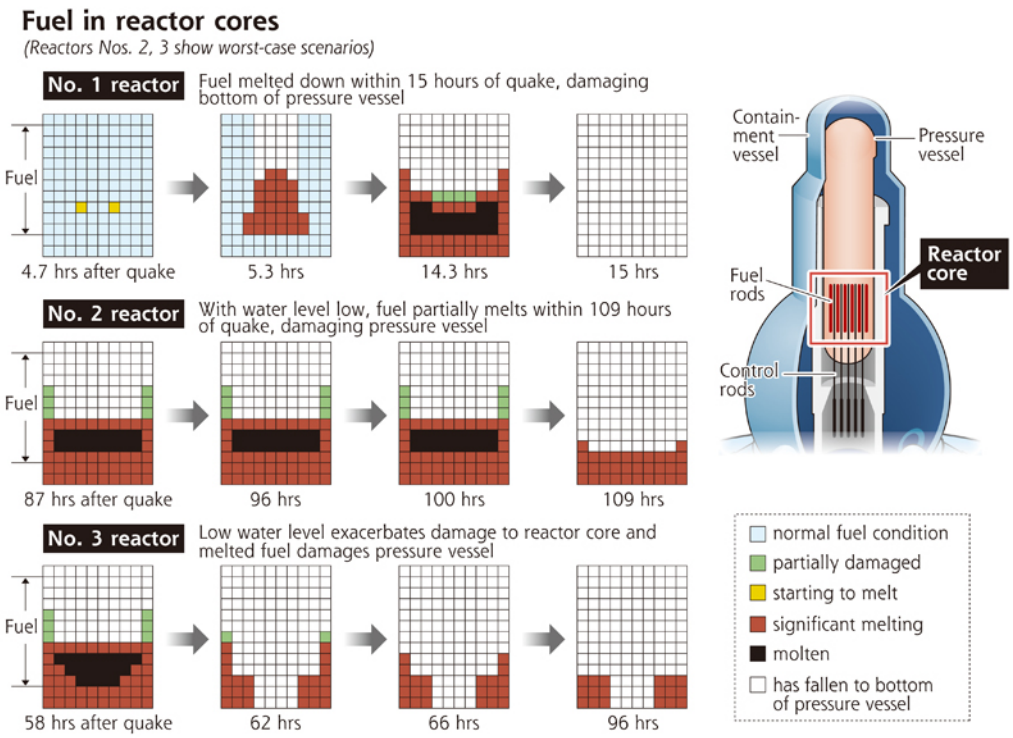
TEPCO describes 3 meltdowns / Report on Fukushima N-plant outlines downward spiral of events

The Yomiuri Shimbun



Tokyo Electric Power Co. admitted for the first time Monday the Nos. 2 and 3 reactors at the Fukushima No. 1 nuclear power plant likely suffered core meltdowns, in addition to a previously acknowledged meltdown in the No. 1 reactor.

The utility made the admission in its report to the government's nuclear safety agency.

TEPCO submitted its report on analyses of the status of the plant Monday night.

The meltdowns at the Nos. 1 to 3 reactors occurred in relatively short periods of time--about a half day to about four days--after the Great East Japan Earthquake hit the Tohoku and Kanto regions on March 11, resulting in damage to the reactor's pressure vessels.

The report was submitted to the Nuclear and Industrial Safety Agency of the Economy, Trade and Industry Ministry.

As much as 800 kilograms of hydrogen was generated as a result of the overheating of nuclear fuel at the No. 1 reactor, according to TEPCO. The amount was enough to destroy the reactor building, according to nuclear experts.

The government will explain details of the TEPCO report to an International Atomic Energy Agency team currently visiting Japan for an inspection of the nuclear complex, located on the border of Okumamachi and Futabamachi in Fukushima Prefecture.

The government's accident research committee, approved at Wednesday's Cabinet meeting, will analyze the report, government officials said.

TEPCO performed computer simulations of the meltdowns using an accident analysis program, based on various data including those already announced, such as water and pressure levels in reactors and operation records.

TEPCO earlier announced provisional results of its analysis on the No. 1 reactor that the core meltdown started around 7:30 p.m. on March 11 after the quake hit at 2:46 p.m.

However, the new report says the meltdown started about four hours after the quake and most of the fuel rods melted and dropped to the bottom of the pressure vessel after about 15 hours. Welded parts of the bottom of the vessel, including a section for control rods to pass through, were damaged.

The amount of hydrogen sharply increased immediately after the fuel rods started to melt, reaching nearly 800 kilograms, enough to cause a major hydrogen explosion, in about half a day.

The progress of the meltdowns at the Nos. 2 and 3 reactors was slower than the pace at the No. 1 reactor because a "reactor isolation cooling system" was working at the two reactors for a certain period of time even after the tsunami that hit the plant after the quake. The No. 1 reactor's cooling system, which uses an isolation condenser, is different from that of the other two reactors and stopped working completely after the tsunami.

As it was impossible to obtain accurate records of the reactors' water levels, TEPCO made calculations about the Nos. 2 and 3 reactors based on two possible scenarios: In one, the lower parts of the fuel rods were immersed in water that was injected into the reactor; in the other, the injection of water did not go well and the fuel rods were left completely exposed.

Under the partial-exposure scenario at the No. 2 reactor, the core was exposed about 75 hours after the earthquake and the fuel rods started to melt at 77 hours after the quake. At the same time, hydrogen started to be generated and a hydrogen explosion occurred in a pressure suppression chamber in the lower part of the reactor containment vessel at the 87th hour. However, half of the fuel rods remained at the bottom of the reactor core in a melted mass even after a week after the quake. As a result, the pressure vessel was not damaged.

Under the full-exposure scenario at the No. 2 reactor, the meltdown rapidly progressed after the hydrogen explosion, and about 80 percent of the fuel rods dropped to the bottom within about 109 hours after the quake, damaging the pressure vessel.

Under both scenarios at the No. 3 reactor, the upper parts of the fuel rods started to become exposed above the water at about the 40th hour after the quake after a high pressure core cooling system, a type of emergency cooling device, stopped operating. At about the 42nd hour after the quake, the fuel rods started to melt.

Under the full-exposure scenario at the No. 3 reactor, however, the pressure vessel became damaged about 66 hours after the quake.

Despite repeated venting--attempts to lower the pressure in the containment vessel by releasing steam--the amount of hydrogen generated reached almost 600 kilograms, causing a hydrogen explosion.

Core temperatures at the Nos. 1 to 3 reactors once neared 3,000 C but currently are stable at around 100 C to 170 C.

As the residual heat of the fuel rods has decreased, TEPCO thinks the risk that overheating will recur is low.

On the other hand, no damage to key pipes or devices has been confirmed as directly due to the quake. Thus, TEPCO maintained its view that it was only after the tsunami hit that the plant lost all its power sources, eventually leading to the loss of the reactors' key cooling functions.

TEPCO said the No. 1 reactor's isolation condenser was temporarily manually stopped by operators but the action was appropriate as it was done in accordance with the reactor's operation manual. After the isolation condenser was automatically activated at 2:52 p.m. on March 11, the device was later switched on and off for about 30 minutes beginning at 3:03 p.m. until the electricity was completely lost. Some experts pointed to the possibility that the meltdown could have been slowed if the device was not stopped.

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