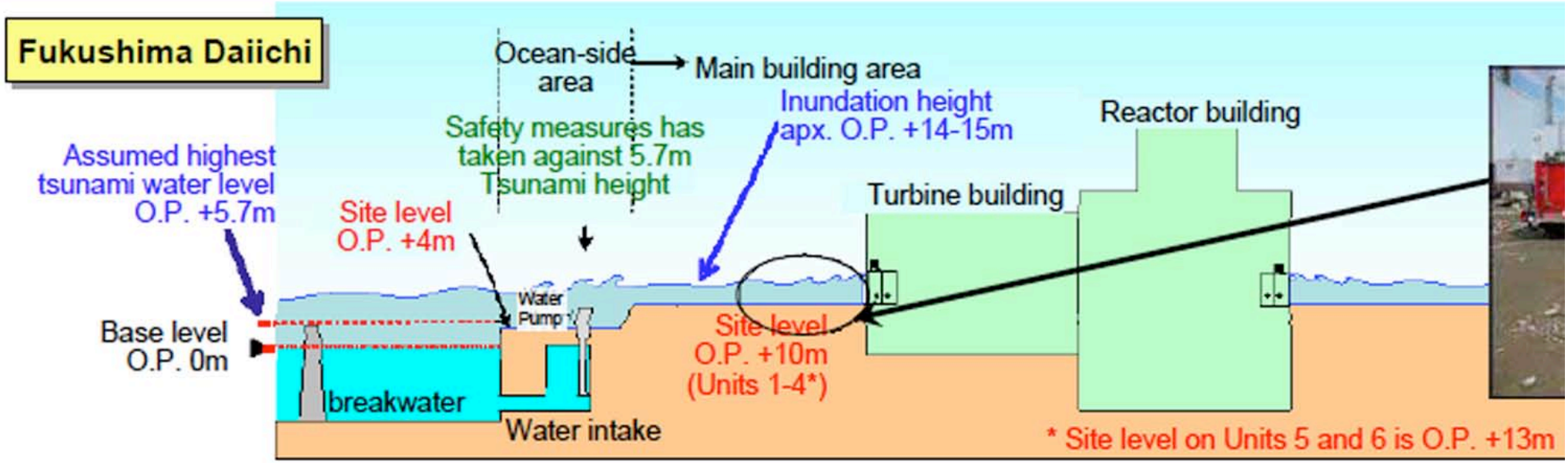
Ultime da Fukushima

Stato delle unità all'11 marzo

	Unità 1	Unità 2	Unità 3	Unità 4	Unità 5	Unità 6
potenza (MWe)	460	784	784	784	784	1100
tipo	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	BWR-5
entrata in funzione	1971	1974	1976	1978	1978	1979
moduli di combustibile nel nocciolo	400	548	548	0	548	764
moduli di combustibile esausto	292	587	514	1331	946	876
calore residuo nel combustibile esausto (kW)	60	400	200	2000	700	600
tipo di combustibile	LEU	LEU	LEU e MOX	LEU	LEU	LEU
stato	attivo	attivo	attivo	spento	spento	spento


Fukushima Daiichi
Ocean-side area
Main building area
Inundation height apx. O.P. +14-15m
Reactor building
Safety measures has taken against 5.7m Tsunami height
Assumed highest tsunami water level O.P. +5.7m
Site level O.P. +4m
Turbine building
Water Pump
Base level O.P. 0m
Site level O.P. +10m (Units 1-4*)
breakwater
Water intake
* Site level on Units 5 and 6 is O.P. +13m

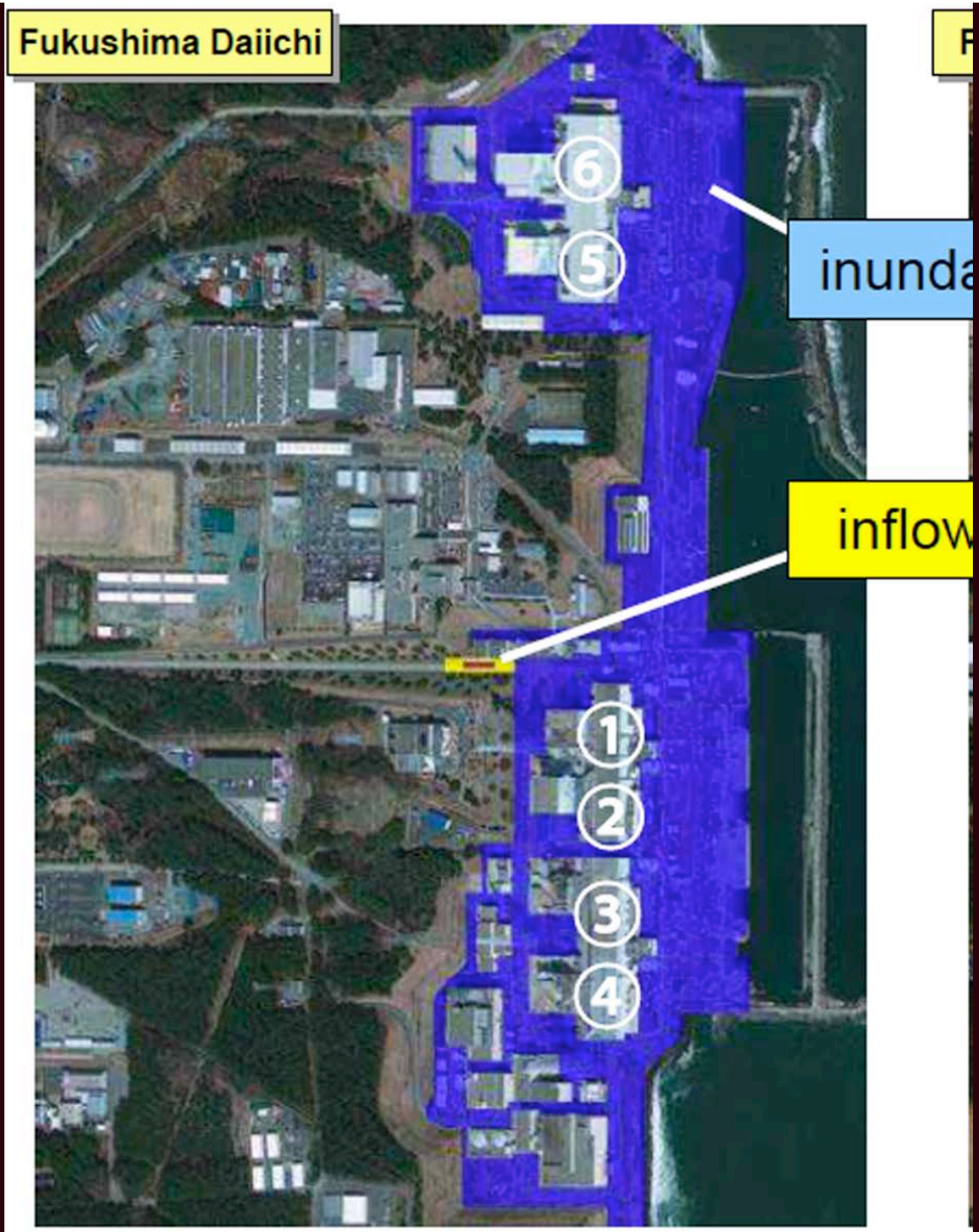

Fukushima Daiichi
6
5
inunda
inflow
1
2
3
4


Image Credit: DigitalGlobe
Image Annotation: ISIS
Image Date: March 14, 2011
Smoke or dust plume from the explosion
After the explosion at Unit 3, damage to the reactor building can be seen. Steam can be seen venting out of the reactor building
Steam venting out of the building
After the explosion at Unit 1, the top of the reactor building is damaged


Image Credit: DigitalGlobe - ISIS
Image Date: March 17, 2011
Roof of reactor building for Unit 4 appears different than in the March 16, 2011 image
Steam still venting from the top of Unit 3 reactor building
Steam likely still venting from side of Unit 2 reactor building
Reactor building for Unit 1; top portion of building damaged from explosion


Unit 1 reactor building; top portion damaged from earlier explosion
Unit 3 reactor building; steam is no longer visible venting from the building
Unit 4 reactor building
Unit 2 reactor building; steam can still be seen venting through a hole from removed panel
Image Credit: DigitalGlobe - ISIS
Image Date: March 18, 2011

On Thursday, 2 June 2011, the IAEA provided the following information on the status of nuclear safety in Japan:

Overall, the situation at the Fukushima Daiichi nuclear power plant remains very serious.

SF Pool | Reactor | Power Supply

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5-6	Common SF Pool

March 11, 14:46 **Earthquake**

11 Cooling by injecting fresh water

12th — 12 Start injecting sea water

13th — 13 Start injecting sea water

14th — 14 Start injecting sea water

17th — 17 Start watering (sea water, fresh water)

20th — 20 Start injecting sea water

21th — 20 Start watering (sea water, fresh water)

