

Fukushima: Panel doubts TEPCO claim tsunami caused nuke accident

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Contents

- [Report doesn't answer blast](#)
- [TEPCO bias clear in N-crisis](#)
- [US official: Fukushima fuel](#)
- [TEPCO did not act on tsunami](#)

Not a few members of the government panel looking into the accident at the Fukushima No. 1 nuclear power plant are skeptical about Tokyo Electric Power Co. pointing the finger of blame at an unprecedented tsunami.

"The claim that tsunami alone caused the accident is nothing but a hypothesis," said panel member Hitoshi Yoshioka, vice president at Kyushu University, who has written a book about the social history of nuclear energy.

"I feel a majority of panel members feel this way. It is close to a common understanding that it would not be good to trust as is TEPCO's analysis that tsunami was the cause of the accident."

The conclusion reached by the panel could have ground-shaking ramifications for other nuclear power plants in Japan.

If the March 11 earthquake is viewed as the main culprit behind the Fukushima nuclear accident, that would mean that other nuclear plants are also vulnerable to large earthquakes.

Such a possibility is not small since about 10 percent of the world's earthquakes occur in Japan.

The government panel is chaired by Yotaro Hatamura, a professor emeritus at the University of Tokyo noted for his work on the "science of failure." The Hatamura panel is scheduled to release its interim report on Dec. 26.

Sources said that report would likely cast strong doubts on TEPCO's repeated claims until now that tsunami was the main cause of the Fukushima nuclear accident.

Panel members apparently feel there is a need to also consider the possibility that major piping at the Fukushima nuclear plant was damaged by the quake even before any tsunami hit the plant.

Such a theory would severely hinder plans by other electric power companies to resume operations at their nuclear power plants after implementing measures to deal with the possibility of a major tsunami. For example, Chubu Electric Power Co. plans to resume operations at the Hamaoka nuclear plant after construction of a coastal levee.

Many questions, however, remain about the relationship between the quake and the subsequent

accident at the Fukushima nuclear plant.

For one thing, the only shaking on March 11 that exceeded government anti-quake standards was the east-west shaking at the No. 2 and No. 3 reactors. All the shaking at the No. 1 reactor was within anti-quake standards. Still, the No. 1 reactor was the first where a hydrogen explosion occurred, spewing radioactive materials into the atmosphere.

For that reason, if the Hatamura panel were to take into consideration the possibility that the quake was the main cause of the Fukushima nuclear accident, that would call into question the inspection guidelines for anti-quake design that were revised in 2006 for all nuclear plants in Japan. Such doubts would make even more difficult resumption of operations at those plants.

That possibility is one reason TEPCO and others in the electric power industry are insisting that only the tsunami was to blame for the Fukushima nuclear accident.

According to Hatamura panel member Yoshioka, there is no way of knowing if the quake actually damaged the major piping at the Fukushima plant without conducting an on-site inspection.

That is one reason there is no member of the Hatamura panel who supports without qualification the theory that the quake was the main cause of the accident.

At the same time, there is little support for TEPCO's argument that if a tsunami had not hit, a major accident would not have occurred and that there would be no safety issue at Japan's nuclear plants as long as measures were strengthened against tsunami.

"There are many important weak points in the safety of Japan's nuclear plants so it is implausible that everything would be all right as long as tsunami measures were implemented," said Yoshioka, whose specialty is the history of science. "I feel this is the common understanding of panel members."

There are 10 members of the Hatamura panel and two others who serve as technical advisers.

According to one panel member, between six to eight of the 12 members have doubts about TEPCO's claim that tsunami was the main cause.

Some members, such as Kazuo Oike, the director of the International Institute for Advanced Studies, have said, "The accident would have been unthinkable without the tsunami. Isn't the tsunami the cause of the accident?"

However, at least half of the panel members are taking TEPCO's arguments with a grain of salt.

A major reason for that doubt is an article by Mitsuhiko Tanaka in the September edition of Kagaku (Science) magazine, published by Iwanami Shoten. Tanaka is a former nuclear plant design engineer who was involved in the design of the pressure vessel of the No. 4 reactor at the Fukushima plant.

