



IAEA

International Atomic Energy Agency

Atoms for Peace

Fukushima Daiichi Status Report

22 December 2011

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.

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

On 16 December the Government of Japan announced through the Nuclear Emergency Response Headquarters that all of the reactors at the Fukushima Daiichi Nuclear Power Station have been brought into a condition equivalent to “cold shutdown” (described in the Roadmap document). NISA provided the [following comment](#):

“The Nuclear Emergency Response Headquarters evaluated that the reactors at Fukushima Dai-ichi NPS, TEPCO, were brought to a condition equivalent to “cold shutdown” and, even if an unforeseeable incident occurs, the exposure dose at the site boundaries can be kept at a sufficiently low level as a result of evaluation of the securing of safety at nuclear reactor facility of Fukushima Dai-ichi NPS, TEPCO, at the completion phase of Step 2, stating that a safe condition has been achieved and the accident at the NPS itself has come to be settle. [sic]”

The latest [Roadmap document](#) states that the Government-TEPCO Integrated Response Office will be reorganized into a new body. This new body will develop the “Mid-to-long-term Roadmap towards the Decommissioning of Units 1 to 4 at Fukushima Daiichi Nuclear Power Station, TEPCO.” This document will address both onsite work and research and development towards new technologies that may be required during the decommissioning of the reactors.

The new organization and the Mid-to-long-term Roadmap will adopt the basic mission of “enabling evacuees to return to their homes and for all citizens to be able to secure a sound life.” The Government and TEPCO will continue efforts to achieve this goal.

In response to the announcement by the Government of Japan that the Units at the Fukushima Daiichi nuclear power plant have achieved cold shutdown condition and following an evaluation of the current situation from the point of view of the potential response activities, **the IAEA’s Incident and Emergency Centre (IEC) has decided to step down its activation level and resume normal-ready operational status effective 21 December 2011.**

The IAEA will release its next Fukushima Daiichi Status Report in late January 2012. Additional updates will follow on a monthly basis.

If at any point the radiological and/or nuclear safety situation changes in a significant way, the IAEA will assess and adjust its Status Report frequency as required to ensure prompt distribution of information.

Updated “Roadmap Towards Restoration” Document

On 16 December an updated version of the “Roadmap Towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station, TEPCO” [document was released](#). This document outlines in detail what TEPCO has achieved throughout the completion of Step 2 of its Roadmap.

The significant updates and changes that are mentioned in this updated document (many of which have been discussed in previous status reports) include the following:

- Nitrogen was injected directly into the pressure vessel of Units 1 and 3 on 30 November. Nitrogen was injected directly into the pressure vessel of Unit 2 on 1 December.
- On 6 December the hydrogen concentration in the Primary Containment Vessel (PCV) of Unit 2 was measured to be 0.5%.
- As of 16 December 29000 m³ of debris has been removed from the site. 6000 m³ of debris is being stored onsite in 900 containers.
- Test operation of the PCV gas control system for Unit 1 began on 14 December.

- The filter used in the PCV gas control system for Unit 2 was operating with a removal ratio of 1/14000 for airborne caesium.
- As of 29 November the evaporative concentration apparatus was lowering the chlorine concentration in water from 9000 ppm to below 1 ppm after processing.
- As of 12 December 135200 tons of processed water was being stored in tanks onsite.
- As of 13 December 189610 tons of accumulated water had been processed onsite. Of this amount, 80543 tons of this water has been recycled and used for cooling the reactors.
- The number of workers treated at the onsite emergency medical room has been 23 in July, 13 in August, 14 in September, 22 in October, 21 in November, and 3 in December (as of Dec. 6).
- On 6 December TEPCO submitted a report on the operation and management plans for its facilities based on a request by NISA for these plans related to 'Ensuring Mid-Term Safety'.
- Air sampling is still being used to determine the current release rates from each reactor Unit. The current caesium release rate from Unit 1, 2 and 3 is estimated to be 0.01 billion Bq/h, 0.01 billion Bq/h and 0.04 billion Bq/h respectively. The total release rate of caesium is 0.06 billion Bq/h which is 1/13000000th of the release rate at the time of the accident. [Note: this is the same release rate as in the previous month]
- The dose to a person at the site boundary is estimated to be 0.1 mSv/yr. [Note: This is the same as in the previous month]. Figure 1 shows the estimated annual dose to a person at the boundary of the site based on the calculated release rate of material from Units 1 – 3 from July onwards (1 calculation per month).

