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Fukushima Daiichi Status Report

28 June 2012

The IAEA issues regular status reports to the public on the current status of the Fukushima Daiichi Nuclear Power Plant, including information on environmental radiation monitoring, the status of workers, and current conditions on-site at the plant.

The information cited in this report is compiled from official Japanese sources, including the Ministry of Economy, Trade and Industry (METI), the Nuclear and Industrial Safety Agency (NISA), the Ministry of Education, Culture, Sports, Science and Technology (MEXT), the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), the Ministry of Health, Labour and Welfare (MHLW) and the Ministry of Foreign Affairs (MOFA) through the Japanese Permanent Mission in Vienna and the Cabinet's Office of the Prime Minister. Information is also provided by the Tokyo Electric Power Company (TEPCO), the operator of the Fukushima Daiichi Nuclear Power Plant.

Questions on the information provided in this report may be directed to info@iaea.org.

Release of Fukushima Accident Investigation Report

Previously TEPCO established the "*Fukushima Nuclear Accidents Investigation Committee*" and "*Nuclear Safety and Quality Assurance Meeting Accident Investigation Verification Committee*". In December 2011 they [released](#) an interim report on the accident.

On 20 June 2012 TEPCO [announced](#) the release of the "*Fukushima Nuclear Accidents Investigation Report*". This report was produced by these committees and is presented in 7 parts which include:

- Fukushima Nuclear Accidents Investigation Report: Main body (Summary)
- Fukushima Nuclear Accidents Investigation Report: Main body (Summary, Attachment)
- Fukushima Nuclear Accidents Investigation Report: Main body
- Fukushima Nuclear Accidents Investigation Report (Appendix-1) Statement of the Prime Minister's Office regarding decommissioning
- Fukushima Nuclear Accidents Investigation Report (Appendix-2) Schedule (Time series)
- Fukushima Nuclear Accidents Investigation Report (Attachment)
- Major changes made on the interim report issued on December 2, 2011

This report and its annexes are currently only available in Japanese. When English translations are released, the IAEA will provide links to the material.

Revised estimate amount of radionuclides released into the air and ocean due to the accident

On 24 May TEPCO [released](#) a report providing revised estimate radionuclide releases from the accident based on the information currently available. Four reports have been made available in English:

- "[Estimated Amount of Radioactive Materials Released into the Air as a Result of the Accident Occurred at Fukushima Daiichi Nuclear Power Station](#)"
- "[Estimated Amount of Radioactive Materials Released into the Ocean \(Near the Port\)](#)"
- "[Methods Used to Estimate the Radioactive Materials Released into the Air \[Outline\]](#)"
- "[Estimation Result of the Amount of Radioactive Materials Released into the Ocean \(Near the Port\)](#)"

A fifth report titled "[Estimated Amount of Radioactive Materials Released into the Air as a Result of the Accident Occurred at Fukushima Daiichi Nuclear Power Station](#)" has been made available in Japanese. Table 1 and Table 2 provide the revised estimate radionuclide releases in air and water made by TEPCO compared with those made by several other organizations.

Table 1: Estimate releases into the air from the accident in March 2011

	Released amount (PBq) ¹				
	Rare gas	I-131	Cs-134	Cs-137	I-131 equivalent (INES) ³
TEPCO	About 500	About 500	About 10	About 10	About 900
JAEA Nuclear Safety Commission (12 Apr 2011– 12 May 2011)	-	150	-	13	670
JAEA Nuclear Safety Commission (22 Aug 2011)	-	130	-	11	570
JAEA (6 March 2012)	-	120	-	9	480
NISA (12 April 2011)	-	130	-	6.1	370
NISA (6 June 2011)	-	160	18	15	770
NISA (16 February 2012)	-	150	-	8.2	480
IRSN (Institut de Radioprotection et de Sûreté Nucléaire)	2000	200	30		-
Accident at Chernobyl Nuclear Power Plant [Reference]	6500	1800	-	85	5200
¹ PBq = 1x10 ¹⁵ Bq ² The value estimated by TEPCO has been rounded off to one decimate place, being a figure in Bq at the time of being released. The value for rare gas is one equivalent to 0.5 MeV [<i>sic</i>] ³ I-131 equivalent is a value of an activity of released isotope(s) that shows relative significance to public health in comparison to iodine 131. I-131 was chosen as a reference isotope in INES ratings for large releases because it would generally be one of the more significant isotopes released. Eg. equivalence value of Cs-137 is 40 (i.e. 10 PBq of Cs-137 would be equivalent to 400 PBq of I-131)					