Copies of the article were distributed to all Hatamura panel members and quite a few read it.

Tanaka's article criticized the computer simulation analysis conducted by TEPCO, which was attached to the Japanese government's report submitted to the International Atomic Energy Agency. He also surmises that piping at the Fukushima plant was damaged by the quake before the tsunami struck, which led to a loss of cooling water to the reactors.

The major defect in the TEPCO analysis in Tanaka's view is that the times used in the computer

simulation for the changes in water levels within the core pressure vessel and the changes in pressure within the containment vessel were clearly different from the actual times measured when the accident was unfolding.

The result of the TEPCO analysis is that after the tsunami struck, electric power sources were lost and a hole was burned in the pressure vessel by a meltdown of the nuclear fuel.

However, the times used in that simulation were vastly different from the actual measured times.

In fact, the actual times measured for the changes in water level and pressure as well as the various notes left by workers at the plant indicate a high possibility that some of the major piping in the plant may have been damaged by the quake before the tsunami struck.

Tanaka's views will likely obtain a wider audience because he has been picked to serve on a Diet panel to look into the Fukushima nuclear accident. That Diet panel will be chaired by Kiyoshi Kurokawa, the former president of the Science Council of Japan.

The views of the Hatamura panel will be closely followed by other electric power companies.

Of the 54 nuclear reactors in Japan, only nine are currently operating. Thirty reactors have stopped operations for periodic inspections.

TEPCO and the Federation of Electric Power Companies of Japan have laid out plans to resume operations at those reactors after conducting two stress tests through computer simulation.

The stress tests will show the extent to which the reactors can withstand effects from quakes and tsunami before they are damaged.

On Oct. 28, Kansai Electric Power Co. submitted the first stress test evaluation for the No. 3 reactor at the Oi nuclear plant to the Nuclear and Industrial Safety Agency. The evaluation showed that the reactor would be able to withstand a quake that was 1.8 times stronger than anti-quake standards.

However, in the case of the Fukushima plant, a hydrogen explosion occurred even though the shaking was within the limits of those anti-quake standards.

If there is the possibility that the Fukushima accident was caused by the quake, not only would that call into question the anti-quake standards, but it would also totally destroy the electric power industry's plans to resume operations after conducting stress tests.

Experts have already raised questions about using the stress test as a condition for deciding to resume operations.

On Nov. 14, experts were allowed to express their views in response to the stress test evaluation for the Oi No. 3 reactor.

Hiromitsu Ino, a professor emeritus at the University of Tokyo who specializes in metal materials, said, "It is wrong to link stress tests with the resumption of operations. The Fukushima nuclear accident demonstrates there were defects in safety inspections until now. If stress tests are conducted without revising those procedures first it would lead to confusion in making safety evaluations."

Ino had a further suggestion.

"In order to verify the effectiveness of stress tests, a stress test should be conducted at the Fukushima No. 1 plant where the accident occurred," he said.

In the background to the strong doubts about TEPCO's claim that tsunami was the main cause of the Fukushima accident is the belief that something is wrong about logic that allows for resumption of operations at nuclear plants based on armchair calculations, when no one knows what the real cause of the Fukushima accident was.

At the first meeting of his panel on June 7, Hatamura said, "(The conclusions of this panel) will be able to withstand an evaluation 100 years from now because it will think about future generations."

AKIRA SATO, *Asahi Shimbun* Weekly AERA, December 06, 2011
<http://ajw.asahi.com/article/0311disaster/fukushima/AJ201112060052>

Tsunami was direct cause of nuclear crisis: TEPCO investigation

TOKYO (Kyodo) — Tokyo Electric Power Co. said Friday it has determined that the direct cause of the nuclear crisis at its Fukushima Daiichi power plant was a larger-than-expected tsunami that flooded key buildings after the March 11 earthquake, apparently defending itself from possible criticism that the accident could have been prevented.

"We had prepared for accidents at a certain level and had documented procedures, but, because of the impact of the tsunami far larger than our expectations, the situation developed into one that deviated from our accident-response assumptions," TEPCO said in an interim report on an in-house investigation into the world's worst nuclear accident in 25 years.