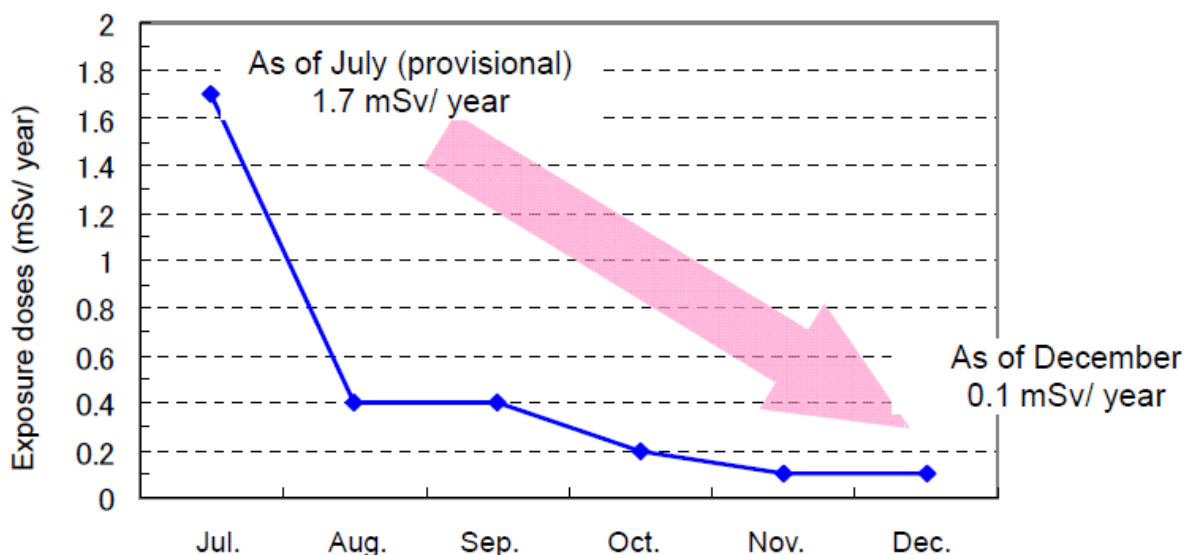


Figure 1: Estimate annual dose to a person at site boundary based on calculated release rate of caesium from the reactor (assumed maintained at that rate for 1 year)

Other new documents released with the updated Roadmap include a [summary of the progress of the roadmap](#), and two documents where the current progress is classified either by [issue](#) or [countermeasure](#).

“Mid and Long Term Roadmap Towards Decommissioning” Document

On 21 December METI released a new Roadmap [document](#) describing the decommissioning of the Fukushima Daiichi Nuclear Power Plant. This document was finalized during a meeting on 21 December between the Agency of Natural Resources and Energy (ANRE), METI, NISA and TEPCO.

Currently only a summary document is available in English. Figure 2 provides a summary of the items discussed in this new Roadmap document.

