the decision making since there is a great uncertainty.
3. Hospital & Medical Crisis
    a. Nearby hospitals faced a surge in trauma victims, staff shortages due to the evacuation.
    b. The burst water pipes and halted gas supplies doesn't help. Combined with the minimal prep time.



What Worked

1. Evacuation of Vulnerable Patients
    a. An evacuation zone was set up around the nuclear power plant. It spans 30 km. Total of 124 patients were air transported by the Japan Self Defense force, and 509 bedridden patients were successfully evacuated.
2. Military & Multi-agency response
    a. The Japan self defense forces provided air transport for people who needed evacuation within the 20-km zone. The national police contributed in monitoring the nuclear radiation. The Japanese Red Cross Society gave medical and physical support to the earthquake, tsunami and nuclear accident victims.



Human cost of Displacement

1. Elderly in Temporary Housing
    a. A sharp increase in deaths was recorded among elderly people placed in temporary housing. It was made worse with the lack of access to healthcare and drastic life changing disruptions
2. Mental Health Crisis
    a. Six years after the disaster, 35,000+ repained in temporary housing. The demographics were elderly and the prolonged dislocation caused mental health challenges.
3. Chronic Disease Surge
    a. Displaced populations faced increased rates of chronic conditions such as diabetes. These lifestyle changes proved to be more damaging than radiation due to their long-term impact.

Long-term recovery

2011-2015: Intensive Reconstruction. Basic infrastructure such as roads, public housing are rebuilt. Roughly 185,000 people begin gradual return.

2015-2020: Community Rebuilding: Mental health centres established and social programs were created to rebuild community bond.

2020-now: Agricultural production rebounds. Around 21,000 out of the 62,800 evacuees have returned home.

Takeaways

1. Worse case compound scenarios must be included in disaster planning
2. Clear, pre-defined criteria for hospital and patient evacuation can save lives under pressure.
3. Redundant Communications is key. Monitoring systems must be robust and redundant.
4. Psychological and social recovery is as important as physical rebuilding.
5. Recovery from compound disaster takes decades, hence government must plan long term recovery.

Conclusion

- Assumptions matter more than resources. Better to have it then to not have it when needed.
- The failures in handling the triple disaster stemmed from the assumption that a compound disaster is not possible.
- This case proved that preparedness of a isolated disaster are inadequate when there are other events like natural disasters came to play.
- Recovery communities and trust are as important as rebuilding roads and reactors.

Sources

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More sources