22th — 22 Power Center (P/C) energized from Offsite Power

23th — 23 Recover Main Control Room lighting

24th — 24 Recover Main Control Room lighting

25th — 25 Switch from sea water to fresh water

26th — 26 Recover Main Control Room lighting

27th — 26 Switch from sea water to fresh water

31st — 31 Start watering fresh water

29 Switch from sea water to fresh water

25 Switch from seawater to fresh water

29 Switch from seawater to fresh water

29 Recover Main Control Room lighting

30 Switch from sea water to fresh water

One D/G survived

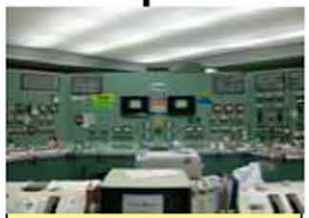
20 Reactor cooling shutdown

20~21 Switched from D/G to offsite power

21 Fresh water injection

24 Received electricity from offsite

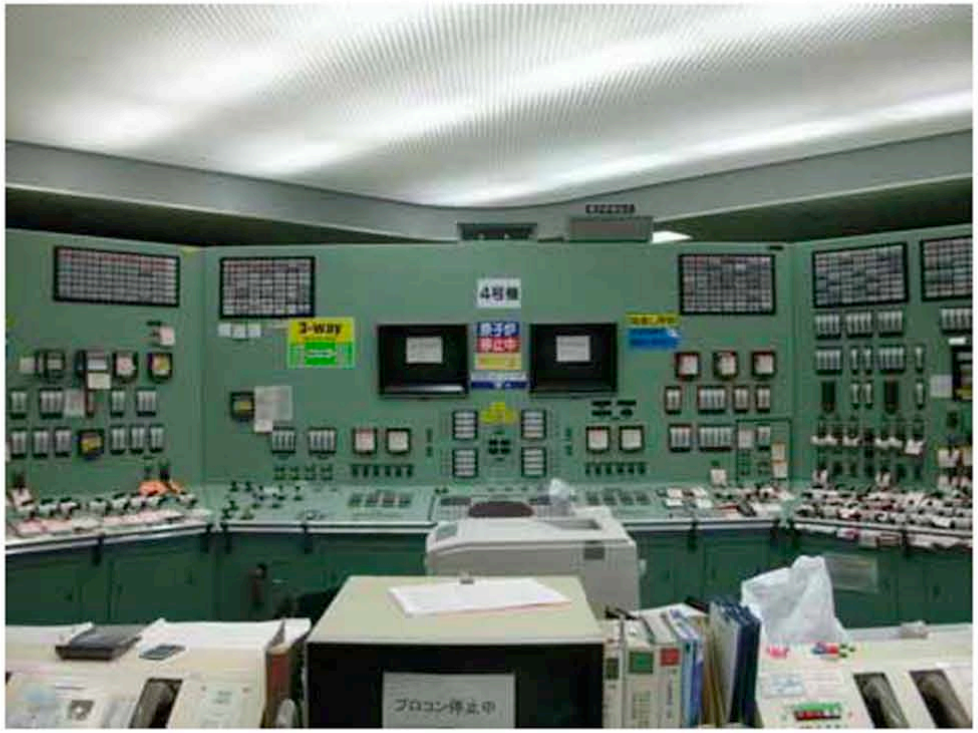
24 Start cooling by existing system



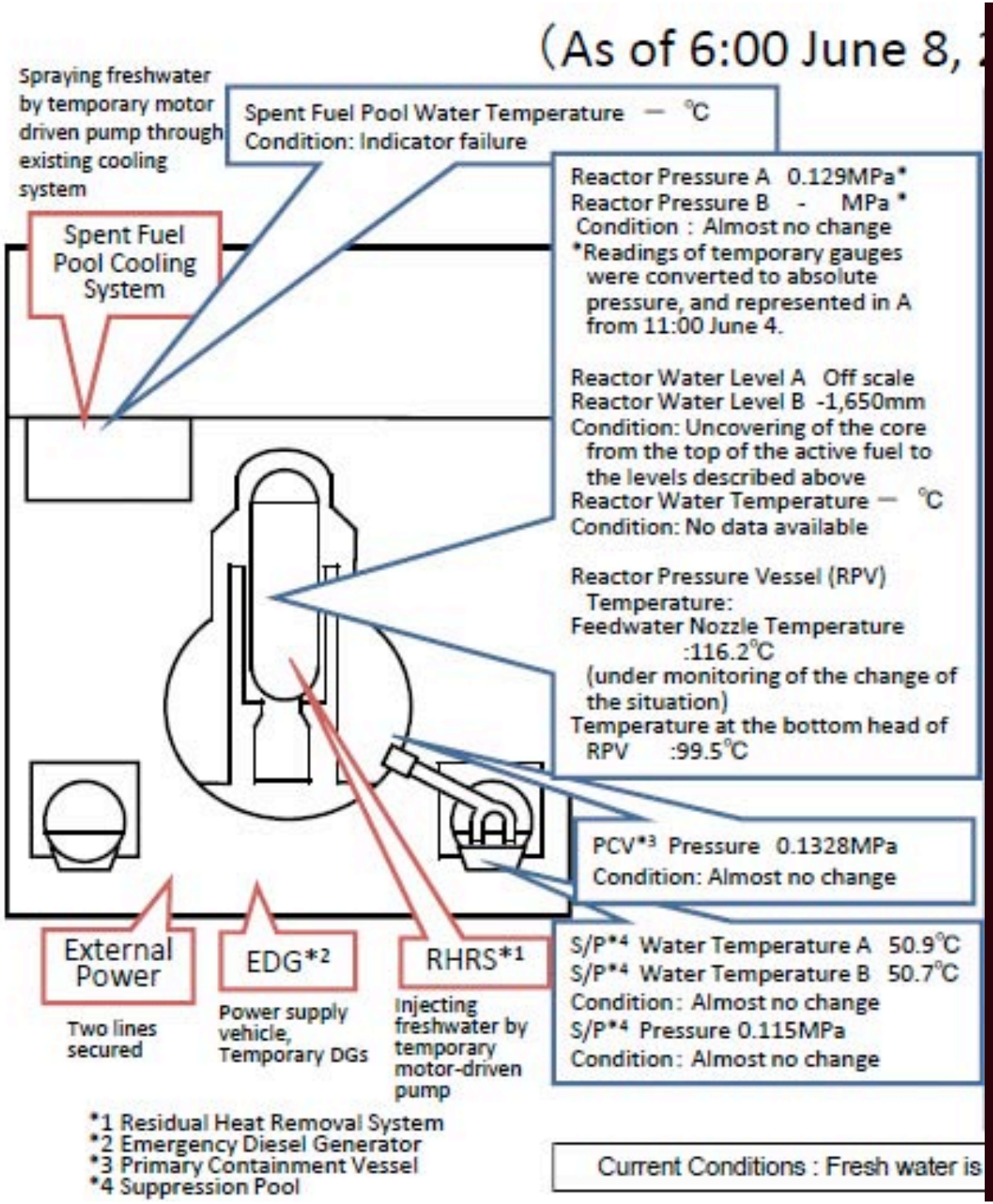
Recovery Status (Main Control Room)

- Main Control Room Power recovered as the first step of restoration
  - March 22 at 22:45 Unit 3 Main Control Room lights turned on
  - March 24 at 11:30 Unit 1 Main Control Room lights turned on
  - March 26 at 16:46 Unit 2 Main Control Room lights turned on
  - March 29 at 11:50 Unit 4 Main Control Room lights turned on

Unit 1 Main Control Room lights turned on



Unit 4 Main Control lights turned on


(As of 6:00 June 8,
Spraying freshwater by temporary motor driven pump through existing cooling system
Spent Fuel Pool Water Temperature — ℃
Condition: Indicator failure
Spent Fuel Pool Cooling System
Reactor Pressure A 0.129MPa*
Reactor Pressure B - MPa *
Condition : Almost no change
*Readings of temporary gauges were converted to absolute pressure, and represented in A from 11:00 June 4.
Reactor Water Level A Off scale
Reactor Water Level B -1,650mm
Condition: Uncovering of the core from the top of the active fuel to the levels described above
Reactor Water Temperature — ℃
Condition: No data available
Reactor Pressure Vessel (RPV) Temperature:
Feedwater Nozzle Temperature :116.2℃
(under monitoring of the change of the situation)
Temperature at the bottom head of RPV :99.5℃
PCV*3 Pressure 0.1328MPa
Condition: Almost no change
S/P*4 Water Temperature A 50.9℃
S/P*4 Water Temperature B 50.7℃
Condition: Almost no change
S/P*4 Pressure 0.115MPa
Condition: Almost no change
External Power
Two lines secured
EDG*2
Power supply vehicle, Temporary DGs
RHRS*1
Injecting freshwater by temporary motor-driven pump
*1 Residual Heat Removal System
*2 Emergency Diesel Generator
*3 Primary Containment Vessel
*4 Suppression Pool
Current Conditions : Fresh water is

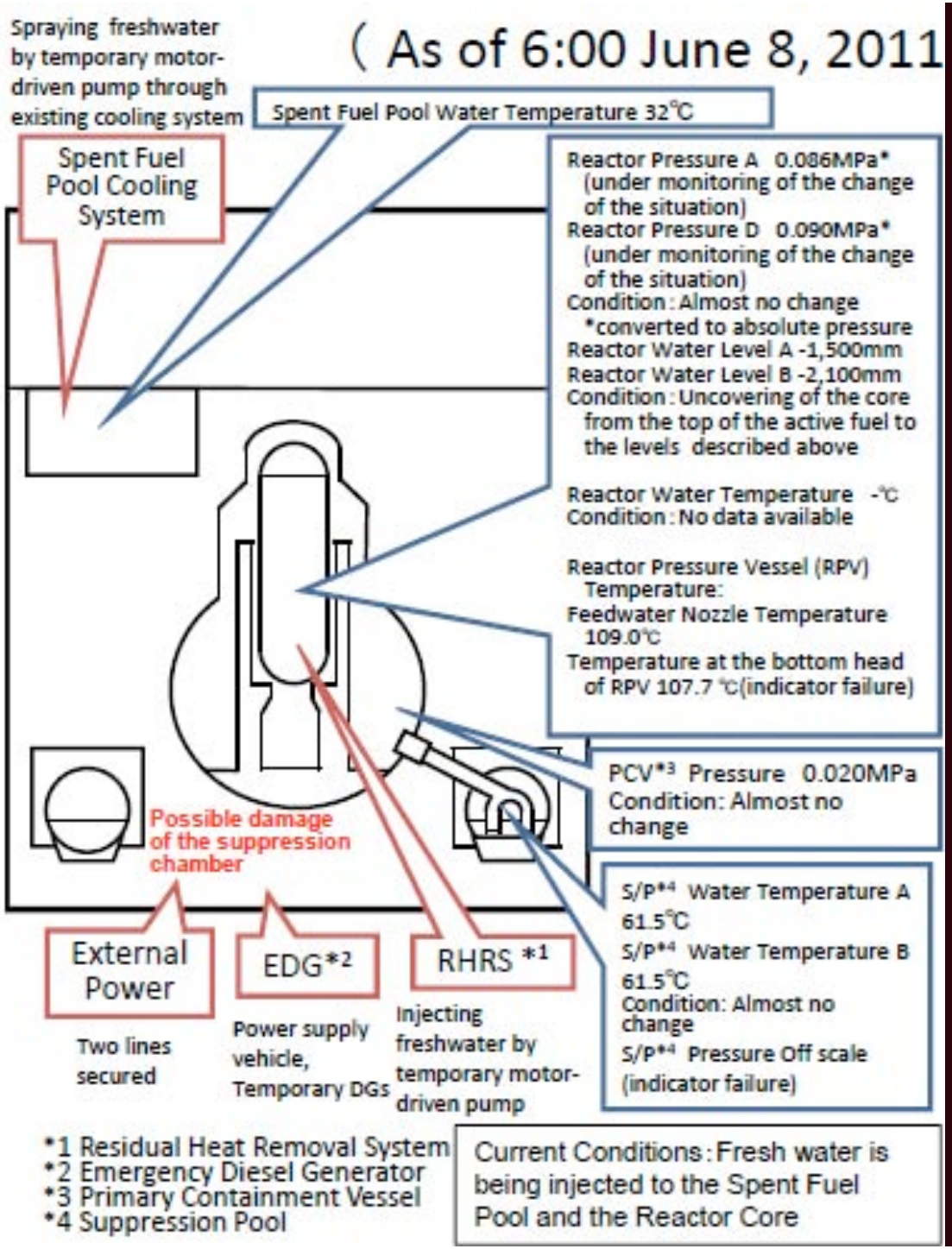
UNIT 1 - REACTOR: FUKUSHIMA DAIICHI NUCLEAR POWER PLANT:

ASSESSMENT OF STATUS IN TERMS OF FUNDAMENTAL SAFETY FUNCTIONS FOR ACHIEVING A SAFE STATE

May 31st 2011

	Necessary safety function and conditions	Observation	Evaluation of safe state	TEPCO Roadmap countermeasures
Control of Reactivity	Reactor is subcritical and sub-criticality is demonstrated and maintained	• No power spike or power increase • No significant neutron flux measured and reported • Short lived fission products (e.g. La-140) are not reported at present	**ACHIEVED** **Caution:** Continue detection of neutrons and short-lived isotopes. Continue the evaluation of need for Boron injection.	No additional countermeasures reported Boric acid injection is being considered by TEPCO
Residual heat removal	Stable cooling shall be assured: • Keep the coolant temperature sufficiently below the boiling point at atmospheric pressure • Cover the damaged core adequately with water • Off-site and back-up power supply shall be available • Achievement of long term closed-loop heat removal capability	• The rate of water injection into the reactor pressure vessel of Unit 1 was changed from 6 m3/h to 6,2 m3/h at 21:00 UTC 29 May. • Reactor vessel temperatures are: 112 °C at feedwater nozzle and 95.4 °C at the lower head. • Reactor pressure: (A) 6,66 atm / (B) 16.24 atm based on available measurements. • Changes in temperature and pressure are not significant. • In accordance with TEPCO information, after calibration of the reactor water level gauges, the actual water level in Unit 1 reactor pressure vessel has been lower than was indicated. The results of provisional analysis show that fuel pellets melted and fell to the bottom of the reactor pressure vessel. TEPCO also reported that leakage of cooling water from the reactor pressure vessel is likely to have occurred • Off-site power supply and backup power from portable diesel generators are available • Fresh water injection is provided; however, closed-loop heat removal is not yet established	**NOT ACHIEVED** Establishment of a long term closed-loop heat removal circuit is advised	Nos 1, 3, 4, 7, 8, 9, 13, 14, 16 and 17 Actions aimed to establish closed-loop cooling are in progress: 1.Installation of primary and secondary closed-loop cooling systems (planned for 31 May). No completion reported 2.Flooding of the containment to provide water supply for the primary system
Containment integrity	• Containment is leak-tight • Containment pressure maintained below design limits • Hydrogen explosion to be prevented	• Pressure in the primary containment vessel stabilized at about 1.29 atm which is well below the design operating pressure of 4.85 atm. • Nitrogen injection is maintained	**NOT ACHIEVED** **Caution:** • Pressure and H2 concentration of the containment to be further monitored • if the RPV is melted through, the containment integrity could be endangered	Nos 2, 6, 11 and 15
Confining radioactive material	• Reactor pressure vessel (including connected systems) should not leak; or if so the leakage shall be confined • Leakages from the containment should be prevented or controlled, or shall be confined	• Reactor pressure vessel is assumed to be leaking. The location of the leak is not clear as the level in the reactor is not known. It might be either the possible damaged bottom of the reactor or through the connected recirculation system • Exiting gap in pressure containment vessel is assumed (ongoing injection of nitrogen has not led to increase of pressure in pressure containment vessel) • TEPCO has reported on 15 May that leakage of cooling water from the reactor pressure vessel due to fuel pellets melted and fell down to the bottom of RPV is likely to have occurred and TEPCO considers that the actual damage to the reactor pressure vessel is limited, on the basis of the temperatures at present measured around the reactor pressure vessel.	**PARTIALLY ACHIEVED** **Caution:** • Radioactive releases including venting operations should be limited, controlled and monitored Among other parameters, indications of radiation monitoring system in the drywell should be followed to identify increase in the radioactivity level if the reactor is damaged at the bottom.	Nos 5, 10, 29–46, 50, 54 and 55 TEPCO has on 13 May commenced the preparatory work for the installation of a cover for the reactor building of Unit 1.
Limiting effects of releases	• No additional releases shall be anticipated • Radiation monitoring measurements shall be available	• Intermittent releases have been observed • Radiation monitors are available • Reactor pressure vessel and pressure containment vessel are assumed to be leaking. • Opening of the airlock in the reactor building did not lead to measurable increase in the releases to the environment	**PARTIALLY ACHIEVED** **Caution:** • Radioactive releases including venting operations should be limited, controlled and monitored	Nos 12, 47–49, 51–53, 55–63 In order to reduce air radiation levels inside the reactor building, a filtered air circulation system and system circulating outside air through the building have been installed

(As of 6:00 June 8, 2011



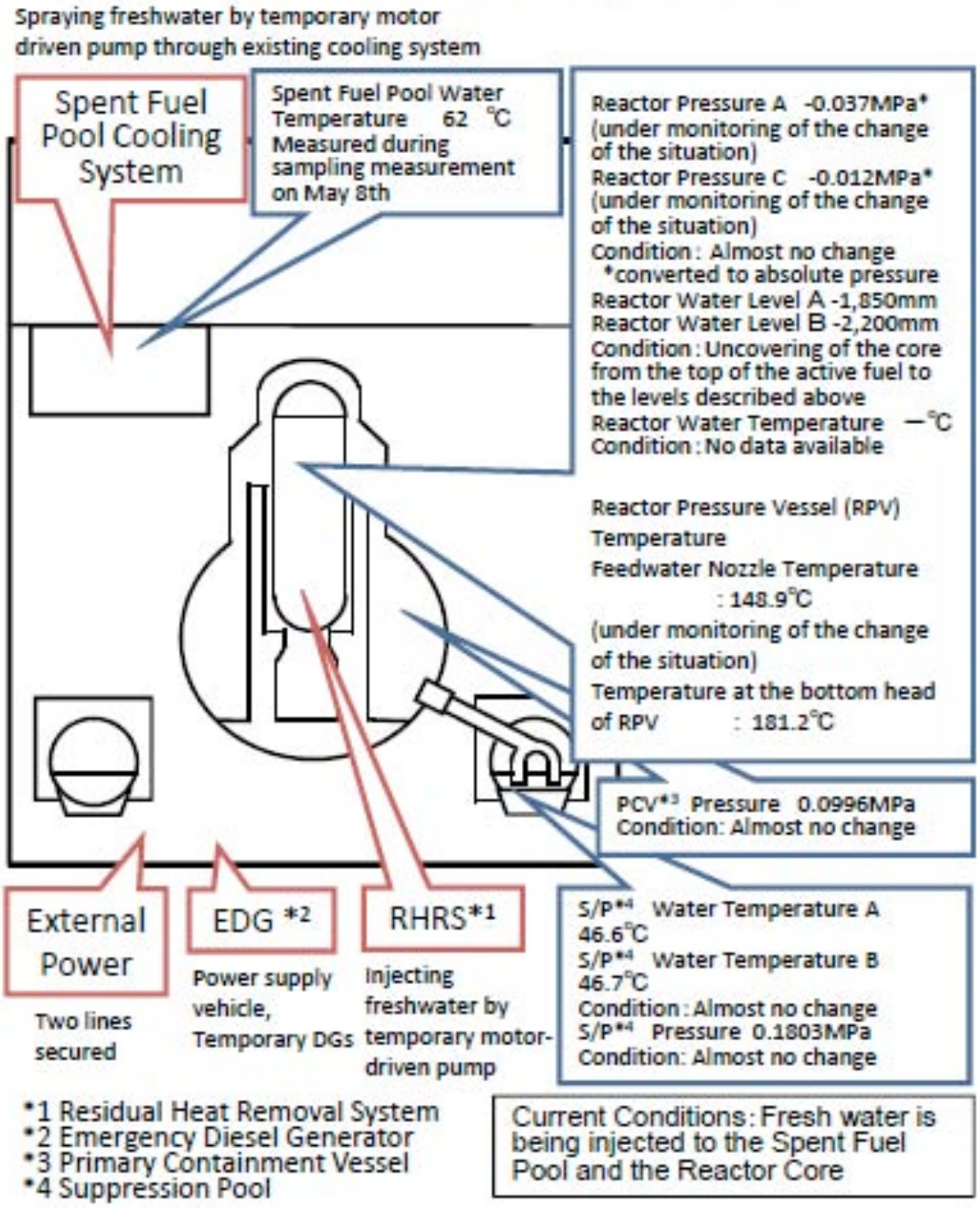
UNIT 2 - REACTOR: FUKUSHIMA DAIICHI NUCLEAR POWER PLANT:

ASSESSMENT OF STATUS IN TERMS OF FUNDAMENTAL SAFETY FUNCTIONS FOR ACHIEVING A SAFE STATE

May 31st 2011

	Necessary safety function and conditions	Observation	Evaluation of safe state	TEPCO Roadmap countermeasures
Control of Reactivity	Reactor is subcritical and sub-criticality is demonstrated and maintained	• No power spike or power increase • No significant neutron flux measured and reported • Short lived fission products are not reported at the moment (e.g. La-140)	**ACHIEVED** **Caution:** • Continue detection of neutrons and short-lived isotopes • Continue the evaluation of need for Boron injection	No additional countermeasures reported Boric acid injection is being considered by TEPCO
Residual heat removal	Stable cooling shall be assured • Keep the coolant temperature sufficiently below the boiling point at atmospheric pressure • Cover the damaged core adequately with water • Off-site and back-up power supply shall be available • Achievement of long term closed-loop heat removal capability	• Injection of fresh water into the RPV was changed from 7.0 m3/h to 5.0 m3/h at 21:00 UTC on 29 May. • Reactor vessel temperature is: (110.7 °C at feedwater nozzle, reactor pressure vessel pressure is around atmospheric based on available measurements) • Changes in temperature and pressure are not significant. • Water level of reactor core is below about -1500 mm (A) and -2100 mm (B) from the top of active core • Off-site power supply and backup power from portable diesel generators are available • Fresh water injection is provided; however, closed-loop heat removal is not yet established	**NOT ACHIEVED** Establishment of a long term closed-loop heat removal circuit is advised	Nos 1, 3, 4, 7, 8, 9, 13, 14, 16 and 17
Containment integrity	• Containment is leak-tightness • Containment pressure is maintained below design limits • Hydrogen explosion to be prevented.	• Containment is believed to be damaged: latest measurements show the containment pressure to be around atmospheric • Containment probably damaged following hydrogen explosion at this unit at 21:14 UTC on 14 March 2011	**NOT ACHIEVED** • Measures to make the containment leak-tight should be pursued • Pressure and H2 concentration of the containment to be further monitored • if the RPV is melted through, the containment integrity could be endangered	Nos 2, 6, 11 and 15
Confining radioactive material	• Reactor pressure vessel (including connected systems) should not leak; or if so the leakage shall be confined within allowable limits • Leakages from the containment should be prevented or controlled, or shall be confined	• Reactor pressure vessel is assumed to be leaking. The location of the leak is not clear as the level in the reactor is not known. It might be either the possible damaged bottom of the reactor or through the connected recirculation system • Containment is believed to be damaged: latest measurements show the containment pressure and reactor pressure vessel pressure to be around atmospheric	**NOT ACHIEVED** Construction of a cover above the reactor building has to be pursued Among other parameters, indications of radiation monitoring system in the drywell should be followed to identify increase in the radioactivity level if the rector is damaged at the bottom.	Nos 5, 10, 29–46, 50, 54 and 55
Limiting effects of releases	• No additional releases shall be anticipated • Radiation monitoring measurements shall be available	• Intermittent releases have been observed • Radiation monitors are available • White smoke has been observed but is no longer reported Samples of water in the turbine building floor area show high radioactivity releases from the reactor and the containment to the environment	**PARTIALLY ACHIEVED** Measures to prevent radioactive releases and leaking of water with high level radioactivity to the environment should be further pursued	Nos 12, 47–49, 51–53, 55–63 The transfer of stagnant water from the turbine building to the radioactive waste treatment facilities is continuing Work to block the trench pit to prevent release of water with high level radioactivity to the environment is continuing