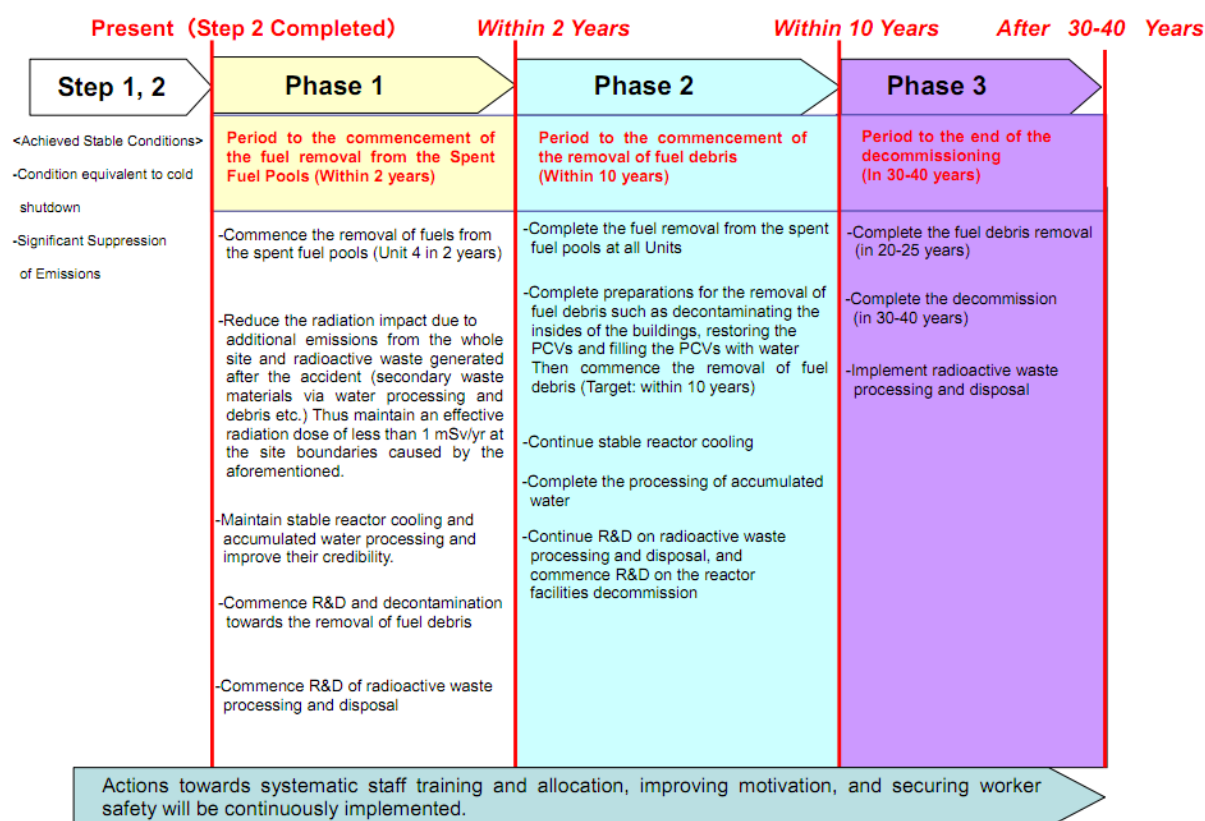


Figure 2: Summary of decommissioning Roadmap document

“The Concept of Securing Medium Term Safety” Document

On 3 October NISA gave to TEPCO [a document outlining](#) basic targets and requirements for securing safety at the facility until operations for reactor decommissioning begin following the completion of Step 2 from the Roadmap document. NISA requested that TEPCO submit a report on its safety assessment results as well as a facility operation plan to meet the targets specified in NISA’s document.

On 17 October TEPCO provided to NISA a report on the facility operation plan for equipment related to the circulating injection cooling system (which was one of the requirements for achieving the cold shutdown condition for the reactor units). TEPCO provided NISA revisions of this report on 9 November and 6 December. The latest material provided by TEPCO is [available online](#). (Please note this material is provided in Japanese only.)

NISA conducted an evaluation of the reports provided by TEPCO in coordination with subject matter experts to determine if TEPCO’s plans were reasonable to achieve the targets set by NISA. On 12 December NISA reported the results of their evaluation to the Nuclear Safety Commission. NISA made the following comment in their report:

“As a result of the evaluation, NISA has determined that TEPCO’s Facility Operation Plan is the measures necessary for achieving the following basic targets, and that its implementation as emergency measures is reasonable for securing the safety of the general public and workers.

- 1) To specify the source of the release of radioactive materials, take appropriate measures to suppress the release, and conduct monitoring (release suppression and management function)*
- 2) To appropriately remove decay heat in the RPV and the containments and in the spent fuel pools (cooling function)*
- 3) To prevent criticality in the RPV and the containments, and in the spent fuel pools (criticality prevention function)*
- 4) To appropriately detect, control and dispose of flammable gas (hydrogen explosion prevention function)*

NISA will request TEPCO to periodically report on the contents of the report submitted by TEPCO from now on, and, at the same time, directly check the operational situations, etc. on site.” [sic].