Table 2: Estimate releases into the sea from the accident in March 2011

	Period of assessment	Released amount in PBq ¹		
		I-131	Cs-134	Cs-137
TEPCO	26 March to 30 September ²	11	3.5	3.6
JAEA	21 March to 30 April ³	11.4	-	3.6
IRSN (Institut de Radioprotection et de Sûreté Nucléaire)	21 March to mid-July	-	-	27
¹ PBq = 1x10 ¹⁵ Bq ² The released amount from March 21, when the measurement of the concentration of radioactive materials in seawater near the water discharge canals was started, to March 25 was calculated tentatively to be about 0.1 PBq for 137Cs; the ratio of I-131 and Cs-137 suggests the predominance of release into the atmosphere. [sic] ³ Includes the releases into the atmosphere.				

Evaluation of the seismic evaluation of Spent Fuel Pool at of Unit 4

On 25 May NISA [released](#) a statement regarding the seismic safety evaluation of the Spent Fuel Pool of Unit 4. The following is an abridged quote of its statement:

“Regarding the seismic safety evaluation on the spent fuel pool in Unit 4 at TEPCO’s Fukushima Dai-ichi NPS, the Nuclear and Industrial Safety Agency (NISA), so far having implemented the evaluation using simulation reflecting damages and the like caused by hydrogen explosion and having heard opinions from experts, has confirmed that the reactor building has a seismic margin in terms of evaluation even if an earthquake (seismic intensity 6+) equivalent to the Tohoku District - Off the Pacific Ocean Earthquake occurs.” “Regarding the seismic safety of the reactor building of Unit 4, NISA considered that there was no immediate and serious effect because other outside walls were almost vertical and the entire building did not outstandingly tilt, etc. However, since more detailed status of the reactor building has become clear, NISA issued to TEPCO, as a precautionary measure, a direction under the name of Director General of NISA to re-examine and report the evaluation of integrity of the outside walls and the seismic safety of the entire reactor building after further detailed site confirmation.”

In May, the Government and TEPCO’s Mid-to-Long Term Countermeasures Meeting Management Council [released](#) a presentation titled “*The integrity evaluation of the reactor building at unit 4 in the Fukushima Daiichi nuclear power station*”. This presentation discusses the evaluation of the reactor building stability, summarizes the testing that has taken place thus far and discusses other work that has taken place recently at the Unit 4 Reactor Building (such as the clearing of debris from the roof).

On 30 May TEPCO [provided](#) a direct response on their website in response to media reports discussing potential leaking of water from the Unit 4 Spent Fuel Pool. The statement includes the quote that has been provided below and Figure 4 was also given to clarify the geometry of the Spent Fuel Pool.

“1. The SFP is made of reinforced concrete which has a thickness of approximately 140 - 185cm, lined with 6mm-thick stainless steel plate. The pool is supported by a steel and concrete structure, mostly isolated from the 4th and 5th floor walls of Unit 4 Reactor Building, which has been damaged by the explosion.

2. The pool water is circulated by injecting from the top of the pool and collecting the flooded water from the upper edge of the pool which is sent to the Skimmer Surge Tank*. There are no pipes or drainage holes that pass through the concrete structure of the pool, either on the side or at the bottom of the pool.