（As of 6:00 June 8, 2011）



*1 Residual Heat Removal System
*2 Emergency Diesel Generator
*3 Primary Containment Vessel
*4 Suppression Pool

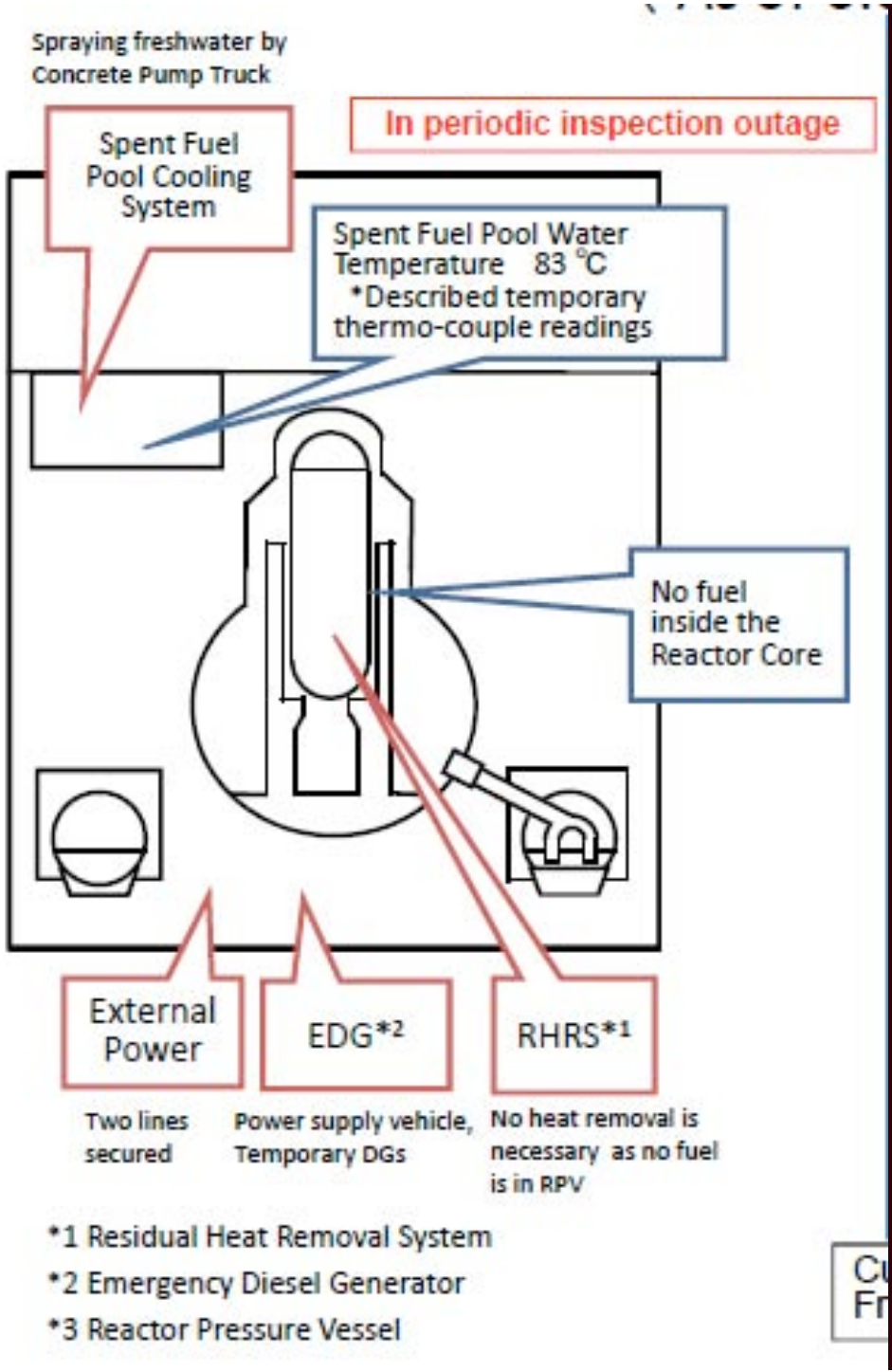
Current Conditions: Fresh water is being injected to the Spent Fuel Pool and the Reactor Core

UNIT 3 - REACTOR: FUKUSHIMA DAIICHI NUCLEAR POWER PLANT:

ASSESSMENT OF STATUS IN TERMS OF FUNDAMENTAL SAFETY FUNCTIONS FOR ACHIEVING A SAFE STATE

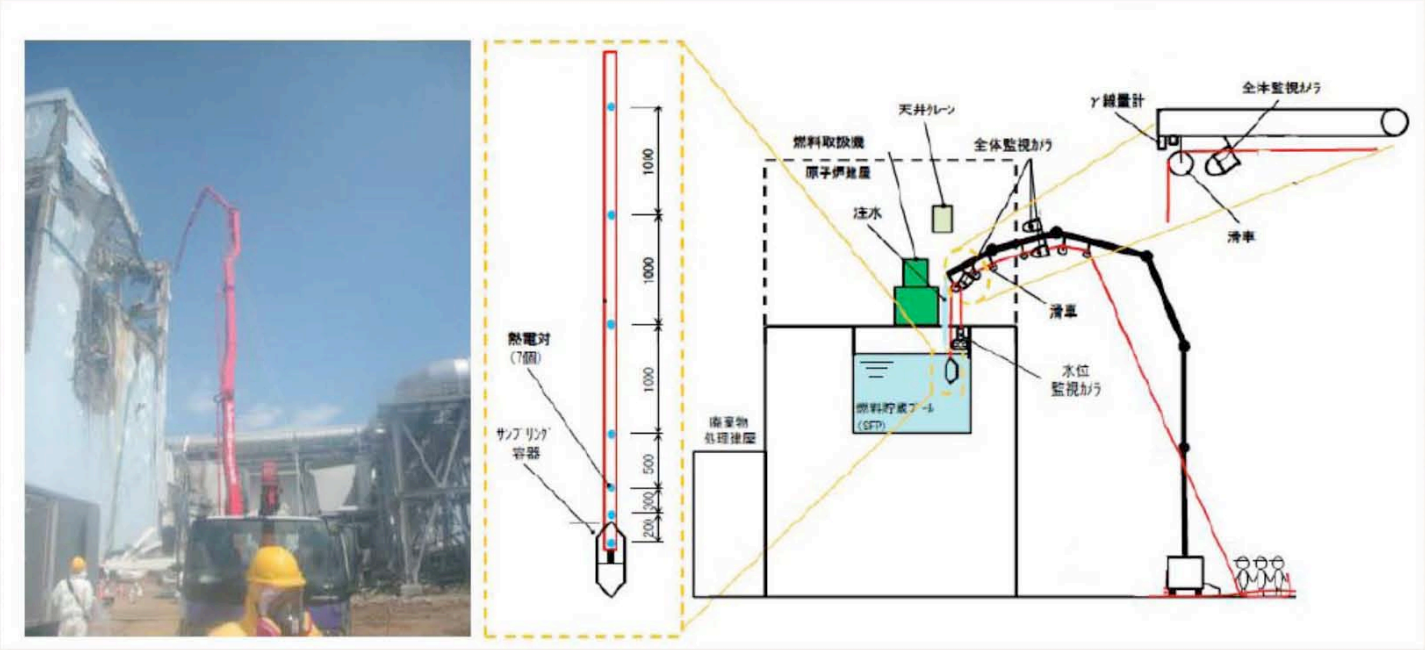
May 31st 2011

	Necessary safety function and conditions	Observation	Evaluation of safe state	TEPCO Roadmap countermeasures
Control of Reactivity	Reactor is subcritical and sub-criticality is demonstrated and maintained	• No power spike or power increase • No significant neutron flux measured and reported • Short lived fission products (e.g. La-140) are not reported at present	**ACHIEVED** **Caution:** • Continue detection of neutrons and short-lived isotopes • Continue the evaluation of need for boron injection	Boric acid was injected on May 15 as a precautionary measure to preclude criticality a condition
Residual heat removal	Stable cooling shall be assured: • Keep the coolant temperature sufficiently below the boiling point at atmospheric pressure • Cover the damaged core adequately with water • Off-site and back-up power supply shall be available • Achievement of long term closed-loop heat removal capability	• Stopped injection of fresh water through fire extinguishing lines on May 28, and injection through feedwater system at a rate of 13.5 m3/h (from May 30) • Increase in temperature have been measured: 122.4 °C on May 29 at the feedwater nozzle (104.6 °C on 22 May); 128 °C at the lower head on May 29 (114.6 °C on 18 May) • Reactor pressure vessel pressure and containment pressure reported are about atmospheric; however, the pressure measured on 29 May in the wet well is 1.84 atm, showing a slight decrease since May 22. • Off-site power supply and backup power from portable diesel generators are available • Fresh water injection is provided; however, closed-loop heat removal is not yet established	**NOT ACHIEVED** Establishment of a long term closed-loop heat removal circuit is advised.	Nos 1, 3, 4, 7, 8, 9, 13, 14, 16 and 17 Preparation for injection of water through the feedwater system is continuing: • The water from the condenser was transferred to the basement of the turbine building on 9 May
Containment integrity	• Containment is leak-tight • Containment pressure is maintained below design limits • Hydrogen explosion must be prevented	• The latest measurements show the reactor pressure vessel pressure and containment pressure to be around atmospheric pressure • On 20 March a sudden significant drop in pressure in the reactor pressure vessel and a decrease in the containment pressure occurred. The reasons for this are unknown. One possible explanation is a loss of containment integrity; however, the pressure in the containment was decreasing slowly and at present remains stable at around atmospheric. In addition water on the turbine building floor of Unit 3 does not show high level radioactivity • Images of Unit 3 showed a crack in the primary containment and steam being released from the reactor building	**NOT ACHIEVED** • Measures to make the containment leak-tight should be pursued • Pressure and H2 concentration of the containment to be further monitored • If the RPV is melted through, the containment integrity could be endangered.	Nos 2, 6, 11 and 15
Confining radioactive material	• Reactor pressure vessel (including connected systems) should not leak; or if so the leakage shall be confined • Leakages from the containment should be prevented, controlled or shall be confined	• Reactor pressure vessel is assumed to be leaking. The location of the leak is not clear as the level in the reactor is not known. • Containment is believed to be damaged; latest measurements show the containment pressure is about atmospheric pressure	**NOT ACHIEVED** Construction of a cover above the reactor building should be pursued Among other parameters, indications of radiation monitoring system in the drywell should be followed to identify increase in the radioactivity level if the rector is damaged at the bottom	Nos 5, 10, 29–46, 50, 54 and 55
Limiting effects of releases	• No additional releases shall be anticipated • Radiation monitoring measurements shall be available	• Intermittent releases have been observed • Radiation monitors are available • Reactor pressure vessel and pressure containment vessel are assumed to be leaking • White smoke has been observed but is no longer reported • Highly contaminated water flew out into the sea from a pit near the intake channel of Unit 3 (NISA report of May 23)	**PARTIALLY ACHIEVED** Measures to prevent radioactive releases should be further pursued	Nos 12, 47–49, 51–53, 55–63