A [press release](#) and the [full report](#) of NISA’s results are available online.

Discovery of Accumulated Water in a Trench Outside

On 18 December an accumulation of water was [discovered](#) in a trench between the radioactive waste treatment facility and the building of the miscellaneous solid waste volume reduction facility at approximately 0100 UTC. Water was flowing into the trench from a cable conduit. It was [estimated](#) that 230 m³ of water had accumulated.

No radioactive material was detected in the sub-drain near the trench. An investigation is on-going.

On 19 December NISA responded to this discovery by directing TEPCO to do the following ([quoted](#)):

- “(1) to promptly transfer the water accumulated in the trench to the equipment that can appropriately manage the water;*
- (2) to investigate the inflow route of the water accumulated in the trench and to consider the water stoppage measures;*
- (3) to investigate the cause of the event that radioactive materials are contained in the water accumulated in the trench as well as to take recurrence prevention measures to prevent the water containing radioactive materials from flowing into the trench;*
- (4) to formulate and implement the patrolling visual inspection and checkup plan to check the existence of accumulated water containing radioactive materials in other trenches”*

Removal of contaminated rubble using remote controlled heavy machinery is still on-going.

Status of Cooling Water Flow, Temperatures and Pressure at Units 1, 2 and 3

TEPCO’s Fukushima Daiichi nuclear power plant station reactors 1, 2 and 3 require circulating water to remove heat from their fuel.

Plant operators have brought the reactors into a “cold shutdown condition” defined by TEPCO and the Nuclear Emergency Response Headquarters as:

- 1) Lowering the coolant water temperature to below 100 degrees centigrade while reducing the pressure inside the reactor vessels to the same as the outside air pressure, or 1 atmosphere (atm); and
- 2) Bringing release of radioactive materials from primary containment vessels under control and reducing the public radiation exposure by additional release (not to exceed 1 mSv/year at the site boundary as a target).

Indications	Measurement	Reactor		
		Unit 1	Unit 2	Unit 3
Water flow into the reactor ¹	Litres/hour	6400	8800	8900
Reactor vessel pressure	Atm	1.04	1.06	Downscale ²
Outer containment vessel pressure ³	Atm	1.07	1.10	1.02
Reactor vessel temperature (feed water nozzle) ⁴	°C	29.9	58.9	53.8
Reactor vessel temperature (at bottom of reactor) ⁵	°C	30.5	61.7	60.8
Suppression Pool Pressure ⁶	Atm	0.81	Below scale ⁷	1.86
Date/Time of Data Acquisition		21 Dec 03:00 UTC	21 Dec 03:00 UTC	21 Dec 03:00 UTC

Notes

1. Plant operators are pumping water into Unit 1 through one injection point and through two injections points in Units 2 and 3.
2. “Downscale” means the reading is below the lowest indication the instrument is capable of detecting. This is typically an indication that an instrument has failed.
3. The containment vessel completely surrounds the reactor vessel and support systems. It is designed to prevent the release of radioactive materials following an accident. Japanese plant operators are working to reduce the pressure in the containment vessel to 1 atmosphere, the same as the outside air pressure.
4. The temperature of the coolant water as it is pumped into the reactor vessels.
5. The temperature of the coolant water, measured at the bottom of the reactor vessel.
6. The suppression pool is designed to limit pressure in the containment vessel during an accident by condensing steam from the containment vessel. Japanese workers are aiming to get this pressure down to 1 atmosphere.
7. “Below scale” means the reading is below the lowest indication the instrument is capable of detecting. This is typically an indication that an instrument has failed.

Most recently reported temperatures in the Fukushima Daiichi Spent Fuel Pools

Spent fuel removed from a nuclear reactor is highly radioactive and generates intense heat. Nuclear plant operators typically store this material in pools of water that cool the fuel and shield the radioactivity. Water in a spent fuel pool is continuously cooled to remove heat produced by spent fuel assemblies.

According to IAEA experts, a typical spent fuel pool temperature is kept below 25 °C under normal operating conditions. The temperature of a spent fuel pool is maintained by constant cooling, which requires a constant power source.