3. We continuously monitor the water level of the Skimmer Surge Tank*, adding the appropriate amount of water to the pool, the amount which evaporates from the surface of the pool. We could detect any water leakage as an abnormal water level fall at the Skimmer Surge Tank*, should the pipes get damaged. Furthermore, the pool itself is equipped with water leak detectors that lie inside the gap between the reinforced concrete and the stainless steel plate.

4. A backwater valve -which is not driven by motor, is installed in the pipe that injects water inside the pool. Should the pipe get damaged, the backwater valve shuts down automatically, preventing the pool water from flowing out.

5. The pool depth is approximately 11m, about 7m above the top of the 4m-long spent fuels. If the pool loses its cooling function by the stop of water circulation, it takes about 3 weeks for 5m-level amount of water to evaporate. It is possible to add water into the pool either by restarting circulation by making necessary repairs or by directly pouring water from the concrete pump vehicles which stand by at the station.”

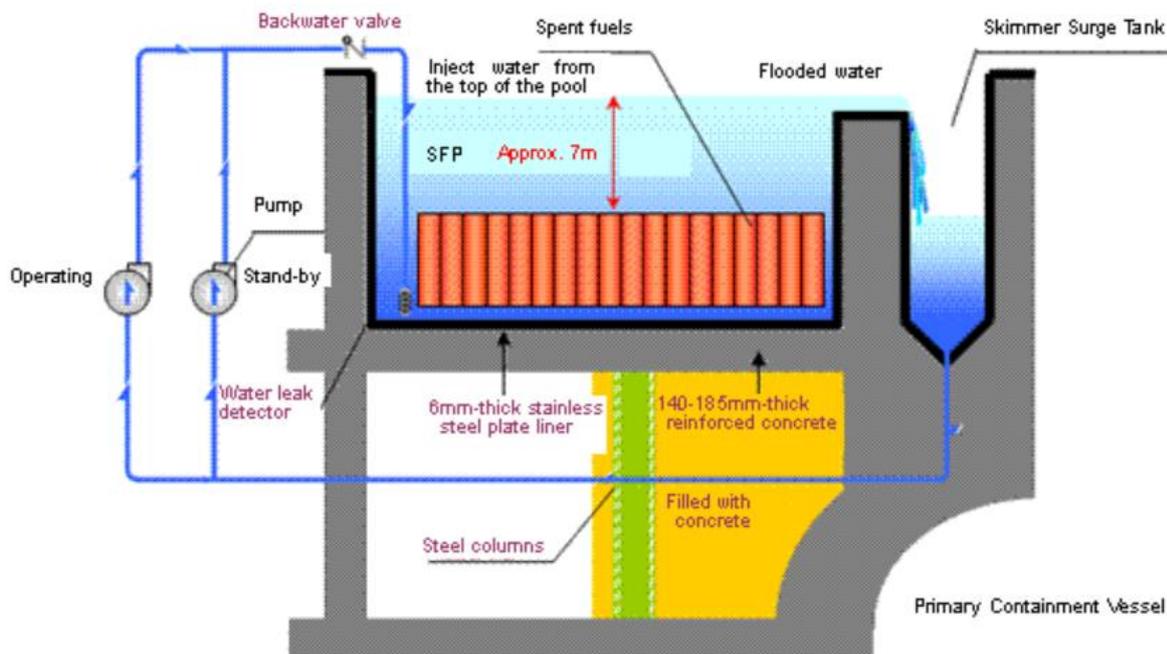


Figure 4: Cross section of the Unit 4 Spent Fuel Pool provided by TEPCO

What are the recent developments at the Fukushima Daiichi nuclear power plant?

The following section of the summary concentrates on the recent activities conducted in relation to the reactors at Fukushima Daiichi.

