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World watches nervously as Japan struggles with nuclear reactors

(CNN) -- People across Japan and the world watched nervously Saturday as crews at a nuclear plant struck by an earthquake, a tsunami and then an explosion in the span of 36 hours resorted to drowning a feverish nuclear reactor in sea water in hopes of preventing a meltdown with potentially catastrophic implications.

An explosion that sent white smoke rising above the Fukushima Daiichi plant Saturday afternoon buckled the walls of a concrete building that surrounded one of the plant's nuclear reactors, but did not damage the reactor itself, Chief Cabinet Secretary Yukio Edano told reporters.

The explosion was caused, he said, by a failure in a pumping system as workers tried to prevent the reactor's temperature from racing out of control.

While Edano said radiation levels appeared to be falling after the explosion, the government nevertheless ordered an expanded evacuation of the area around the Daiichi plant, as well as a second facility where the cooling system had failed -- the Fukushima Daini plant.

Although government officials painted a hopeful picture, saying crews had begun implementing a backup plan to flood the reactor containment structure with sea water, a nuclear expert said the situation is dire even if it is already under control.

"If this accident stops right now it will already be one of the three worst accidents we have ever had at a nuclear power plant in the history of nuclear power," said Joseph Cirincione, an expert on nuclear materials and president of the U.S.-based Ploughshares Fund, a firm involved in security and peace funding.

If the effort to cool the nuclear fuel inside the reactor fails completely -- a scenario experts who have spoken to CNN say is unlikely -- the resulting release of radiation could cause enormous damage to the plant or release radiation into the atmosphere or water. That could lead to widespread cancer and other health problems, experts say.

Tens of thousands of people live within the evacuation zone around the Daiichi plant, which authorities expanded to 20 kilometers (12.6 miles) from the earlier 10 kilometer radius following the explosion. More than 51,000 of those live within 10 kilometers, according to Japan's Nuclear and Industrial Safety Agency.

A total of more than 83,000 live within 10 kilometers of the two plants under evacuation orders, the agency said.

Precise figures for the 20-kilometer zone were not immediately available.

Japanese authorities appeared to be preparing for the possibility of a nuclear release. Japan public broadcaster NHK reported the country's defense ministry had sent a unit that specializes in dealing with radioactive contamination to a command post near the stricken plant.

The government was also preparing to distribute iodine tablets to residents, the IAEA said. Iodine is commonly prescribed to help prevent the thyroid gland from taking in too much radioactivity, according to the U.S. Environmental Protection Agency website.

In all, the earthquake prompted the automatic shutdown of 10 reactors at three nuclear plants near the quake site, Japan's nuclear agency said. Problems have been reported at all three plants, although the fire reported Friday at the Onagawa nuclear plant was quickly extinguished and it has not been a focus of concern since.

At the Fukushima Daini plant, problems had been detected with the pressure and cooling systems at three of the four reactors that shut down, but plant owner Tokyo Electric Power Company reported all of the reactors were stable on Saturday.

Japan's nuclear agency said there is a strong possibility that the radioactive cesium the monitors detected was from the melting of a fuel rod at the plant, adding that engineers were continuing to cool the fuel rods by pumping water around them. Cesium is a byproduct of the nuclear fission process that occurs in nuclear plants.

A spokesman for the agency said atomic material had seeped out of one of the five nuclear reactors at the Daiichi plant, located about 160 miles (260 kilometers) north of Tokyo.

The problems at the Fukushima Daiichi plant began with the 8.9-magnitude quake that struck Friday off the eastern shore of Miyagi Prefecture. The quake forced the automatic shutdown of the plant's nuclear reactors and knocked out the main cooling system, according to the country's nuclear agency.

A tsunami wave resulting from the quake then washed over the site, knocking out backup generators that pumped water into the reactor containment unit to keep the nuclear fuel cool, according to the agency.

As pressure and temperatures rose inside the reactors at the Daiichi and Daini plants, authorities ordered the release of valves at the plants -- a move that experts said was likely done to release growing pressure inside as high temperatures caused water to boil and produce excess steam.

As crews were working to pump additional water into the reactor containment unit to bring the temperature down, the pumping system failed, Edano said, causing an explosion that injured four workers and brought down the walls of the building containing the reactor.

The team then reverted to a plan to flood the reactor with sea water, which Edano said would bring the temperature down to acceptable levels. That work began Saturday night and was expected to take two days, Edano said.

Before Edano's announcement, Malcolm Grimston, associate fellow for energy, environment and development at London's Chatham House, said the explosion indicated that "it's clearly a serious situation, but that in itself does not necessarily mean major (nuclear) contamination."

"This is a situation that has the potential for a nuclear catastrophe. It's basically a race against time, because what has happened is that plant operators have not been able to cool down the core of at least two reactors," said Robert Alvarez, a senior scholar at the Institute for Policy Studies in Washington.

The situation ranks as the third most serious nuclear accident on record, Cirincione said. He said only the 1971 partial meltdown of a reactor core at the Three Mile Island nuclear plant in Pennsylvania and the 1986 Chernobyl disaster in the Soviet Union were worse.

If damage from the explosions or continued aftershocks hitting Japan have compromised the structural integrity of the reactor complex, it could make efforts to cool the reactors more difficult, Cirincione said.

"The big unanswered question here is whether there's structural damage to this facility now," he said.

Janie Eudy told CNN that her 52-year-old husband, Joe, was working at the Fukushima Daini plant and was injured by falling and shattering glass when the quake struck. As he and others were planning to evacuate, at their managers' orders, the tsunami waves struck and washed buildings from the nearby town past the plant.

"To me, it sounded like hell on earth," she said, adding her husband -- a native of Pineville, Louisiana -- ultimately escaped.

Utility officials reported Saturday that more than 3 million households were without power, NHK reported, and that power shortages may occur due to damage at the company's facilities.

"We kindly ask our customers to cooperate with us in reducing usage of power," Tokyo Electric Power Company said.

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