Location	Water Temperature	
	Temperature °C	Date measured
Unit 1	11.0	21 December
Unit 2	18.2	21 December
Unit 3	12.9	21 December
Unit 4	20.0	21 December
Unit 5	16.5	21 December
Unit 6	16.0	21 December
Common Spent Fuel Pool	15.0	21 December

What are the latest developments regarding protective measures for the public?

On 16 December METI [released an updated version](#) of the “Roadmap for Immediate Actions for the Assistance of Residents Affected by the Nuclear Incident”. The main updates added to the document include the following points:

- As of 4 December 21267 households comprising 49743 people had been granted temporary to their homes via private car (in the second round of access).
- 377 vehicles have been retrieved as of 15 December (in the second round of access).
- As of 16 December the construction of 90% of the temporary housing units has been started (16226 units). Of the units that have begun construction 90% (15779 units) have been completed. These units are intended for those displaced by the tsunami as well as those evacuated.
- As of 7 December 2116 households have moved into new houses or been assigned new housing.
- As of 14 December 60 cattle remain in the Deliberate Evacuation Areas out of approximately 9300 heads subject to evacuation.
- On 14 December the ‘Order for Enforcement of the Act on Special Measures Concerning Handling of Radioactive Pollution’ was released.
- On 14 December the ‘Special Measures Concerning Handling of Radioactive Pollution’ was released.
- On 14 December the decontamination-related guideline which describes the decontamination measures, collection, transportation and soil removal procedures that are to be used was published.
- On 7 December the Japan Self-Defence Force in cooperation with the Ministry of the Environment started decontamination of the municipal offices of Naraha Town, Tomioka Town, Namie Town and Iitate Village. This will be the basis for full scale decontamination activities that are scheduled to begin in January 2012.
- A trial decontamination project which involves technologies from 25 companies (selected out of 305 applicants) has been under way since 7 November.
- The ‘Law for Special Zone for Reconstruction’ was enacted on 7 December.
- The ‘Act for Establishment of Reconstruction Agency’ was enacted on 9 December. The agency will be established by 11 March 2012.

- As of 1 December more than 230,000 people have been screened with contamination meters.
- As of 2 December there have been 63584 measurements made of tap water since March – only 69 cases exceeded regulatory limits. All of the cases that exceeded the regulatory limits were from samples taken before 20 March.
- On 25 November, additional Specific Spots Recommended for Evacuation were established at 13 spots (15 households) in Date City and 20 spots (22 households) in Minamisoma City. This brings the total Specific Spots Recommended for Evacuation in Date City to 117 spots (128 households) and in Minamisoma City to 142 spots (153 households).

The updated document also includes information released on job creation activities, support to small and medium sized businesses and financial assistance measures that have been and will continue to be given. A summary is also [available online](#).

Based on the '[Basic Approach for Reassessing Evacuation Areas](#)' the Nuclear Emergency Response Headquarters lifted the restriction of the 'Evacuation Prepared Areas in Case of an Emergency'. Current evacuation areas are shown in Figure 3.

