

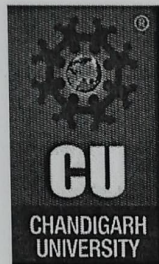


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Submitted By:

Name: Priya Chauhan

UID: 22BCS15310

Branch/Sec: BE-CSE

Submitted To:

Dr. Avani Chopra

(Teacher's Name)

Q-10 The Fukushima Nuclear Disaster: Causes and Problems

Introduction.

The Fukushima Daiichi nuclear disaster was one of the most severe nuclear accidents in history, occurring on March 11, 2011 in Japan. It was triggered by a powerful 9.0 magnitude earthquake, followed by 15-meter tsunami. The tsunami disabled the power supply and cooling system of the three nuclear reactors, leading to catastrophic meltdown. The event was classified as a Level 7 disaster on the International Nuclear and Radiological Event Scale (INES), the highest rating, due to the extensive radioactive contamination and long term environmental consequences.

Causes of the Fukushima Disaster.

1. The Great east Japan earthquake and Tsunami
 - On March 11, 2011 at 2:46 PM (JST), a 9 magnitude earthquake struck off the coast of Japan, causing a massive tsunami.
 - The Fukushima Daiichi nuclear plant, located on the north eastern coast of Japan, was directly hit by a 15-meter high tsunami wave.
2. Failure of Cooling Systems
 - The nuclear plant's reactors automatically shut down due to the earthquake, but they still required cooling to prevent overheating.
 - The tsunami flooded the emergency backup generators, leading to a complete loss of power (station blackout).
 - Without cooling the reactors cores overheated, causing fuel rods to melt down.

3. Hydrogen explosions
 - Due to high temperatures, water inside the reactors split into the hydrogen and oxygen gases, causing massive hydrogen explosions in Reactors 1, 2, and 3.
 - These explosions damaged the containment structures releasing radioactive materials into the air & ocean.
4. Poor Design and Safety Issues.
 - The plant's defense against tsunamis was inadequate, as the sea wall was only 5.7 meters high, while the tsunami waves reached 15-meters.
 - Emergency power generators were placed in low lying areas, making them vulnerable to flooding.
 - TEPCO (Tokyo Electric Power Company) failed to act on warnings about potential tsunami risks before the disasters.

Problems Caused by the Disaster.

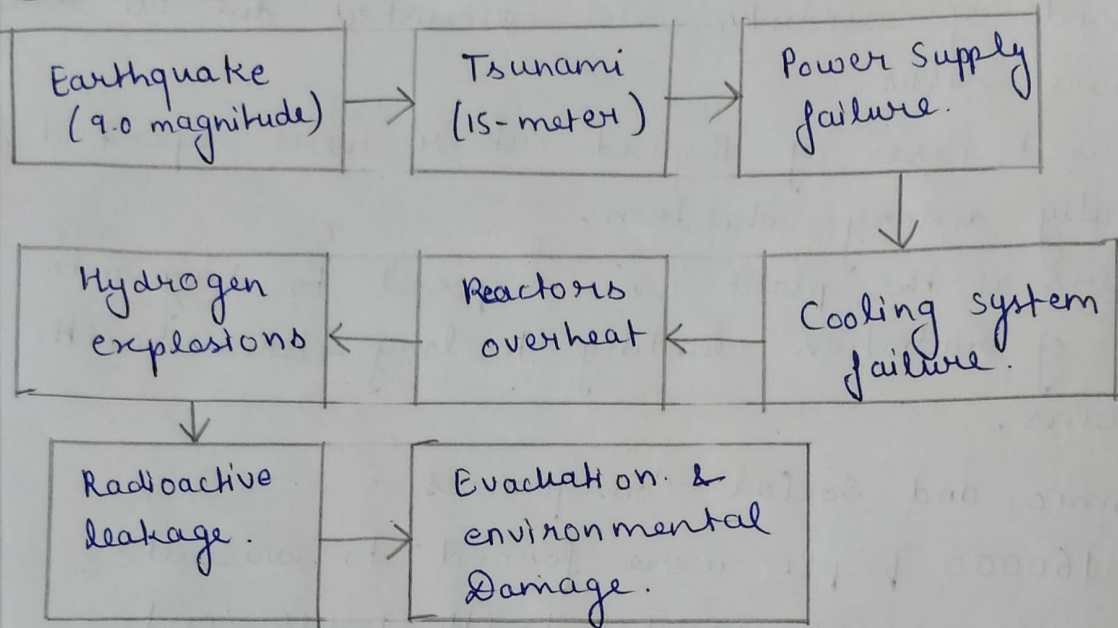
1. Radiant Release and Environmental Impact
 - Large amounts of radioactive materials such as Cesium-137 and Iodine-131 were released into the air, water and soil.
 - Radioactive water leaked into the Pacific Ocean, affecting marine life and fisheries.
 - Land near the plant was heavily contaminated, making it unsafe for habitation.

2. Human health effects.
 - Thousands of residents were evacuated due to radiation exposure risks.
 - Increased cases of thyroid cancer were reported, especially among children.
 - Workers at the plant were exposed to dangerous levels of radiation, leading to long-term health problems.
3. Economic and Social Consequences.
 - Over 160000 people were forced to evacuate, leading to severe mental health issues and displacement problems.
 - The cleanup process has cost over \$200 billion, with full decontamination expected to take decades.
 - Many countries like Germany reconsidered or phased out nuclear power after this incident.

Timeline of the Fukushima Disaster

Date	Event
March 11, 2011	9.0 magnitude earthquake strikes Japan.
March 11, 2011	15-meter tsunami hits Fukushima Daiichi
March 12, 2011	Explosion in Reactor 1
March 14, 2011	Explosion in Reactor 3
March 15, 2011	Explosion in Reactor 2 & fire in Reactor 4
March 16, 2011	Evacuation Large radioactive released.
March 17, 2011	Evacuation expanded to 30 km radius
March 24, 2011	Radiation found in water, soil and food.
April 2011	Disaster rated level 7 on INES scale.

Cause Effect FlowChart



Conclusion

The Fukushima nuclear disaster was a tragic event caused by natural disasters (earthquake and tsunami) but also worsened by design flaws, lack of safety measures, and poor crisis management. The accident highlighted the dangers of nuclear energy, emphasizing the need of better safety protocols, improved reactors designs and disasters preparedness. Even today the effects of the Fukushima are still being addressed, reminding the world of the importance of nuclear safety and environmental protection.

References

- World Nuclear Association - Fukushima Daiichi Accident
- International Atomic Energy Agency (IAEA) - Fukushima Nuclear disaster reports.
- TEPCO official Reports - Fukushima Daiichi Recovery updates.