"As a result, we were not able to take measures to counter the accident at the Fukushima Daiichi plant and could not prevent reactor cores from sustaining damage," it said.

According to the 130-page report, attached with massive reference data, the facilities important to the plant's safety measures did not sustain damage as a direct result of the magnitude 9.0 earthquake, but the flooding from the 13-meter-high tsunami led to the "simultaneous loss of multiple safety functions."

The prolonged loss of power sources and functions to cool the reactors resulted in the meltdown of nuclear fuel in the Nos. 1 to 3 reactors, leading to a massive release of radioactive substances into the environment.

In compiling the report, TEPCO sought advice from a panel of experts, which also announced its views in a separate paper also Friday, saying TEPCO's "insufficient" safety measures were a factor in the accident.

The panel's paper also noted that TEPCO may have been stuck on the "myth" that atomic power is safe.

However, Executive Vice President Masao Yamazaki said in a news conference that TEPCO had taken "the best possible measures at the time" for safety.

The TEPCO report said the utility had taken enough measures to withstand tsunami waves as high as

6.1 meters, while the latest tsunami that set off the nuclear crisis at the plant in northeastern Japan was “far larger than the company’s expectations.”

TEPCO projected in an in-house study in 2008 that a tsunami as high as 10.2 meters could hit the plant, but the figure was “just something based on an assumption without specific evidence,” the report also said, justifying the company’s decision not to take immediate action.

TEPCO repeatedly said in its report that the state was also involved in working out steps to deal with accidents, in remarks that can be taken as suggesting the company was not the only one to blame for failing to project a loss of power sources by tsunami.

The report also included measures to prevent a recurrence, such as setting barriers to block water from entering the buildings and installing functions that would not allow reactor cores to be damaged.

TEPCO will continue to look into such issues as how senior company officials made decisions and responded to the crisis, as well as on the release of radioactive substances. It plans to compile a final investigative report by around June.

Another panel set up at the government’s initiative is also looking into the causes of the accident and is set to compile an interim report in late December.

Kyodo Press, December 3, 2011

<http://mdn.mainichi.jp/mdnnews/national/archive/news/2011/12/03/20111203p2g00m0dm005000c.html>

Report doesn’t answer blast, radiation leak mysteries

Why did such massive amounts of radioactive substances escape from the crippled Fukushima No. 1 nuclear power plant? Why did explosions tear through its reactor buildings?

Tokyo Electric Power Co.’s interim report on the accident at the nuclear plant shed some light on some causes of the nation’s worst-ever nuclear crisis, but these and other crucial questions remain unanswered.

The release of radioactive substances is believed to have peaked on the morning of March 15. As radiation spewed from the plant’s reactors, residents in an extensive area—even as far as Iitatemura, Fukushima Prefecture, about 30 kilometers from the plant—were forced to evacuate.

The report said the air pressure in the containment vessel of the plant’s No. 2 reactor dropped drastically that morning. However, TEPCO says the causal relationship between the pressure drop and the radioactive release is “unclear at this moment.”

It had been assumed that a blast in the pressure control chamber below the No. 2 reactor’s containment vessel caused the increase in radiation leaked into the environment. Analysis of data from a seismometer and other equipment at the complex later showed this hypothesis was incorrect.

The accident will need to be examined from scratch to pinpoint its true cause. However, an on-site

investigation at the plant remains extremely difficult due to the high levels of radiation in the area.

The report's verification of TEPCO's initial response to the nuclear accident also lacked details.

After a hydrogen blast wrecked the No. 1 reactor building shortly after 3:30 p.m. on March 12—a development nobody had anticipated—TEPCO scrambled to prevent similar blasts from occurring at the other reactors.

The utility arranged to have a hydraulic device break open holes in the reactor buildings to release hydrogen from inside. But shortly after 11 a.m. on March 14, before the device arrived, a hydrogen blast ripped through the No. 3 reactor.

The report did not specify why TEPCO failed to prevent this blast, which happened nearly two days after the first explosion.

TEPCO Vice President Masao Yamazaki said: "It was difficult to obtain equipment due to bad road conditions and other problems after the [March 11] earthquake. We'll look into the matter further for the final report."