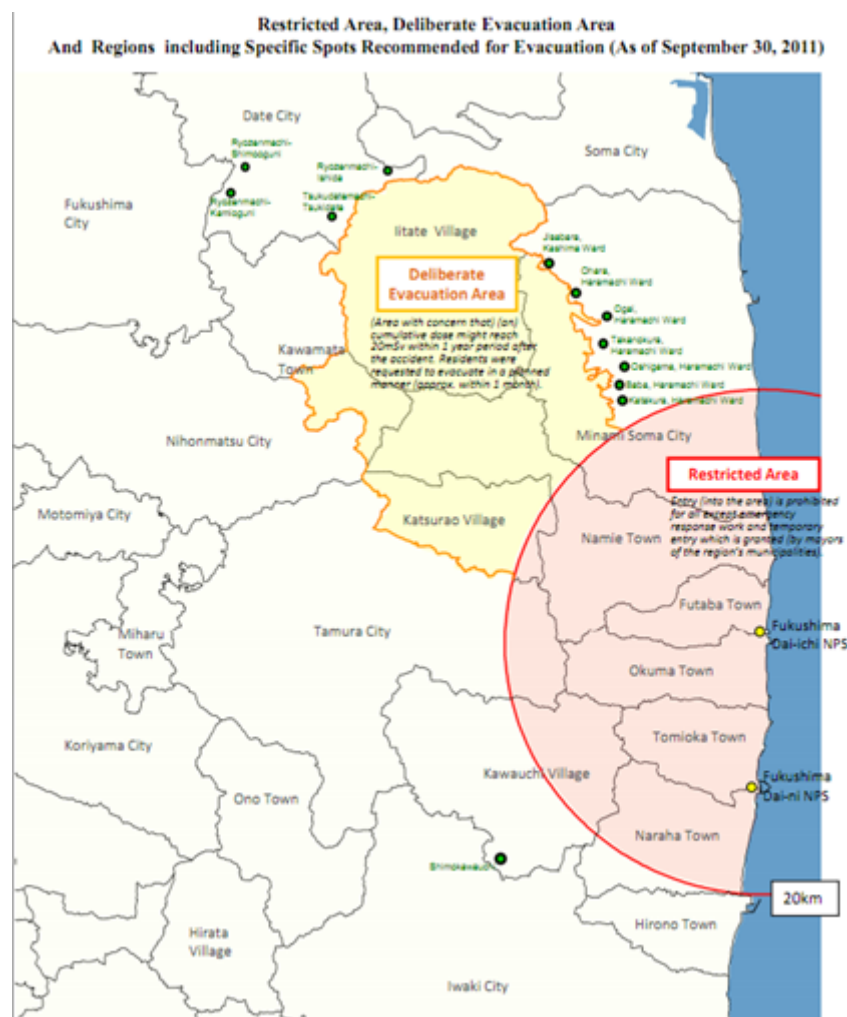


Figure 3: Current evacuation areas (as of 30 September)

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

What is the latest information regarding radiation monitoring of foodstuffs?

Food monitoring data were reported from 14-20 December 2011 by the [Ministry of Health, Labour and Welfare \(MHLW\)](#) for a total of 6590 samples collected on 5-7, 14, 17-19, 25 and 27-30 November, and 1-20 December in 40 different prefectures (Aichi, Akita, Aomori, Chiba, Ehime, Fukui, Fukushima, Gifu, Gunma, Hokkaido, Hyogo, Ibaraki, Ishikawa, Iwate, Kagawa, Kagoshima, Kanagawa, Kochi, Kumamoto, Kyoto, Mie, Miyagi, Nagano, Nara, Niigata, Oita, Okayama, Saga, Saitama, Shiga, Shimane, Shizuoka, Tochigi, Tokushima, Tokyo, Tottori, Toyama, Wakayama, Yamagata and Yamaguchi). Samples comprised school lunches, cereals and cereal products, dairy products (including formula milk), eggs, flowers, vegetables and vegetable products, fruit and fruit products, mushrooms, nuts, tea, meat and meat products, seafood, fish and fish products.

Analytical results for 6579 (over 99.5%) of the 6590 samples indicated that Caesium-134 (Cs-134) and Caesium-137 (Cs-137) or Iodine-131 (I-131) were either not detected or were below the regulation values set by the Japanese authorities. However, 11 samples were found to be above the regulation values for radioactive caesium (Cs-134 and Cs-137), as follows:

- As reported on 14 December, one sample of northern sea urchin collected on 11 December and seven samples of fish (common skate collected on 8 and 12 December, greenling, brown hakeling, fox jacopever, rock fish and spotbelly rockfish taken on 12 December) in Fukushima prefecture.
- As reported on 15 December, two samples of sika deer meat collected on 3 and 4 December from Tochigi prefecture.
- As reported on 19 December, one sample of beef taken on 18 December in Fukushima prefecture.

Updated information on food restrictions was reported by MHLW on 19 December indicating that restrictions were placed on the distribution of rice produced in specific parts of Fukushima prefecture during 2011.

Resources Available

TEPCO has posted a page on its [website](#) listing all of the video material it has posted between March and 30 September. These videos will remain available online until the end of December after which time they may be removed.

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

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