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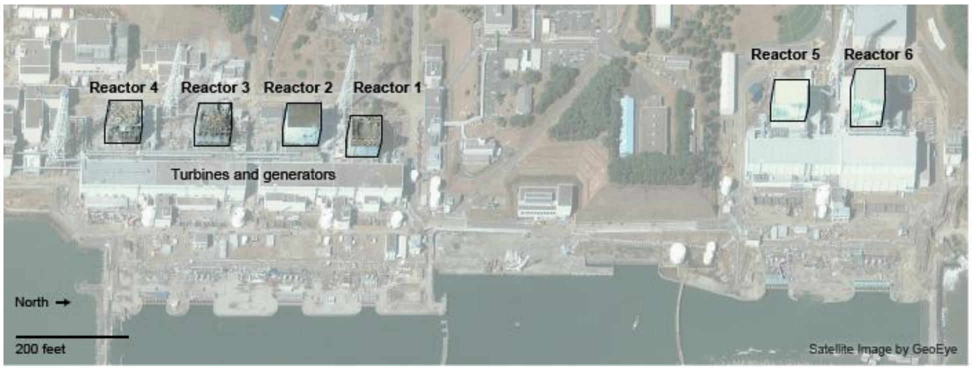
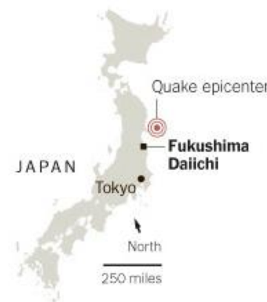
Fukushima Daiichi Nuclear Power Station 'Issue'

Map:





Timeline:

- March 11th: An earthquake with a recorded magnitude of 8.9 on the Richter scale occurs off the northeast coast of Japan, sparking a tsunami
- March 14th: Explosion reported by second nuclear reactor, authorities scramble to cool reactors to avoid full nuclear meltdown
- March 15th: A second explosion occurs in reactor 4. Radiation levels spike, but as workers rushed to contain the explosion, the radiation levels stabilized and declined by the evening, according to Japanese officials.
- March 16th: Reactor 3 seemed to have had a rupture in its holding tank and was spewing radioactive steam like reactor 2. Efforts were concentrated on reactor 2 since it used a fuel known as mox or mixed oxide because it contains reclaimed plutonium which could be the most dangerous if released into the environment
- March 22nd: Main efforts are to restore power to the generators so pumps can be turned back on in an effort to cool the spent fuel rods, but these efforts are hampered by the amount of radiation present. It was released that just a month before the earthquake as 10 extension was granted to the oldest of the 6 reactors. The company in charge of the plant stated that they had failed to inspect 33 pieces of machinery at the plant including water pumps and generators responsible for cooling the spent fuel rods.

- March 23rd: Radioactive iodine detected in Tokyo's water supply
- March 26th: It was found that there were no regulations found in any of Japans building codes to protect against tsunamis (a word that came from the Japanese)
- March 28th: contaminated water is leaking from a reactor and could easily spill into the ocean, the Japanese government warns
- March 29th: Plutonium is found in the soil around the plant, which could indicate a partial meltdown of at least one of the reactors
- March 31st: Cesium-137 is found in dangerous levels at a location 25 miles from the nuclear plant. Milk is tested in Spokane, Washington and is found to contain trace amount of iodine although the EPA states that it is far below levels that would be of concern
- April 4th: 11,500 tons of low-contaminated water is pumped into the ocean to make room in the storage tanks for more highly contaminated water
- April 6th: American engineers speculate that some of the spent fuel rod material has leaked from the tank, which was more badly damaged than previously thought. Japanese officials plan to pump nitrogen into reactor 1 to prevent hydrogen explosion.
- April 12th: Japan raises its assessment of global damage from a 5 to a 7, on par with that of Chernobyl. As of now it has released 10% the amount of radiation that Chernobyl had.

<u>Notable events from the reactors:</u>

Reactor 1

- March 23rd: The reactor temperature is approximately 580 degrees Fahrenheit (normal is around 500 degrees, if it were operating; shut down temperature is cooler).

- March 26th: Freshwater is now being injected into the reactor. There have been reports that the use of saltwater in Reactor 3 may be dislodging highly radioactive cobalt and molybdenum.

Reactor 2

- March 26th: A worker measuring radiation levels of puddles of water near the reactor finds the readings exceed the scale of the instrument (meaning the level is extremely toxic) and is forced to leave the area immediately.

- MARCH 27: Radiation measuring 1,000 millisieverts per hour was detected in water in an overflow tunnel outside the reactor. The maximum dose allowed for workers at the plant is 250 millisieverts in a year.

- April 2nd: An 8-inch crack is found on a pit where cables are stored. The pit is near the water intake channel to the reactor and water is found to be spilling out into the ocean. Measurements show that the water has a radiation level of more than 1,000 millisieverts an hour, meaning it is quite toxic. After reaffirming that water is spilling out of a crack in the pit near the reactor, workers begin to inject concrete into the crack to try to seal it, but the patch does not work. Experts and equipment are summoned from Tokyo to use a different method to seal the leak. They are expected to begin working on April 3.

- April 6th: A leak in a maintenance pit that was spilling highly radioactive water into the ocean is sealed after workers inject sodium silicate, a sealant also known as liquid glass, into gravel below pipes near the pit. Water is also no longer leaking into the turbine building.

- April 10th: A worker wearing protective gear becomes sick while laying a hose to discharge water. He is taken to a hospital; no radiation is found on him.

Reactor 3

- March 23rd: Three contract workers suffer radiation exposure of roughly 170 millisieverts after radioactive water gets into their boots while they are laying a new cable. Two are taken to a hospital with radiation burns.

Reactor 4

- March 15th: A hydrogen-gas explosion created by chemical reactions with the spent fuel rods damages the building. A fire also breaks out.

Note that reactors 4,5 and 6 were in shut down mode for maintenance at the time of the tsunami.

<u>Atmospheric Chemistry Tie-in</u>

- Partial nuclear meltdown has released many radioactive elements into the water, soil and atmosphere, most notably cesium-137 and iodine-131? (not sure if its iodine-131 or 129)

- Cesium-137 undergoes radioactive decay with the emission of beta particles and relatively strong gamma radiation. Cesium-137 decays to barium-137m, a short-lived decay product, which in turn decays to a nonradioactive form of barium. The major dose from cesium-137 is from the barium-137. The half-life of cesium-137 is 30.17 years. Because of the chemical nature of cesium, it moves easily through the environment. This makes the cleanup of cesium-137 difficult

- average annual dose from exposure to cesium-137 associated with atmospheric fallout is less than 1 mrem; this dose continues to diminish every year as cesium-137 decays.

- Iodine 131 and 129 subliminate. Iodine released to the environment from nuclear power plants is usually a gas. Iodine reacts easily with other chemicals. Iodine-129 has a half-life of 15.7 million years; iodine-131 has a half-life of about 8 days. Both emit beta particles upon radioactive decay.

- Radioactive iodine can disperse rapidly in air and water, under the right conditions. However, it combines easily with organic materials in soil. This is known as ‘organic fixation' and slows iodine's movement in the environment. Some soil minerals also attach to, or adsorb, iodine, which also slows its movement.

- The long half-life of iodine-129, 15.7 million years, means that it remains in the environment. However, iodine-131's short half-life of 8 days means that it will decay away completely in the environment in a matter of months. Both decay with the emission of a beta particle, accompanied by weak gamma radiation.