Spraying freshwater by Concrete Pump Truck
In periodic inspection outage
Spent Fuel Pool Cooling System
Spent Fuel Pool Water Temperature 83 °C
*Described temporary thermo-couple readings
No fuel inside the Reactor Core
External Power
EDG*2
RHRS*1
Two lines secured
Power supply vehicle, Temporary DGs
No heat removal is necessary as no fuel is in RPV
*1 Residual Heat Removal System
*2 Emergency Diesel Generator
*3 Reactor Pressure Vessel

Spent fuel pool of Unit 4

- Total of about 160t of fresh water was sprayed again over the Spent Fuel Pool using a Concrete Pump Truck on May 27 and 28 (method shown the fig. below). Total of about 0.7 m3 of hydrazine was also injected during those days.
  - Periodical fresh water injection serves to reduce the SFP temperature. However cooling through a closed loop circulation must be pursued.



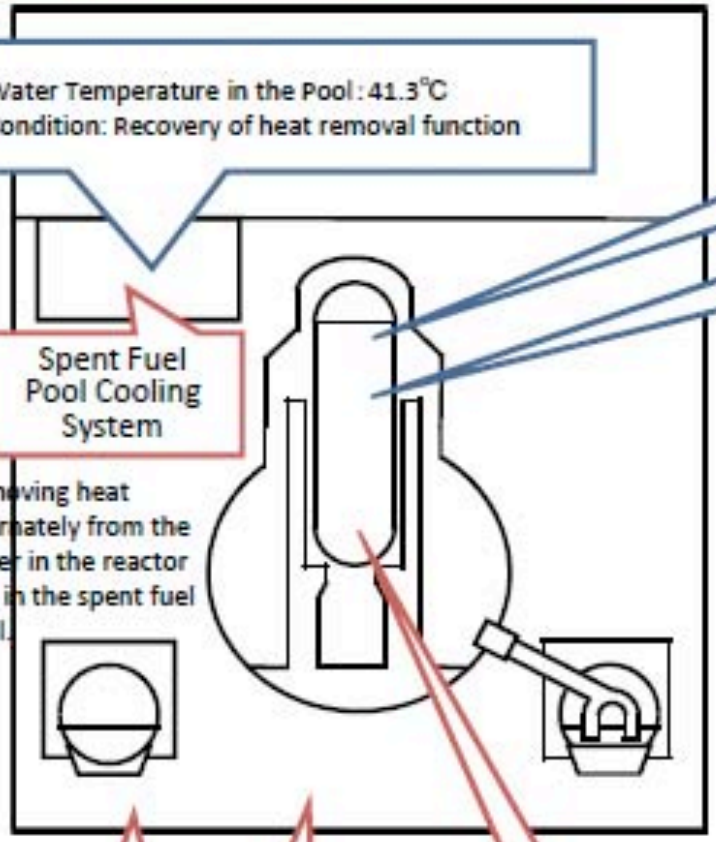
IAEA

In periodic inspection outage

Reactor Pressure : 0.109MPa*
Reactor Water Level : 1,778mm
Reactor Water Temperature 41.2℃
Condition : Pressure is under control.
*converted to absolute pressure

Water Temperature in the Pool : 41.3℃
Condition: Recovery of heat removal function

Reactor Pressure Vessel Temperature:
Monitoring by Reactor Water Temperature



Spent Fuel Pool Cooling System

Removing heat alternately from the water in the reactor and in the spent fuel pool.

External Power

One line secured

EDG*2

Share two EDGs of Unit 6

RHRS*1

Removing heat alternately from the water in the reactor and in the spent fuel pool.

*1 Residual Heat Removal System

*2 Emergency Diesel Generator

Major Events after the Earthquake :

March 20th 14:30 Cold shutdown

March 21st 11:36 Receiving electricity from external power supply

March 23rd 17:24 Pump for Residual Heat Removal Seawater System (RHRS) was automatically stopped when the power supply was switched from the temporary to the permanent.

March 24th 16:14 Repair of the RHRS pump was completed.

March 24th 16:35 Started to cooling.

April 4th 21:00 – 8th 12:14 Discharged the groundwater with low-level radioactivity in the Sub Drain Pit to the sea (around 950 ton).

April 25th 12:22 ～16:43 For reinforcement work of the power supply, the pump for Residual Heat Removal (RHR) was temporarily stopped.

April 25th 14:44～17:38 Implemented reinforcement work of the power supply (connection of the power supplies between Units 1-2 and Units 5-6).

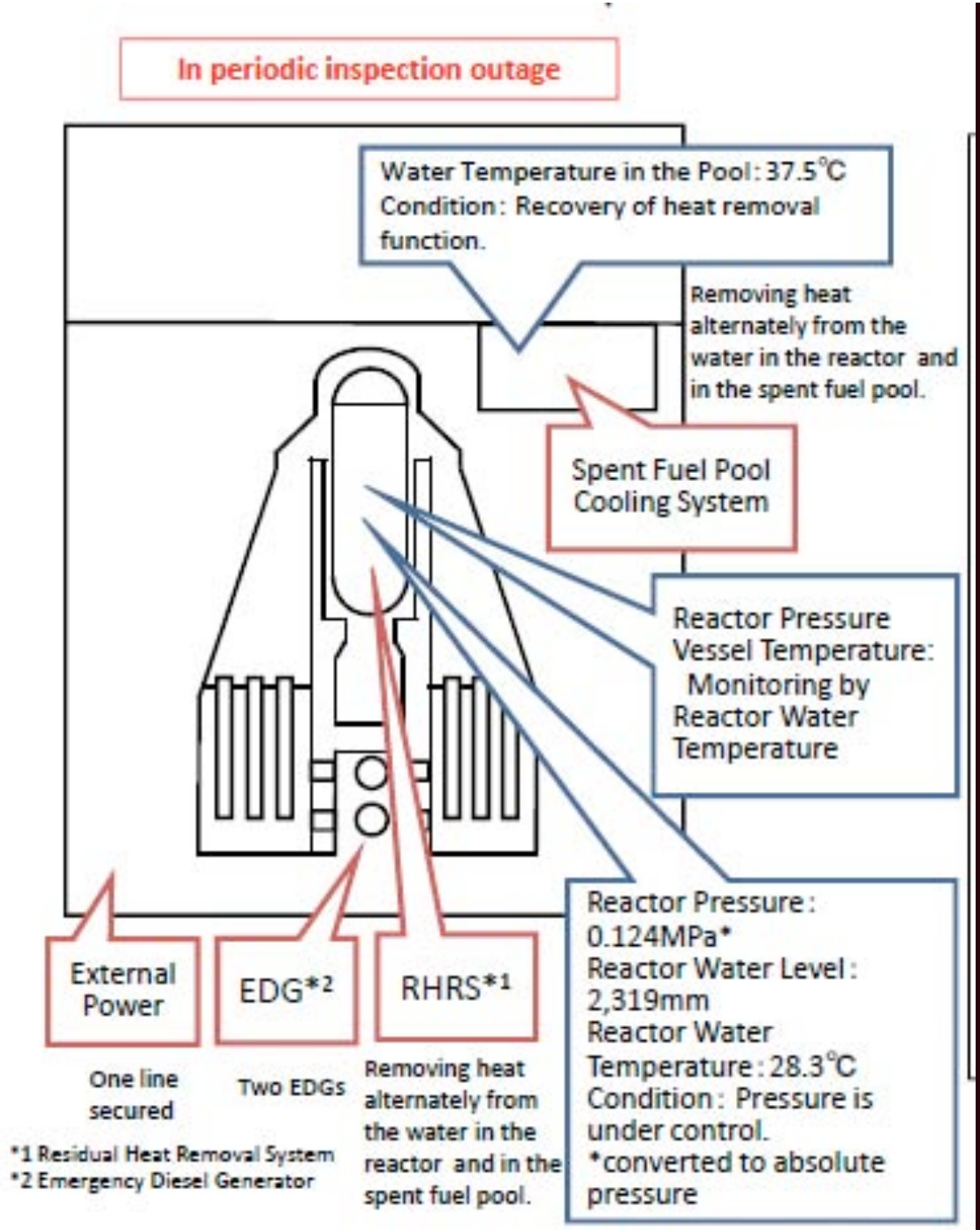
May 2nd 13:30 ～15:03 The pump for RHR was temporarily shut off in order to test the Start-up Transformer for power reception.