- On 8 May TEPCO [released](#) the latitude and longitude coordinates of more than 50 sea area monitoring locations

- On 14 May TEPCO [provided](#) information regarding planned improvements to the cesium adsorption apparatus that will be put in place by the end of June
- On 28 May TEPCO provided three series of high resolution videos and images captured during a tour of the site by the Minister of State for the Nuclear Power Policy (provided [here](#), [here](#) and [here](#))
- On 1 June TEPCO [submitted](#) to NISA a report on the reliability of the thermometers currently in use at Units 1-3. At this time this report is only available in Japanese.
- On 11 June TEPCO [released](#) results of a radionuclide analysis of air from the opening of the Unit 3 Waste Treatment Building
- On 12 June TEPCO [provided](#) images of their enhancement work for the cesium absorption apparatus
- On 20 June TEPCO [released](#) a document with the latest results from a radionuclide analysis of air from the openings at different buildings onsite
- On 25 June TEPCO [released](#) a document of images showing the current conditions onsite around the Daiichi Nuclear Power Plant. Higher resolution versions of these images are [available online](#).

Mid and long term roadmap updates

On 15 June 2012 the Nuclear Emergency Response Headquarters [released](#) an updated “Progress Status of Mid-and-long Term Roadmap towards the Decommissioning of Fukushima Daiichi Nuclear Power Units 1-4, TEPCO”. This document notes the following updates (many of which have been discussed in previous status summary updates):

- The start of engineering work for the installation of new thermometers into the Unit 2 RPV has begun with installation expected to take place in July
- A robot investigation into the TIP room of Unit 3 was limited due to damage to a door caused by an explosion. Based on a limited survey, no major damage was discovered to equipment (including guide tubes) in the TIP room.
- An investigation into the current state of the Unit 1 RPV is planned to take place at the end of August
- TEPCO is planning to reduce the volume of ground water going into the Reactor Buildings by lowering the ground water level in the area by pumping it upstream (primarily on the side of the buildings facing the mountains). This system is currently being designed with installation expected to take place in August
- To prevent leaks in the water purification system, work is in progress to replace the accumulated water transfer pipes with polyethylene pipes to improve reliability, externalizing [*sic*] the cesium absorption equipment (KURION), and to construct dams in the area of that equipment
- Preliminary drilling into the area off shore to determine the best location for installing steel pipes for the water shield wall is ongoing
- Rubble clearing work is currently taking place on the top of the Unit 3 and 4 Reactor Buildings
- An inspection of the Unit 4 Reactor Building (between 17-23 May) confirmed the following points: 1 - The Spent Fuel Pool is not slanted. 2 - There was bulging discovered on one wall due to the stress of the explosion but it is believed the building remains stable - analytical tests are ongoing to confirm this conclusion. 3 - There were no cracks greater than 1mm in the iron reinforcement bars. 4 - Non-

destructive testing confirmed that concrete strength has remained above the design strength required for the building

- Mock contamination and decontamination tests are scheduled to be performed in July to test decontamination methods
- Investigations are currently underway concerning existing technologies that could be used to detect leaks in the reactor PCVs
- Characterization tests for the long term storage of secondary waste are ongoing. In order to estimate the radioactive inventory included in secondary wastes water samples from the water treatment facilities have been transported to JAEA where analysis of the radioactivity density is being conducted according to each nuclide. Analysis of Co-60, Cs-137, Nb-94, Eu-152, Eu-154, and H-3 is completed, and C-14 has been partially analyzed; other nuclides are in progress.
- Sampling and analysis of collected debris onsite is currently planned to take place in June
- Job rotation of employees who have received 75 mSv of total radiological dose began in October 2011. Of the 300 persons who exceeded 75 mSv at the end of March 2012, 177 have been transferred in these job rotations as of 1 May.
- The current estimate dose to someone at the site boundary based on the current release rate of radioactive material is estimated to be 0.02 mSv/yr
- TEPCO currently estimates that the total current release rate of radioactive material (cesium) from the PVCs of Unit 1-3 is at most 0.01 Billion Bq/hour. This corresponds to 0.0003 Billion Bq/h at Unit 1, 0.0005 Billion Bq/h at Unit 2 and 0.0003 Billion Bq/h at Unit 3. Figure 5 shows the trend in the total release rate since July 2011.