There also are some loose ends regarding the injection of cooling water into the reactors.

Even after the huge tsunami triggered by the March 11 earthquake hit the power plant and knocked out its cooling systems, the emergency water injection system functioned for about three days at the No. 2 reactor and about 1-1/2 days at the No. 3 reactor. TEPCO had time to prepare substitute water injection methods, such as stationing fire engines at the plant. Its failure to do so eventually resulted in core meltdowns at the Nos. 1-3 reactors.

The report says TEPCO's response was delayed because valves to reduce pressure in the reactors could not be operated due to a lack of electricity and "TEPCO workers had to remove batteries from staff cars to collect enough power to conduct the operation."

The report did not clarify why TEPCO did not prepare more power sources while the emergency water injection system was in operation.

Makoto Mitsui, *Yomiuri Shimbun* Staff Writer, December 4, 2011

<http://www.yomiuri.co.jp/dy/national/T111203003352.htm>

TEPCO bias clear in N-crisis examination

Outside experts investigating the crisis at the Fukushima No. 1 nuclear power plant operated by Tokyo Electric Power Co. seem to have taken a sympathetic attitude toward TEPCO although they concluded the utility's safety measures were insufficient.

It is believed their probe into TEPCO's reaction to the accident was superficial out of concern for the potentially huge compensation claims that TEPCO faces.

"TEPCO should have decided in advance detailed procedures based on the assumption that all external power supplies were lost," the panel of outside experts said in its assessment of the

accident.

The view of the panel of outside experts, which was created to verify TEPCO's internal investigation, was revealed Friday, when TEPCO announced an interim report on the nuclear crisis put together by an in-house investigation committee set up by the utility.

The committee of outside experts presented the view that both the government and TEPCO failed to assume the complete loss of power in planning countermeasures against severe accidents such as those that resulted in the ongoing nuclear crisis.

At the nuclear plant, the March 11 tsunami disabled emergency power generators, and workers concentrated their efforts mostly on venting steam containing radioactive substances from the reactors.

But TEPCO had not decided how the venting and water injections should be carried out when all the power supplies are lost, and thus workers at the plant were confused.

TEPCO has said the core of the No. 1 reactor started being damaged shortly before 7 p.m. on March 11, four hours after the massive earthquake hit east Japan.

However, venting at the No. 1 reactor was not begun until about 2 p.m. on March 12.

The outside experts' crisis examination committee also touched on the fact that there were only two phone lines connecting the plant's quake-proof building for emergency use and three central control rooms, though the workers had to handle six reactors at the plant simultaneously.

"Sharing such information is a very important task," the experts simply pointed out in their report.

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Experts agree with probe panel

However, the interim report by the in-house investigation panel contained almost no descriptions of failures in TEPCO's responses to the accident.

It has been already revealed that venting equipment was delivered to the wrong place and plant workers knew nothing about auxiliary battery storage. But the report did not mention such failures at all.

About the fact that TEPCO had assumed tsunami more than 15 meters high—equivalent to the March 11 tsunami—in 2008, the in-house investigation committee flatly denied that the assumption required action.

The committee concluded, "The estimate was based on a simulation of unlikely events, and thus the predicted tsunami were not likely enough to require the company to prepare."

The outside experts' panel agreed, saying, "Tsunami of a scale that could not be predicted."

The experts also did not deeply examine why venting in the No. 1 reactor was delayed for so long. More than seven hours elapsed between the time the government confirmed the evacuation of nearby residents at 12:30 a.m. on March 12 and the time when the venting was ordered.

Kenji Sumita, professor emeritus of Osaka University and former acting chairman of the Nuclear Safety Commission, said: "The investigation committee's report shows a lack of self-reflection on

how insufficient the safety measures were. Also, the report doesn't tell us what roles TEPCO's head office played in the crisis."The opinions of the outside experts' panel are also ambiguous about the fact that TEPCO said it was unable to predict a hydrogen explosion, and it seems to be trying to protect TEPCO," he added.

One member of the outside experts' committee said, "In the process of compiling the report, I felt TEPCO was worried about the compensation problem."