May 28th around 21:14 Confirmed shutdown of the RHRS pump

May 29th 08:12 Started to replace with the temporary RHRS Spare Pump

May 29th 12:31 Started the RHRS Pump

May 29th 12:49 Started to cool the Reactor Core by RHR


In periodic inspection outage
Water Temperature in the Pool : 37.5°C
Condition : Recovery of heat removal function.
Removing heat alternately from the water in the reactor and in the spent fuel pool.
Spent Fuel Pool Cooling System
Reactor Pressure Vessel Temperature: Monitoring by Reactor Water Temperature
Reactor Pressure : 0.124MPa*
Reactor Water Level : 2,319mm
Reactor Water Temperature : 28.3°C
Condition : Pressure is under control.
*converted to absolute pressure
External Power
EDG*2
RHRS*1
One line secured
Two EDGs
Removing heat alternately from the water in the reactor and in the spent fuel pool.
*1 Residual Heat Removal System
*2 Emergency Diesel Generator

Stato al 10 maggio delle Unità 1, 2 e 3

- il combustibile è danneggiato in vario grado e con insufficiente copertura acquea
- il combustibile è confinato
- prodotti di fissione volatili sono stati emessi nella ventilazione e alcuni solubili fuoriescono con l'acqua dall'Unità 2
- il raffreddamento è ancora fornito da sorgenti esterne
- il collegamento elettrico non è ancora ripristinato
- nell'Unità 1 è altamente probabile la fusione del nocciolo
- la temperatura nell'Unità 3 sta salendo
- l'edificio turbine è ancora allagato da acqua radioattiva

Reactor summary to June 8:

Major fuel melting occurred early on in all three units, though the fuel remains essentially contained except for some volatile fission products vented early on, or released from unit 2 in mid March, and some soluble ones which are leaking with the water, especially from unit 2, where the containment is evidently breached. Cooling still needs to be provided from external sources, using fresh water and pump trucks, while work continues to establish a stable heat removal path to external heat sinks. Temperatures and pressures remain stable. Radioactive water in the turbine buildings is hampering work. NISA and NSC said it could take months to repair or reconstruct the cooling systems to bring them to cold shutdown due to the amount of contaminated water in the turbine buildings.

Reactor summary to June 8:

NISA said in June that it estimated that 800-1000 kg of hydrogen had been produced in each of the units. Nitrogen gas is still being injected into the containment vessel in unit to reduce the possibility of hydrogen combustion inside the containment vessel.
Access has been gained to all three reactor buildings, but dose rates remain high inside.
On 13 May TEPCO commenced the preparatory work for the installation of a cover for the reactor building of unit 1. The reactor building cover will be installed as an emergency measure to prevent the dispersion of radioactive substances until mid- to long term measures, including radiation shielding, are implemented.

Stato al 10 maggio delle vasche di stoccaggio

- il combustibile è danneggiato in vario grado e con insufficiente copertura acquea
- i sistemi di raffreddamento per le Unità 1-4 non funzionano
- continua il versamento di acqua dall'esterno
- problemi di stabilità per la vasca dell'Unità 4 per le gravi condizioni dell'edificio
- la vasca centrale ha recuperato sistema di raffreddamanto il 24 marzo

Spent fuel ponds summary to June 8:

Spent fuel ponds in units 3 & 4 still need to be topped up repeatedly, with some use of internal plumbing for units 2 & 3 and by concrete pump with boom for unit 4. The pond heat exchangers for units 1, 3 & 4 are very damaged. A new cooling circuit with heat exchanger for the unit 2 pond is working well.

To protect against potential damage as a result of future earthquakes, TEPCO started work on 9 May to install a supporting structure for the floor of the spent fuel pool of Unit 4.

TEPCO has formulated the hypothesis that the damage to the Unit 4 building could have been caused by hydrogen generated at Unit 3 that flowed into Unit 4.

Gestione dell'acqua contaminata

- tutta l'acqua presente nei tubi, cisterne, condensatori, ambienti è contaminata: circa 67.000 mc
- durante il periodo 1-6 aprile 520 mc di acqua con 4,7 PBq di attività dall'Unità 2 è finita in mare
- con autorizzazione governativa sono stati scaricati in mare (4-10 aprile) 10.400 mc di acqua leggermente contaminata
- si stanno costruendo serbatoi per procedere alla decontaminazione

Measures against Water Puddles at Fukushima Daiichi

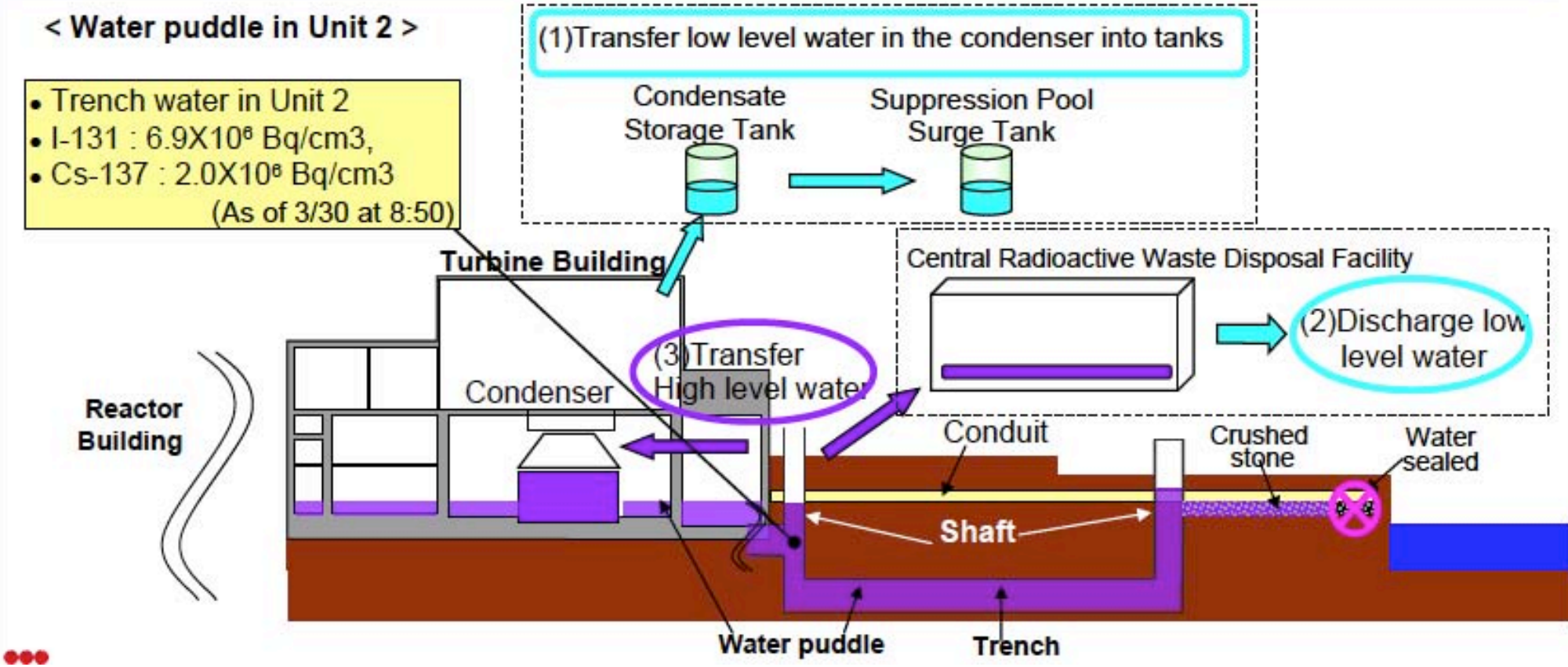
- Contaminated water with high radioactive materials has been found in large quantity in turbine buildings of Units 1-3 etc. Following measures will be taken to store them safely.
- Transfer the water to the condenser or Central Radioactive Waste Disposal Facility (CRWDF) and store them safely to prevent it from running off outside the boundary.
  - ✓ Transferred low level radioactive waste water stored in the condenser to the tanks outside (1).
  - ✓ Discharged 10,000 tons of low level radioactive water stored in CRWDF into the sea (2).

  (Radioactivity in 10,000 tons of the low level water is equivalent to 10 litter of high level water in Unit 2.)
  - ✓ Transferred high level water into the condenser. Begun transferring the water in the trench to CRWDF in Unit 2 (3).

< Water puddle in Unit 2 >

- Trench water in Unit 2
- I-131 : 6.9X10⁶ Bq/cm3,
- Cs-137 : 2.0X10⁶ Bq/cm3

(As of 3/30 at 8:50)



Contaminated water

Stagnant water with high levels of radioactivity in the basement of the turbine buildings of Units 1 and 3 is being transferred to the condensers, the radioactive waste treatment facility, the high-temperature incinerator building and temporary storage tanks.

Stagnant water in the basement of the turbine building of Unit 6 is being transferred to a temporary tank. Countermeasures against the outflow of water to the sea and to prevent and minimize the dispersion of radionuclides in water have been put in place.

By 3 June there was 105,000 m3 of contaminated water awaiting treatment and re-use, containing about 720,000 TBq.
On 21 May a steel barge 136 metres long and 46 metres wide, the "mega-float", arrived at the site. It will be used to store up to 10,000 m3 of contaminated water pending treatment

Countermeasures to Prevent Diffusion of Radioactive Materials

- Sprayed dust inhibitor agents to reduce spreading of powder dust containing radioactive materials on the ground. (Had been spraying intermittently since April 1st. Have been spraying at full-scale since April 26).
- Took following measures in order to prevent radioactive contaminated water from running off into the sea.
  - ✓ Injected coagulants from the holes near the shaft. Have confirmed the outflow from the crack on the concrete wall of the pit stopped. (at 5:38 am, April 6)
  - ✓ Installed a rubber plate and jig to enhance water sealing.
  - ✓ Monitoring continuously for any existence of leakage.
- Took following measures in order to prevent contaminated water from running off from the plant's port .
  - ✓ Launched construction of installing large sandbags around the breakwater at southern part of the site.
  - ✓ Installed silt fences, etc. around the breakwater or in front of screens at southern part of the site.

Spraying dust inhibitor agents

Coagulant injection to stop outflow

Contaminated land

The highest radiation levels on site come from debris left on the ground after the explosions at units 3 & 4.
Some rubble beside unit 3 was giving the highest dose rate of some 1000 mSv/h, while other debris patches are at 30-40 mSv/h.
Full-scale spraying of anti-scattering agent is continuing at the site with the use of both conventional and remote controlled equipment.
TEPCO hopes to finish spraying by late June.
By 25 May some 27 hectares had been covered, and spraying of the buildings commenced. Tepco says that radiation levels around the plant site remain relatively low.
In addition it is removing rubble with remote control front-end loaders, and this is further reducing ambient radiation levels, halving them near unit 1.
A total of 312 skips of rubble, each about 5.6 m3, had been removed by 7 June.

