Fukushima Power Plant Natural Disaster

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The Fukushima nuclear disaster is the most significant nuclear disaster since the Chernobyl accident in 1986. The disaster is measured as level 7.0 on the International Nuclear Events Scale (INES) and has affected the world of nuclear power. Despite numerous opportunities for prevention of such an event, the mismanagement of the Fukushima Daiichi Power Plant ultimately sealed its fate as the most expensive non-wartime disaster to date.

On the 11th of March 2011, the Tohoku earthquake’s epicenter was located 43 miles east of the Oshika Peninsula. As a result of the earthquake, tsunami waves were sent to the coast of Japan. The Fukushima Daiichi Power Plant, maintained and operated by the Tokyo Electric Power Company (TEPCO), as well as other power plants shut down automatically as a result of the earthquake. There was no damage to any of the plant as a result of the earthquake, however the tsunami’s 13m to 14.9m waves overcame the 5.7m seawall and flooded the low-level rooms of the plant where the emergency generators were housed. The generators failed, stopping coolant flow that was being pumped through the reactors. Secondary battery back-up generators of reactors 1 and 2 had also failed. Only the secondary back-up battery generator of reactor 3 was able to run for 30 hours. The cores of all three reactors largely melted in the first three days due to heat from high radioactive decay. Three hydrogen-air explosions occurred from March 12 to March 15 destroying the tops of buildings 1, 3, and 4. Three TEPCO employees at the Daiichi and Daini power plants were killed as a result of the earthquake and tsunami, but there were no fatalities as a result of the nuclear meltdown. On March 12th, the Prime Minister ordered an evacuation zone of 20km.

The Fukushima Daiichi Power Plant began operation in 1971 and is home to 6 of 10 reactors TEPCO operates in the Fukushima Prefecture. The plant is located approximately 250km North of Tokyo and covers 865 acres along the Pacific coast. The Daiichi plant produced 27% of TEPCOs nuclear energy production or 10.8% of the company’s overall energy production. Over the plant’s lifetime it was plagued by many safety issues that bred concern over its ability to survive natural disasters. The Fukushima Daiichi Power Plant plans that were submitted for government approval in 1966 specified an Isolation Condensing System (ICS) that was completely divorced from the standard cooling and pressure release systems. This system is designed to aid in releasing pressure while still maintaining adequate water levels in the reactor. It was found when the plant was built, both systems merged before entering the reactor. During the 2011 disaster this meant that proper function of the ICS could not be confirmed.

In 1991 one of the backup generators supplying power to Reactor 1 of the Fukushima Daiichi plant failed due to a cooling system leak. The basement in which the generators were housed flooded, which raised concern among many about the possibility of flooding and subsequent generator failure due to tsunami waves. Instead of raising the generators, TEPCO installed flood doors meant to prevent water from entering the basement below the reactor. From 2002 to 2005 multiple reactors had to be shut down due to a scandal that involved many inspection and safety check records being falsified by TEPCO officials. During this time regular plant operations were interrupted to ensure all equipment was in proper operating condition.

The plant was designed and built to withstand 5.7m tide levels. This requirement was based on a design condition of 3.122m which was the highest recorded tidal level at the time of the plant’s construction. In 2008 the International Atomic Energy Agency warned a Nuclear Safety and Security Council that the plant’s safety guidelines were outdated and the plant could only withstand a 7.0 magnitude earthquake. This was also found by TEPCO’s own inquiry into the plant’s safety, which suggested the possibility of tsunami waves greater than 10m and urged more precautions to be taken. These warnings among previous warnings from the US Nuclear Regulatory Commission, and Nuclear and Industrial Safety Agency were neglected, as no action was taken to further secure backup power.

The reason that Fukushima is still in the news because of the impact it’s having on the environment. There are 150,000 metric tons of radioactive waste that have not been properly stored. TEPCO is preparing to stop contaminated water overflow from further contamination to the Pacific Ocean. Effects of the radioactive leakage include traces of cesium found in fish caught off the coast of California. The radiation that was released from this disaster will cause health risks to those who were exposed to the radiation as well as generations to come.

The disaster at Fukushima-Daiichi nuclear power plant has the United States reevaluating their plan of emergency response for such a case. This is directly in part because the United States is the world’s largest producer of nuclear power. The United States is also implementing and focusing on long term cleanup plans. According to the U.S. Regulatory Commission, a nuclear accident is extremely remote but possible after the Fukushima-Daiichi disaster. The push for further nuclear preventative measures are on most agendas to prevent future incidents.

In order to prevent another Fukushima nuclear disaster in the future, mistakes performed in this disaster must be strongly considered and taken into account. Numerous future preventions include the following. First, nuclear reactors must be away from towns and villages in case anything goes wrong in it or a natural disaster happen in the same place. However, reactors need to be near a waterway or a water stream in order to help the reactor with the cooling system; therefore it is difficult to replace the nuclear reactor in another place if there is a town near it, and better to reorder the town in another place. Second, before building a nuclear reactor in any place, this place must geographically stable. The reactor must be ready for any kind of natural disasters such as floods, earthquakes, etc. Third, the reactor must have at least three days backup batteries, because in Fukushima nuclear disaster the backup batteries stood up only for one day. Fourth, a sea wall must be strong and tall enough to withstand the most powerful tsunamis. Fifth, Passive Auto-catalytic hydrogen Recombiners need to be installed to turn potentially explosive gases into water. Sixth, Generation 3 reactors need to be installed to take advantage of convection to ensure the reactors can be cooled without using electrical pumps. Considering international regulations and rules for nuclear reactors and applying them in a solid way can also have a countless role in preventing any other kind of nuclear disaster in the future.

The Fukushima Daiichi nuclear disaster could and should have been prevented. The negligence and unethical practices that were performed by TEPCO lead to the meltdown of four reactors at the Fukushima Daiichi Nuclear Power Plant. The biggest unethical decision that TEPCO made was to not idle the reactors down to decrease the chances for a meltdown with the then present severe natural phenomena conditions taking place. The reason that TEPCO did not idle the reactors was because investor-owned utilities like TEPCO are legally obliged to shareholders to maximize profits and limit costs. This is not the first unethical decision that TEPCO has made before. Their constant attendance in several scandals about TEPCO falsifying safety records and other regulatory documents shows the true lack of interest in preventative measures. TEPCO also ignored several tsunami studies that showed the then-current sea water flooding provisions were inadequate.

In conclusion, the Fukushima Daiichi Power Plant disaster is an eye opener into nuclear power safety. The more regulations and quality control that need to be in place worldwide at nuclear power plant locations is in need of drastic change to eliminate the possibility of another potential nuclear disaster.

**References:**

“Fukushima Accident 2011.” *World-Nuclear Association*. N.P., 9 Sept. 2013 Web. 16 Sept. 2013

"Fukushima Accident Analysis Report." *Tokyo Electric Power Company*. N.P., 20 June 2012. Web.

“Fukushima Daiichi Nuclear Disaster.” *Wikipedia.* N.P., Web 16 Sept. 2013

Kitamura, Makiko. "Full original Development Fukushima accident, alarm NRC is it 20 years ago." *Bloomberg JP*. N.p., 16 Mar. 2011. Web. 16 Sept. 2013.

"Stabilisation at Fukushima Daiichi." *Stabilisation at Fukushima Daiichi*. World Nuclear News, 20 Mar. 2011. Web. 16 Sept. 2013.