Fukushima nuclear crisis

February 2013

Overview

On 11 March 2011, a magnitude 9.0 earthquake struck off the coast of Japan, followed by a tsunami that slammed the country's north-eastern coast, destroying communities, and taking the lives of tens of thousands of people. The event triggered the biggest nuclear disaster since Chernobyl in 1986. It also exposed serious failures in the Japanese system for ensuring the safety of nuclear reactors, as well as collusion within the government and nuclear industry.

Nuclear meltdown

The earthquake led to the loss of external power at the Fukushima Daiichi nuclear power plant. The subsequent tsunami flooded the plant's back-up diesel generators, causing complete loss of power and failure of the cooling systems. As temperatures rose, nuclear fuel melted in reactors #1, #2, and #3. Damaged fuel led to a build up of hydrogen gas, and eventually, explosions in reactors #1, #3 and #4. Reactor #4 experienced major structural damage.

The nuclear disaster was eventually rated at Level 7 on the International Nuclear Event Scale (INES), the highest level. Japan's Nuclear and Industrial Safety Agency (NISA) estimated that the amount of radioactive caesium sent into the atmosphere by the explosions was equivalent to 168 Hiroshima bombs.

TEPCO, the plant operator, later admitted that it was aware of the possibility of a tsunami exceeding the design limits of the Fukushima nuclear plant as far back as 2008, and of a crippling power loss as far back as 2006, but never attempted to upgrade or fortify its facilities. Three separate investigations, led by the government, Parliament, and an independent commission, revealed "systematic negligence" and declared the crisis a "man-made disaster". More than a year later, TEPCO finally admitted that a "lack of safety culture" and "collusion with the nuclear industry" led to the meltdowns.

Evacuation

160,000 people were ordered to flee contaminated areas up to 50km around the Fukushima plant and thousands more left voluntarily. Tens of thousands remain homeless. Experts expect the 20km evacuation zone will be uninhabitable for decades at least. Many areas even outside of the 20km evacuation zone are still off limits. So far, most of those who evacuated from these areas have chosen not to return, due to concerns about radiation and unemployment.

Contamination

Widespread radioactive contamination was found beyond the initial 20km evacuation zone, resulting in the evacuation of towns as far away as 50km. Serious levels of radioactive contamination were found in Tokyo, more than 200km from Fukushima, and further away. Experts estimate that 40 quadrillion Becquerels of radioactive caesium were released into the atmosphere; about 20% of the amount released from Chernobyl – far more than initially thought.

A study conducted by scientists from the Woods Hole Oceanographic Society called the Fukushima disaster "the largest accidental release of radiation to the ocean in history." In April 2011, levels of caesium-137 in seawater were 50 million times higher than before the disaster. Concerned researchers warn that the full effects of radiation on the ecosystem will not be known for decades. Testing of oceanic samples gathered by Greenpeace showed excessive levels of radioactive caesium in seaweed and fish. An analysis by Asahi News, using data from TEPCO, showed that 462TBq (terabecquerel = trillion Becquerel) of radioactive strontium have been released into the Pacific Ocean. If it enters the food chain, radioactive strontium accumulates in bones and can cause leukaemia and bone cancer.

In Japan, contaminated rice, beef, fruits, vegetables, milk, and baby formula were found, causing waves of fear among residents and taking a huge toll on the Japanese economy. As recently as January 2013, fish caught off the coast of Fukushima measured 254,000Bq/kg of radioactive caesium, 2,540 times the legal limit for human consumption.

Homes, schools, and municipal areas need to undergo extensive decontamination, including soil removal. About 29 million cubic metres of radioactive soil will have to be removed from Fukushima Prefecture alone. Waste disposal and storage are an ongoing and growing concern. At present, more than four million tons of radioactive debris have been produced. Residents' concerns about hosting so-called "temporary" storage sites means that the majority of that waste is still sitting near homes, schools, and other populated areas. In the meantime, efforts to decontaminate cities and towns have been riddled with widespread scandals. Workers contracted by TEPCO have been charged with dumping radioactive materials into rivers, streams, and forests, and members of organised crime syndicates have infiltrated the process, where billions of dollars are at stake.

State of the Fukushima reactors

In December 2011, the government and TEPCO declared the reactors had achieved a cold shutdown-like status, even though they still couldn't determine the exact location or temperature of the melted fuel. The nuclear fuel is believed to have burned through the thick steel floors of the reactors' pressure vessels and possibly even through the thick concrete base of the containment vessel below. The compound remains in a visible state of destruction, with downed wires and overturned vehicles in the same spots they were when a massive earthquake and tsunami struck the Fukushima coast almost two years ago.