Release rates of radio active materials (Cesium) from the PCVs of Units 1-3

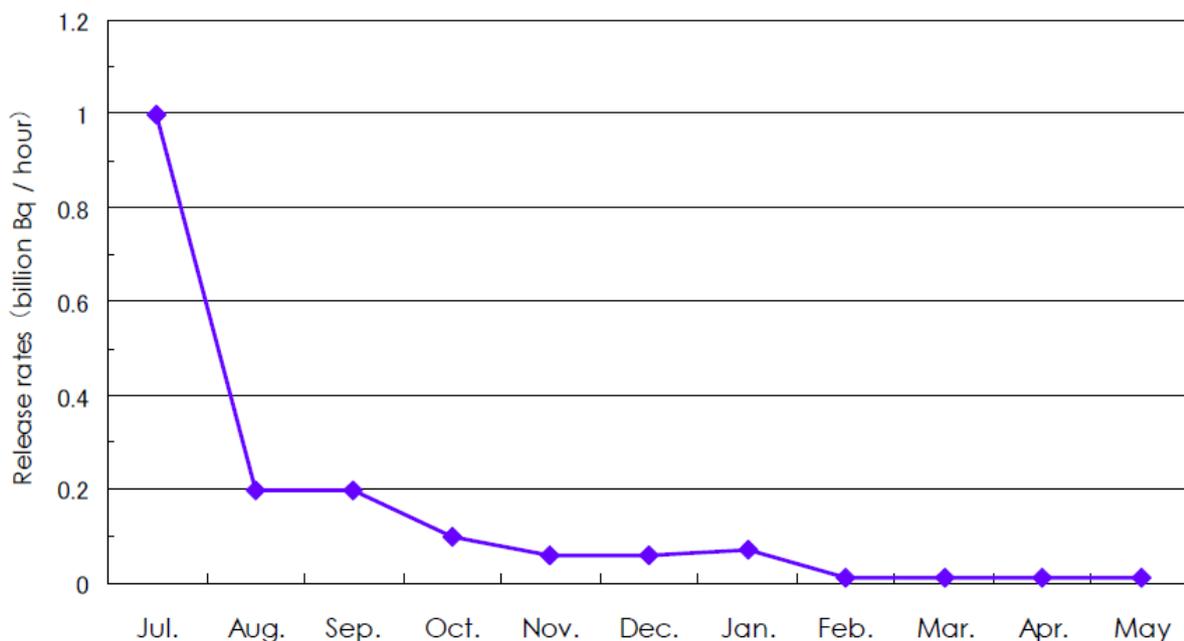


Figure 5: Monthly estimate total release rate of material from Units 1-3

Recent operations in Unit 2

On 15 June TEPCO [released](#) a document discussing an infrared inspection of the Unit 2 Torus room. The following conclusions were provided:

- “1. The water level in S/C (the border surface between the liquid phase and the gaseous phase) could not be confirmed.*
- 2. The temperature was higher in the upper part of S/C (Approx. 38°C) compared to other areas.*
- 3. The temperature of S/C upper part was higher compared to the Torus Room temperature (Approx.35°C).”*

IAEA comments on the infrared survey inside the Unit 2 Reactor Building

To clarify the purpose and potential advantages of the infrared survey in the Unit 2 Reactor Building we have assembled a brief analysis of the results provided by TEPCO. This discussion is based on the information openly available in English and if further information is released we will provide a more comprehensive statement if appropriate.