Fukushima Nuclear Accident

Radiological Monitoring and Consequences

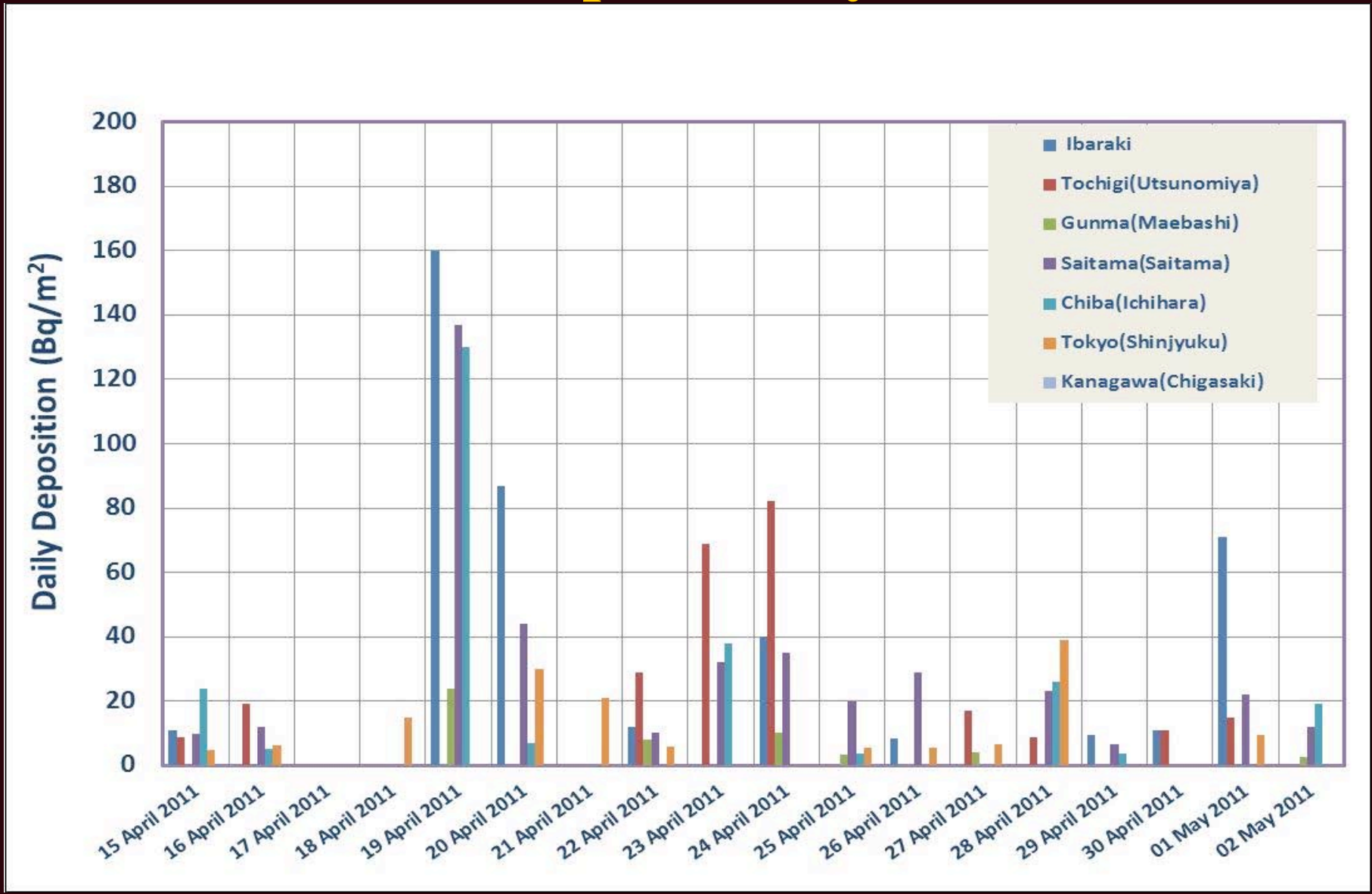
2 June 2011

radiation levels

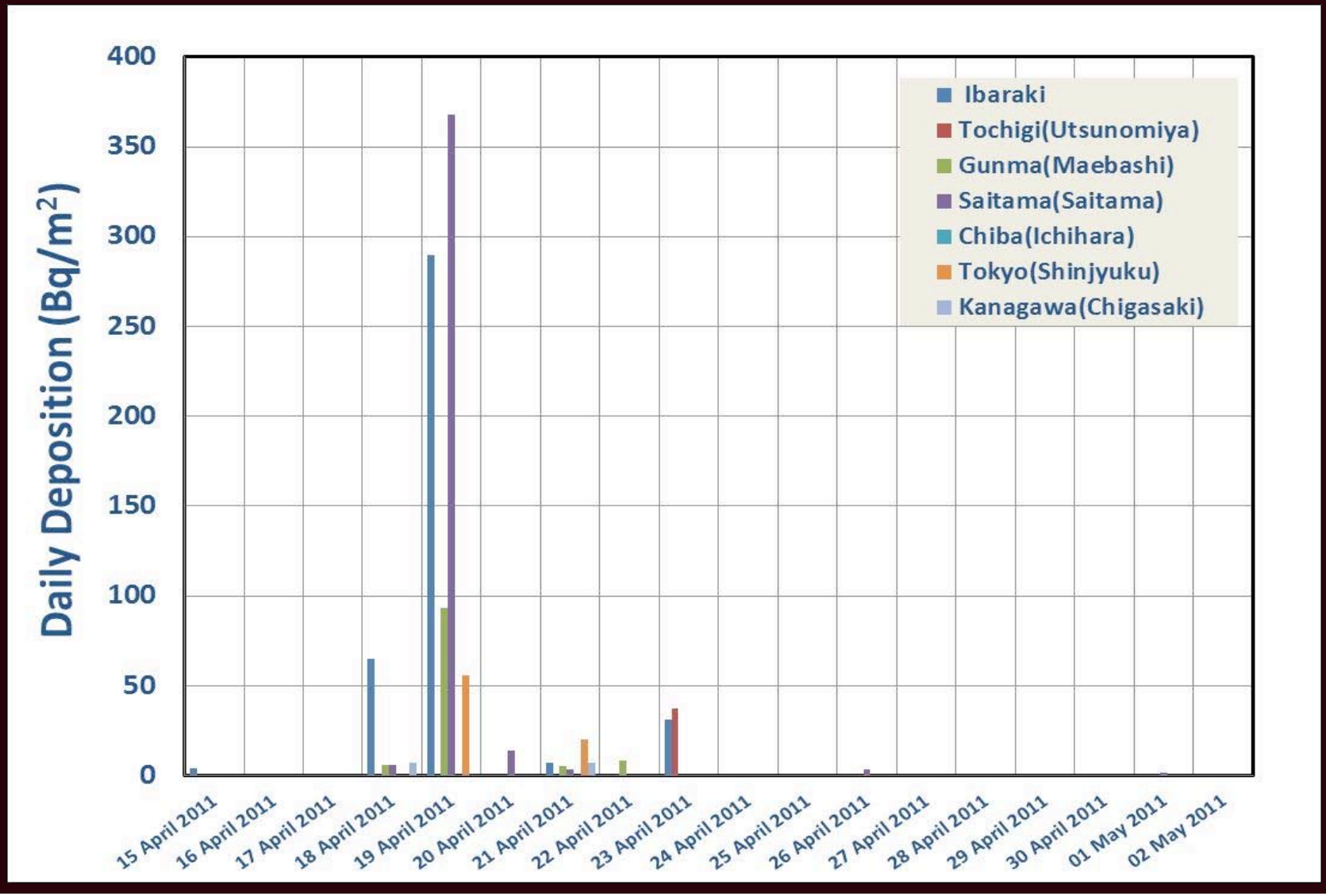
IAEA reported on 19 March that airborne radiation levels had spiked three times since the earthquake, notably on 15th (400 mSv/h near unit 3), but had stabilized since 16th at levels significantly higher than the normal levels, but within the range that allows workers to continue onsite recovery measures.
Gamma radiation on site close to the reactors decreased greatly when unit 3 fuel pond was replenished with water on 19th.
On Sunday 20th, levels were mostly below 3 mSv/h and on 21st were nearly down to 2 mSv/hr about 500 m north on unit 3.

France's IRSN has estimated that maximum external doses to people living around the plant are unlikely to exceed 30 mSv/y in the first year. This is based on airborne measurements between 30 March and 4 April, and remains to be confirmed on the ground. It compares with natural background levels mostly 2-3 mSv/y, but ranging up to 50 mSv/y.

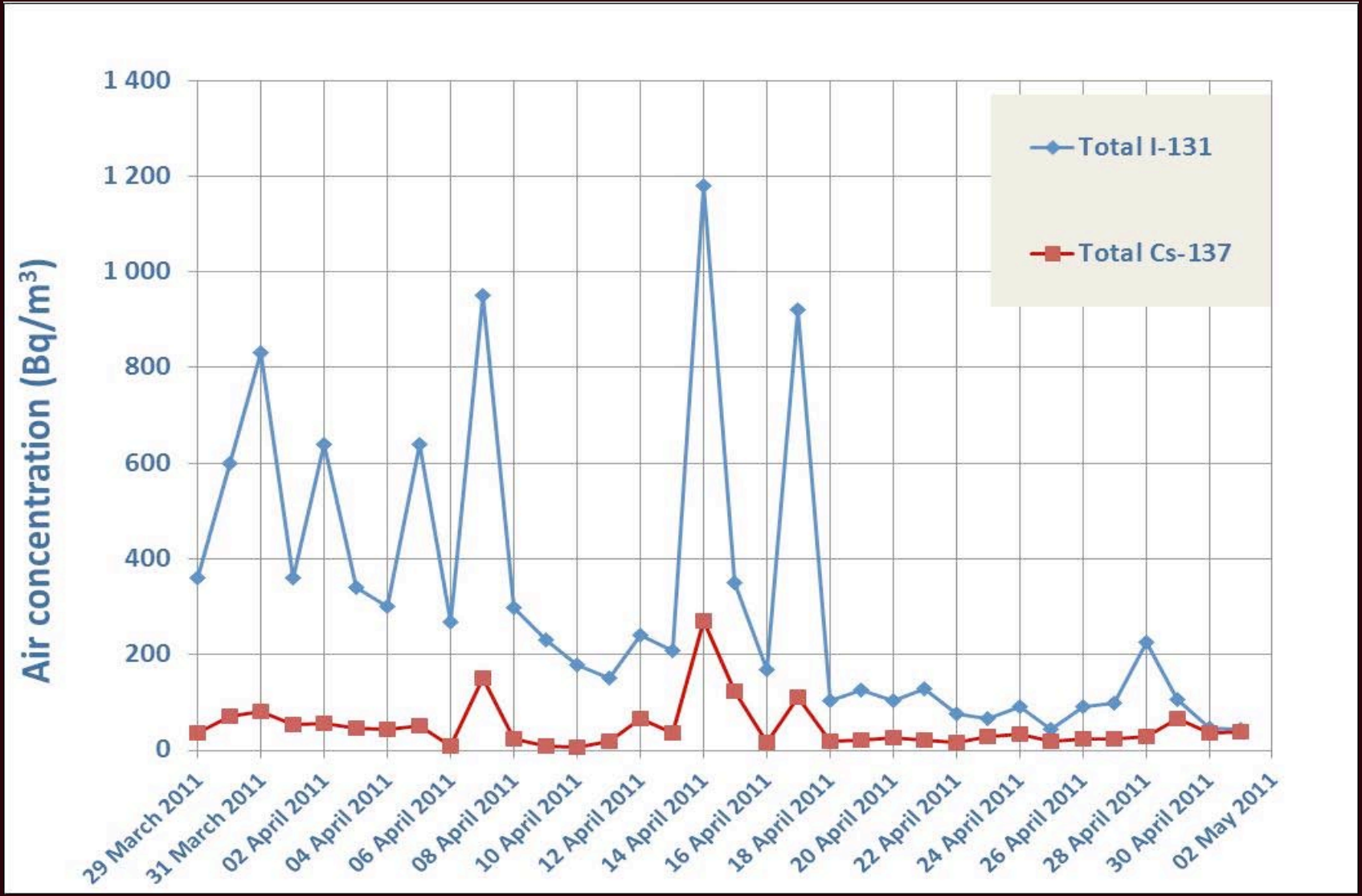
Cs-137 daily deposition (Bq /m^2)
15 April-2 May