The government declared cold shutdown for political reasons, to fulfil an earlier promise to achieve cold shutdown before the end of 2011. The reality is that two years after the disaster first began to unfold, the four nuclear reactors at Fukushima Daiichi are still not in a safe or stable state, and the release of radioactive materials continues to contaminate the ocean and ground water. Radiation levels remain too high for workers and even robots to enter the reactors.

In February 2013, a former member of the Parliamentary commission requested another formal investigation, charging that TEPCO had wilfully obstructed efforts to examine reactor #1 for damage caused by initial earthquake, before the tsunami even reached the plant. If such damage is discovered, it will show that earthquake standards at nuclear power plants are insufficient in a country crisscrossed with fault lines. Recent seismic studies at other nuclear plants have revealed that reactors and their safety equipment have been built over active faults, in violation of Japanese law. Operators of these reactors may now be forced to decommission them.

Efforts to decontaminate highly radioactive water used to cool the reactors and spent nuclear fuel at Fukushima have been fraught with difficulty. Experts estimate that 10,000 gallons of radioactive water leak from the reactors each month, and currently, over 200,000 tons of contaminated water are being stored at the plant. TEPCO destroyed an entire nearby forest in order to make room for tanks that will eventually store 700,000 tons of water. Officials are already expressing concern about what will happen when those tanks also eventually fill up. TEPCO plans to dump contaminated water into the ocean after reducing its radioactivity. At the plant, cooling operations are still makeshift, and the damaged reactors continue to contaminate the environment and remain vulnerable to damage from Japan's frequent earthquakes.

Current estimates indicate decommissioning of the Fukushima Daiichi reactors will take at least 40 years.

Costs

The Japan Centre for Economic Research has estimated the entire cost of Fukushima would be at the range of €48bn to €169bn.

In August 2012, the Japanese government was forced to nationalise TEPCO, because its liabilities outweighed its assets. The government has so far injected about $45bn US dollars into the company to keep it solvent, and approved about $36bn of state-backed financing for compensation to victims of the disaster. Those numbers, which have been shouldered by taxpayers and consumers in the form of higher electricity rates, are expected to continue rising.

Compensation process

Two years after the disaster, nobody has received sufficient compensation to rebuild their lives. There has not yet been a single payment that fully compensates anyone for the loss of a house and property. TEPCO's compensation procedures are complicated and restrictive, initially requiring applicants to fill in a form of more than 60 pages, accompanied by a 156-page manual. In contrast, one TEPCO nuclear accident manual was just three pages in its entirety; another was only six pages long. Victims complained about the form and the company simplified it. In the meantime, more than 10,000 people have filed suits against the utility, claiming negligence, wrongful death, and damage to health and property.

Political and social effects

Outside Japan, the effects of the disaster were felt around the world. Many nations re-evaluated the ability of their own nuclear reactors to withstand natural disasters. Germany has shut down some of its reactors and vowed to abandon nuclear energy entirely.

The Fukushima disaster raised serious questions about the myth of nuclear safety. In Japan – considered an industry high point of safety, tight regulation and technological prowess – it revealed considerable collusion and lack of transparency in the nuclear power sector. This included concerted efforts to mislead the public, and repeated examples of cronyism between power companies and the government agencies that regulate them. In response, Japan established a new Nuclear Regulation Authority (NRA) to replace NISA. The NRA is revising safety regulations for nuclear reactors, including requiring filtered vents, secondary control rooms, and stricter protection against earthquakes, tsunamis, other natural disasters, and terrorist attacks.

Public support for nuclear power in Japan has largely eroded. For the first time in decades, massive public protests of up to 100,000 people against restarting nuclear power have occurred regularly nationwide.

In May 2012, all of the nation's 50 reactors went offline due to regular outages and maintenance, leaving the country nuclear free for the first time in 42 years. Despite fear mongering by the nuclear industry and warnings of blackouts, there were no significant problems with the electricity supply, proving that Japan can survive without nuclear power.

In September 2012, then-Prime Minister Yoshihiko Noda promised to phase out all nuclear power in Japan by the 2030s, but a new administration that came to power in December, led by Prime Minister Shinzo Abe, has since vowed to review this target and push for restarting the country's idle reactors.

As of February 2013, only two reactors at the Ohi nuclear plant in Fukui Prefecture are online after being restarted in August 2012, despite widespread public opposition. These will have to go offline again in September 2013 at the latest. It may take a long time before any reactor is given permission to restart, following new and stricter NRA rules. Costly and time-consuming upgrades may keep many plants offline for a long time to come, leaving Japan once again nuclear-free for a time.

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