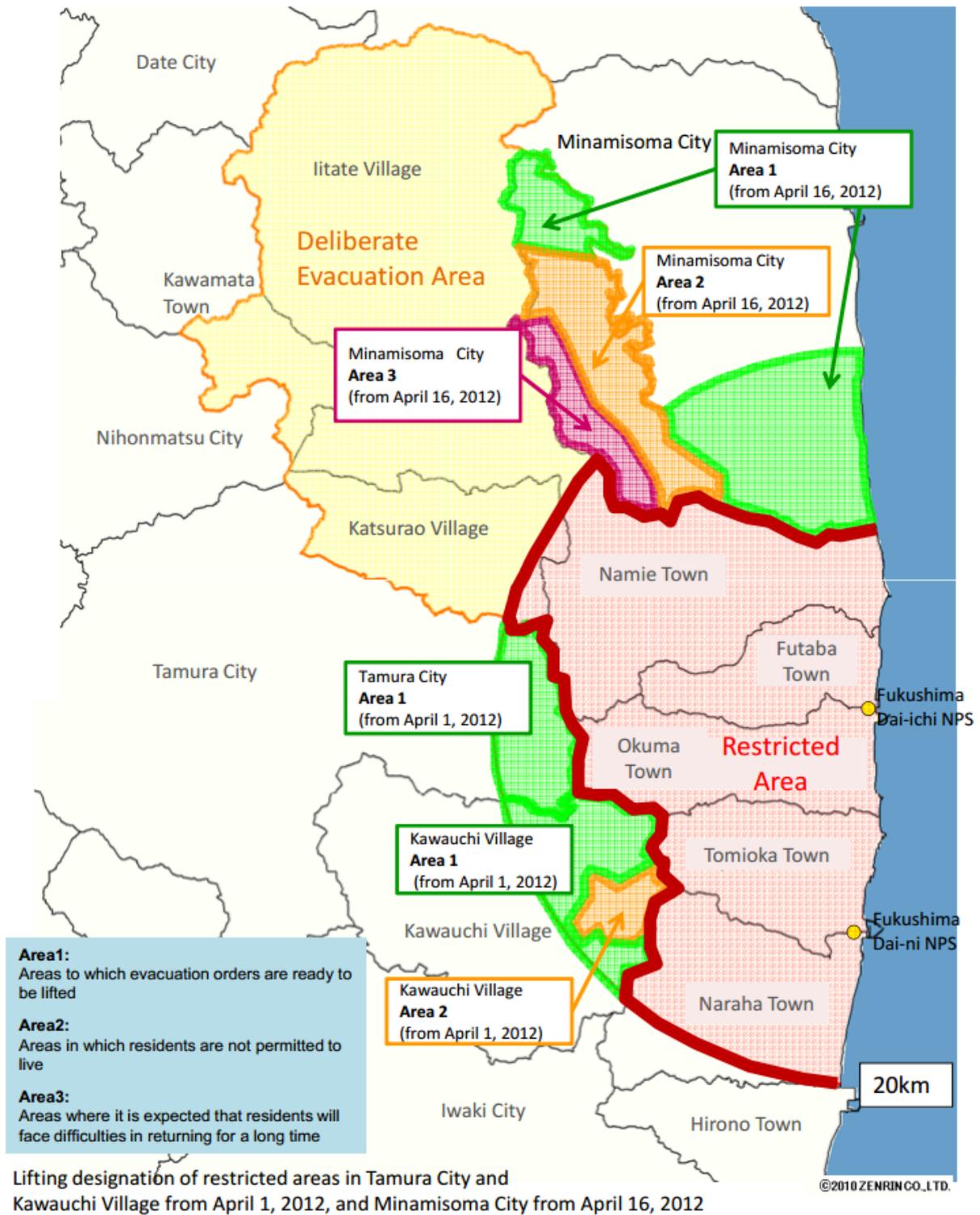
Regarding the infrared camera survey performed by TEPCO on 12 June 2012 in the Unit 2 Reactor Building, we can assume that heat producing sources are present in the water at the bottom of the suppression chamber. Presumably the mean temperature inside the suppression chamber is higher than that of the Torus room outside the Torus.

TEPCO reports that the temperature of the vapour space in the suppression chamber is higher than that of the water. This fact suggests that, within the suppression chamber, the vapour space may be connected somehow to the reactor atmosphere. If this is true, this can explain why the temperature in the upper part of the suppression chamber is influenced by the temperature of the vapour space in the reactor vessel and is therefore higher than the temperature of the liquid phase at the bottom of the suppression chamber.