About 40 shareholders of TEPCO recently demanded in writing that the company's auditors file a lawsuit against 61 past and current management executives seeking more than 5 trillion yen of compensation for the company. They said they will file a class-action lawsuit if the auditors fails to act.

It is inevitable TEPCO will face a shareholders lawsuit as the probability that the auditors will follow the demand is low.

Probably because they took TEPCO's concerns about such a lawsuit into consideration, the outside experts frequently used expressions that skirted the issue of blame or negligence on the part of TEPCO, although the committee emphasized TEPCO's reaction ended in failure.

For instance, the experts committee said, "As a consequence, assumptions of severe accidents were insufficient."

TEPCO Executive Vice President Masao Yamazaki, who chairs the in-house investigation committee, said at a press conference Friday, "We had implemented measures for severe accidents as part of integrated actions with the government." He suggested the government should share responsibility with TEPCO for the inadequate accident-prevention measures.

Shin Watanabe and Naonobu Sato, *Yomiuri Shimbun* Staff Writers, December 4, 2011
<http://www.yomiuri.co.jp/dy/national/T111203003438.htm>

US official: Fukushima fuel worries were justified

ATLANTA (AP) — The top U.S. nuclear official in Japan said Thursday that his team warned higher-ups that a spent fuel pool at a malfunctioning nuclear plant could be at risk of running dry, an issue that created a political controversy between U.S. officials and their Japanese counterparts.,U.S. Nuclear Regulatory Commission official Charles Casto was assigned to direct site operations for the U.S. government's response to the nuclear disaster at the Fukushima Dai-ichi nuclear plant shortly after the accident last March. The plant was struck by a massive earthquake and a tsunami on March 11 that disabled its emergency cooling systems, leading to meltdowns, explosions and radioactive releases.

Less than a week later, NRC Chairman Gregory Jaczko told U.S. lawmakers that all the water from a spent fuel pool was gone — a development that if true raised the risk that the used fuel could ignite and spread more radiation into the environment.

Japanese officials denied Jaczko's statement at the time. NRC officials have since acknowledged that

recent evidence shows that the pool probably did not go dry.

Casto said his team was operating in what he likened to the fog of war. They had the greatest concerns about the spent fuel pool on the Unit 4 reactor, which had the hottest fuel. Without reliable information from plant sensors, his team believed a combination of circumstantial evidence showed that Unit 4 pool could be empty. That information included the massive damage observed at the plant, a spike in radiation readings near the building and water vapor plumes.

Casto said there were also concerns that one of the many aftershocks that followed the initial quake could trigger another tsunami, making conditions at the plant even worse.

"It was a possibility that they may be empty," Casto said, speaking about the pools during an interview in Atlanta with The Associated Press. "It wasn't unreasonable to think there was damage in that liner."

The condition of the plant's spent fuel pools was a concern throughout the crisis. Utility companies must remove nuclear fuel rods from a reactor when they can no longer sustain the nuclear reactions that produce heat and, ultimately, electricity. Those used fuel rods remain extremely hot and radioactive. They must be submerged in pools for a minimum of roughly five years.

While reactors are encased in protective steel and concrete, spent fuel pools are not. If the water drains from a pool, the exposed fuel rods can emit lethal doses of radiation to anyone nearby and even ignite, causing a fire that spreads radioactive toxins.

Working from the U.S. embassy in Tokyo, Casto said NRC officials had very limited information about plant conditions. Without electricity, many plant sensors no longer worked. Information from the remaining equipment was suspect since so much of it was badly damaged. Casto said his team focused instead on radiation readings collected by the U.S. military.

He said he worried that a pool liner could have been punctured by debris flung by the natural disasters or the explosions rattling the plant.

"You see all that damage on the top of that building and you're thinking, 'There's probably some damage on the spent fuel pools,'" Casto said.

U.S. officials were aware that no one had poured water onto the pool for three to four days after the tsunami, Casto said. Images from flying drones and even TV cameras showed white smoke — likely water vapor — coming from the area of the Unit 4 pool. Casto's team interpreted that as a sign water from the spent fuel pool was boiling.

"And then suddenly it stopped," he said.