The fact that the infrared method did not help determine the exact water level in the suppression chamber suggests that the temperature gradient in the suppression chamber in the vicinity of the water-vapour interface did not present a discontinuity clear enough to indicate the change of phase and hence the water level. Under these circumstances, it would be hard to determine the water level based on temperature mapping alone and TEPCO must be looking at different ways to determine the water level in the suppression chamber.

Current status of evacuation areas

On 30 March the Nuclear Emergency Response Headquarters [released a document](#) outlining the reclassification of some restricted areas and area in which evacuation orders have been issued. The reclassification of these areas has been conducted on the basis outlined in [this document](#). The figure below shows which areas have [changed designation](#) including which areas had their restrictions removed during the month of April.



Lifting designation of restricted areas in Tamura City and Kawauchi Village from April 1, 2012, and Minamisoma City from April 16, 2012

The previous map of evacuation areas is available in previous reports and [online](#).

What is the latest information regarding radiation monitoring of foodstuffs?

On 1 June TEPCO [provided results](#) and images from their analysis of fish and shellfish samples collected on 17 May 2012.

Food monitoring

Food monitoring data were reported on 28-31 May and 1, 4-8, 11-15, 18-22 June 2012 by the Ministry of Health, Labour and Welfare (MHLW) for a total of 18,299 samples collected from 45 different prefectures in Japan.

Analytical results for 18,059 (over 98%) of the 18,299 samples indicated that Cs-134 and Cs-137 were either not detected or were below the provisional regulation values or new standard limits for radionuclides (effective from 1 April 2012) set by the Japanese authorities. However, 240 samples were above the new standard limits for radionuclides Cs-134 and Cs-137.

Food restrictions

Updated information was reported by the MHLW on 29-31 May and 1, 4-8, 12, 13, 20 and 22 June 2012 placing restrictions on the distribution of:

- Log-grown shiitake (hothouse cultivation) produced in a certain area of Tochigi prefecture;
- Ocellate spot skate captured offshore of Ibaraki prefecture;
- Wild Japanese parsley produced in specific areas of Iwate prefecture;
- Olive flounder captured in Sendai bay of Miyagi prefecture;
- Japanese dace (excluding farmed fish) captured in certain rivers in Iwate and Tochigi prefectures;
- bamboo shoots produced in certain areas of Iwate and Tochigi prefectures;
- white-spotted char and Japanese dace captured in certain rivers in Fukushima prefecture;
- Ume produced in specific areas of Fukushima prefecture;
- Land-locked salmon (excluding farmed fish) captured in certain rivers in Fukushima prefecture;
- White-spotted char (excluding farmed fish) captured in certain rivers in Gunma, Miyagi and Tochigi prefectures;
- Fat greenling, flathead flounder, red tongue sole, Japanese sand lance (excluding juvenile sand lance), stone flounder, gold-eye rockfish, surfperch, brown hakeling, fox jacopever, black cow-tongue, black rockfish, Japanese black porgy, sea raven, ocellate spot skate, cherry salmon, poacher, rockfish (*Sebastes cheni*), Alaska Pollack, Japanese seabass, nibe croaker, starry flounder, slime flounder, panther puffer, olive flounder, gurnard, spotted halibut, conger eel, little-mouth flounder, marbled flounder, flathead, Pacific cod, spotted halibut, brassblotched rockfish, ridged-eye flounder, Venus clam and northern sea urchin captured in or offshore of Fukushima prefecture.

On 30 May, 1, 5 and 22 June 2012 the MHLW indicated the lifting of restrictions on the distribution of:

- Tea leaves produced in specific areas in Ibaraki and Tochigi prefectures, and;
- Juvenile Japanese sand lance fish landed at Fukushima prefecture.

A summary of the status of food restrictions reported since March 2011 is [available online](#).

The IAEA will continue to issues regular status reports to the public on the current status of the Fukushima Daiichi Nuclear Power Plant.

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