Plant workers also reported high radiation levels from debris in-between the Unit 3 and Unit 4 reactor buildings. Casto said his team thought those radiation readings could indicate that damaged nuclear fuel had spread on the site.

"You put that together and you say, 'We're worried that there may not be water in that spent fuel pool,'" he said.

Some information was open to debate. Japanese officials once called Casto to an emergency center where he watched video taken from a helicopter that flew over the Unit 4 building. Japanese officials told Casto that they saw a reflection among the rubble, indicating there was water in its pool.

"I couldn't see it," he said.

Associated Press, December 9, 2011

<http://mdn.mainichi.jp/mdnnews/national/archive/news/2011/12/09/20111209p2g00m0dm036000c.html>

TEPCO report depicts desperate workers left in tsunami-hit plant

TOKYO (Kyodo) — Tokyo Electric Power Co. said Friday its investigation into the nuclear crisis at the Fukushima Daiichi power plant shed light on how desperate workers at the site felt shortly after the March 11 earthquake and tsunami resulted in the loss of power sources.

"I felt I could do nothing. Other operators appeared anxious. They argued, 'When we cannot control (the reactors) and are at wit's end, is there any meaning for us to be here?'" a person in charge of the reactors' central control room recalled about the situation, according to a separate volume attached to an interim investigation report on the accident. "So, I bowed my head and asked them to stay."

Difficulties to release pressure in containers housing the reactors to avoid damage to the containers in the early days of the crisis were also described. A worker was quoted as saying, "I did not allow young people to go (to open the valves for venting) because they would have to go into an area with high radiation dose."

A worker who engaged in the task of venting was quoted as saying, "I heard some big weird dull, popping sounds ... and when I tried to start working ... my black rubber boots melted (because of the heat)."

Large aftershocks also appear to have hampered restoration efforts, with some saying, "There were quite a lot of times when we had to run to higher ground like crazy with a full face mask on."

In the process to compile the in-house investigation report, the utility known as TEPCO said it has conducted hearings on workers who have dealt with the world's worst nuclear accident since the 1986 Chernobyl disaster.

Kyodo Press, December 3, 2011

<http://mdn.mainichi.jp/mdnnews/national/archive/news/2011/12/03/20111203p2g00m0dm006000c.html>

TEPCO study shows water level in spent fuel pool was dangerously low

TOKYO (Kyodo) — A study by Tokyo Electric Power Co., operator of the crippled Fukushima Daiichi nuclear power plant, has shown that water in the No. 4 unit's spent fuel pool temporarily dropped to a level close to exposing the stored nuclear fuel, sources close to the matter said Thursday.

After the No. 4 unit lost its key cooling functions along with the plant's other reactors in the wake of

the March 11 earthquake and tsunami, the water level in the No. 4 spent fuel pool fell at one point to only 1.5 meters above the top of the fuel assemblies, as heat from the fuel had caused the coolant to evaporate. The water level is usually around 7 meters above the assemblies.

The water level remained low for over a month until at least April 20. Workers injected around 930 tons of water into the spent fuel pool between April 22 and 27, filling up the pool, but a graph compiled by Tokyo Electric shows that the fuel would have been exposed in early May if water had not been injected.

While nuclear fuel inside a reactor is enclosed by multiple barriers so that radioactive substances do not leak outside, a spent fuel pool is only separated from the external environment by the wall of the reactor building.

Exposure of nuclear fuel is dangerous because it could eventually melt and release radioactive substances into the environment. As the wall of the No. 4 reactor building was damaged in a hydrogen explosion, an extremely dangerous situation could have occurred.

The utility known as TEPCO plans to include the outcome of its assessment in a midterm report on its in-house investigation into the world's worst nuclear accident in 25 years at the plant in Fukushima Prefecture. The report is set to be announced Friday.

The study also showed that the water levels in the spent fuel pools of the Nos. 1 to 3 units also dropped, but not significantly.

The heat from fuel in the No. 4 spent fuel pool was greater than in the other units because all of the fuel from the No. 4 reactor, halted for a regular inspection before the quake, was stored in the pool. The temperature of the water in the No. 4 spent fuel pool, usually kept at around 30 C, rose to about 90 C after the nuclear crisis erupted.

Kyodo Press, December 2, 2011

<http://mdn.mainichi.jp/mdnnews/national/archive/news/2011/12/02/20111202p2g00m0dm032000c.html>

TEPCO did not act on tsunami risk projected for nuclear plant

TOKYO (Kyodo) — Tokyo Electric Power Co.'s department responsible for managing nuclear power plant facilities did not act on a risk of massive tsunami near the Fukushima Daiichi nuclear power plant projected in an in-house study in 2008, ruling out an immediate need to better protect the power station from seawater flooding, company sources said Sunday.

Despite the projection of a tsunami as high as 10.2 meters, officials of the department at the company's headquarters insisted that such a risk was unrealistic, they said. In March, the power station was ravaged by a tsunami as high as about 15 meters.

The power plant was designed based on the company's assumption that the biggest tsunami expected in the area would be 5.7 meters high. The 2008 study estimated that waters from a tidal wave that high would lead to an inundation height of 15.7 meters.

Some company sources say the utility, commonly known as TEPCO, could have been better prepared to cope with the tsunamis in March if it took the 2008 projection seriously.

A TEPCO spokesman said the company intended to use the study for its facility management after the estimates in it were reviewed by a national civil engineering society.

Kyodo Press, November 28, 2011

<http://mdn.mainichi.jp/mdnnews/national/archive/news/2011/11/28/20111128p2g00m0dm008000c.html>

TEPCO study on nuclear crisis stressed need to avoid flooding

TOKYO (Kyodo) — An in-house investigation by Tokyo Electric Power Co. has found that the nuclear crisis at the Fukushima Daiichi power plant was triggered by tsunami waves that flooded into key buildings after the March 11 earthquake, causing equipment inside to fail, sources close to the matter said Monday.

In an interim report of its investigation into the world's worst nuclear crisis in 25 years, to be unveiled soon, the plant operator known as TEPCO says it plans to thoroughly implement measures to prevent buildings and important equipment from being exposed to water.

But the report fails to answer why the utility had not taken sufficient measures to deal with tsunami, according to the sources.

The report states that major facilities at the plant did not lose their functions as a direct result of the magnitude 9.0 earthquake, while recognizing that the scale of any direct damage from the quake has "not been clearly confirmed" because the tsunami waves reached within an hour.

As for an in-house study conducted in 2008, which projected that a tsunami as high as 10.2 meters could hit the plant, the report says the figure was "just something based on an assumption without specific evidence" and that the 14 to 15 meter high tsunami that ravaged the plant on March 11 "largely exceeded" the company's expectations.

Kyodo Press, November 29, 2011

<http://mdn.mainichi.jp/mdnnews/national/archive/news/2011/11/29/20111129p2g00m0dm010000c.html>

Melted nuclear fuel eroded reactor container by up to 65 cm: TEPCO

TOKYO (Kyodo) — The operator of the crippled Fukushima Daiichi nuclear power plant said Wednesday that the concrete base of the No. 1 reactor container had been eroded by up to 65 centimeters when the fuel inside melted, although the steel container itself was left intact.

According to Tokyo Electric Power Co.'s analysis, all of the fuel inside the No. 1 reactor melted after cooling functions failed in the wake of the March 11 earthquake and tsunami, with a substantial

amount of the fuel melting through the base of the reactor pressure vessel and dropping into the outer primary container.

If the erosion had expanded another 37 cm, the damage would have reached the steel wall, according to the utility known as TEPCO.

As for the Nos. 2 and 3 reactors, which also experienced meltdowns, the amount of fuel that dropped to the bottom of the pressure vessel is estimated to be around 60 percent.

The bottom of the two reactors' pressure vessels is unlikely to have been damaged on a large scale. But if the fuel had melted through the vessels, the primary container of the No. 2 reactor could have been eroded by 12 cm and that of the No. 3 reactor by 20 cm, TEPCO said.

Currently, the melted fuel inside the Nos. 1 to 3 reactors is believed to be cooled by water injection and no further erosion is occurring, it said.

Kyodo Press, November 30, 2011

<http://mdn.mainichi.jp/mdnnews/national/archive/news/2011/11/30/20111130p2g00m0dm147000c.html>

Panel to say preparation against tsunami at Fukushima plant was possible

TOKYO (Kyodo) — A government panel tasked with investigating the nuclear crisis at the Fukushima Daiichi power plant plans to point out in its interim report that it was possible to take measures in advance to prevent large tsunami waves from causing loss of power sources at the plant, sources close to the matter said Wednesday.

The investigation committee led by Yotaro Hatamura, a professor emeritus at the University of Tokyo, is also expected to touch on the fact that evacuees were not able to receive necessary information or instructions that would have allowed them to reduce radiation exposure, the sources said.

The report is expected to be released Dec. 26, with the panel's members hoping to include a proposal on what can be learned from the world's worst nuclear accident since the 1986 Chernobyl disaster.

During the process of the investigation, the panel has conducted hearings with hundreds of people involved in handling the crisis, including Masao Yoshida, who served as the chief of the plant until being relieved of the post recently due to illness.

Yoshida was quoted as telling the panel that there was a time when he feared that the vessels containing the crippled reactors may explode, making it impossible for workers to engage in restoration efforts and thus result in the release of radioactive substances far more than the actual amount.

"I saw hell," Yoshida was quoted by the sources as telling the panel.

The report comes after plant operator Tokyo Electric Power Co. defended itself in a separate report on its in-house investigation that the direct cause of the crisis was a larger-than-expected tsunami

that flooded key buildings after the March 11 earthquake.

Kyodo Press, December 8, 2011

<http://mdn.mainichi.jp/mdnnews/national/archive/news/2011/12/08/20111208p2g00m0dm014000c.html>

Emergency condensers could have saved Fukushima reactor from core meltdown

The core meltdown at the tsunami-crippled Fukushima No. 1 Nuclear Power Plant's No. 1 reactor would never have happened if emergency condensers had resumed operation within an hour of the tsunami's arrival, a nuclear safety agency has determined.

The Japan Nuclear Energy Safety Organization (JNES), an independent administrative agency under the jurisdiction of the Economy, Trade and Industry Ministry, found on Dec. 8 that the meltdown could have been averted through the prompt restarting of isolation condensers (IC).

The IC system is the only cooling system that can work even in the event of a power cut. However, the valves of the pipes connected to the IC systems were closed following the disaster, preventing the system from working properly, according to JNES. It is likely that a core meltdown could have been avoided if Tokyo Electric Power Co. (TEPCO), the operator of the troubled nuclear plant, had prepared measures to open the valves promptly.

JNES was commissioned by the Economy, Trade and Industry Ministry's Nuclear and Industrial Safety Agency (NISA) to conduct the analysis, and is set to release the results of its probe on Dec. 9.

After the March 11 tsunami struck the nuclear plant, the No. 1 reactor lost all power, which crippled its emergency core cooling system. The two IC systems for the No. 1 reactor were designed to close their valves in the event of a power outage to prevent any radioactive materials from leaking outside. While the IC systems had worked intermittently following the magnitude 9.0 earthquake on March 11, the valves remained closed after the tsunami, according to JNES's analysis.

At 6:18 p.m., about 2 hours and 40 minutes later, the valves opened with the restoration of reserve battery cells, allowing the IC systems to work for seven minutes. However, the IC systems were manually suspended by a plant worker who was concerned that the condensers could be short of cooling water. The IC systems finally resumed operations three hours later.

According to JNES's analysis, the reactor core, which had been covered with water, became exposed one hour after the IC systems stopped. The temperature inside the pressure vessel subsequently rose, generating hydrogen and lowering the IC systems' efficiency, which, as a result, made it difficult to avoid a core meltdown.

NISA estimates that a core meltdown had already started at 6:18 p.m. In order for TEPCO to restart the IC systems, it had been necessary for plant workers to rush to the scene and open the valves by hand, but the utility told the Mainichi, "It was impossible to immediately restore the IC systems by going into a pitch-dark site with high levels of radiation."

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<http://mdn.mainichi.jp/mdnnews/national/archive/news/2011/12/09/20111209p2a00m0na009000c.html>