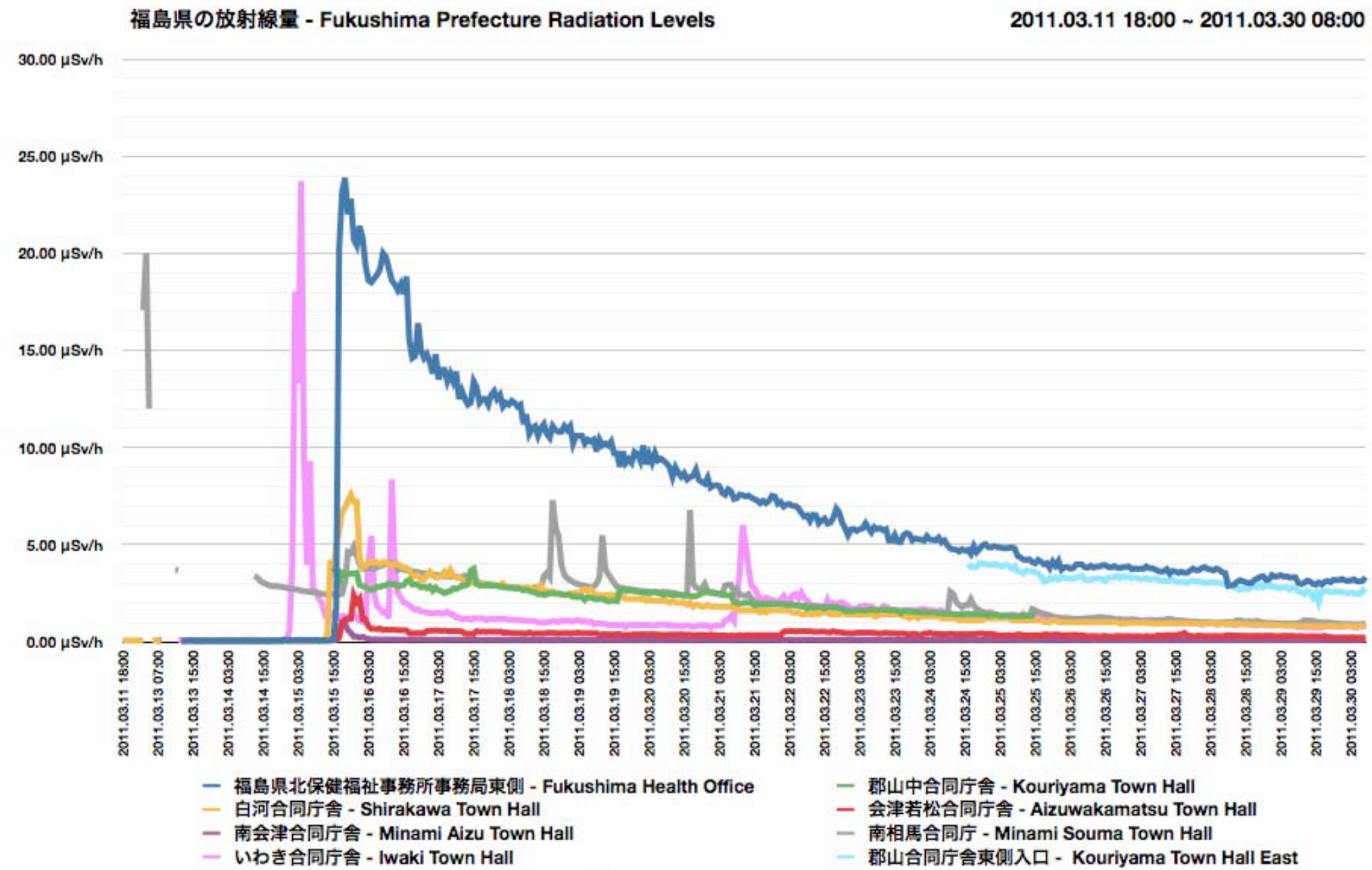


I-131 daily deposition (Bq /m^2)
15 April-2 May



I-131 and Cs-137 Concentration in air
at Fukushima Daiichi West Gate (1 Km from NPP)




福島県の放射線量 - Fukushima Prefecture Radiation Levels
2011.03.11 18:00 ~ 2011.03.30 08:00
30.00 μSv/h
25.00 μSv/h
20.00 μSv/h
15.00 μSv/h
10.00 μSv/h
5.00 μSv/h
0.00 μSv/h
2011.03.11 18:00
2011.03.13 07:00
2011.03.13 15:00
2011.03.14 03:00
2011.03.14 15:00
2011.03.15 03:00
2011.03.15 15:00
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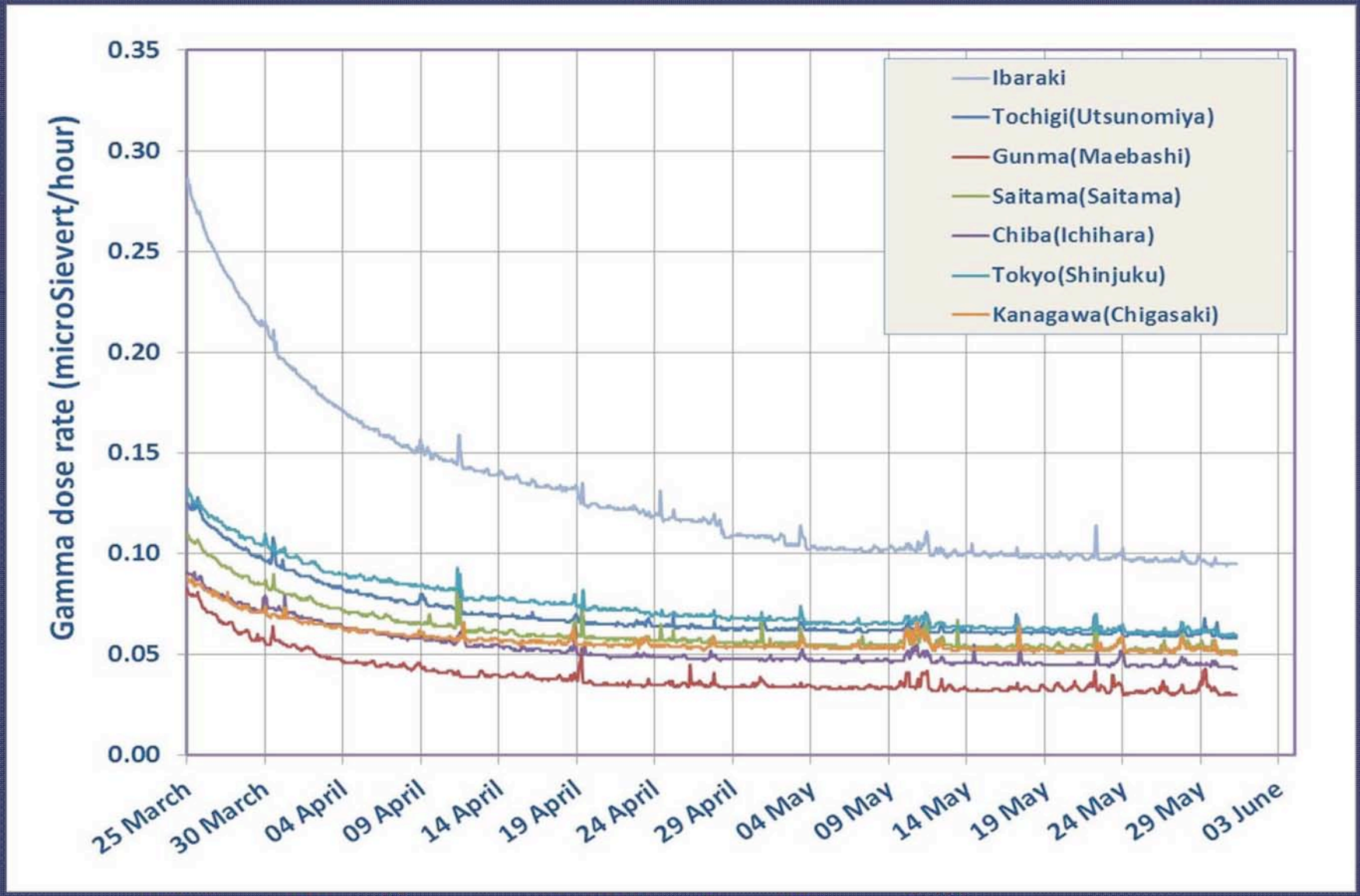
2011.03.27 15:00
2011.03.28 03:00
2011.03.28 15:00
2011.03.29 03:00
2011.03.29 15:00
2011.03.30 03:00
福島県北保健福祉事務所事務局東側 - Fukushima Health Office
白河合同庁舎 - Shirakawa Town Hall
南会津合同庁舎 - Minami Aizu Town Hall
いわき合同庁舎 - Iwaki Town Hall
郡山中合同庁舎 - Kouriyama Town Hall
会津若松合同庁舎 - Aizuwakamatsu Town Hall
南相馬合同庁 - Minami Souma Town Hall
郡山合同庁舎東側入口 - Kouriyama Town Hall East
Data from http://www.pref.fukushima.jp/j/

Deposition of I-131 and Cs-137 in 47 prefectures

- I-131
  - Not detected since 18 May
- Cs-137
  - Detected in a few prefectures over a few days
  - Low levels ranging from 2.2 to 91 Bq/m^2

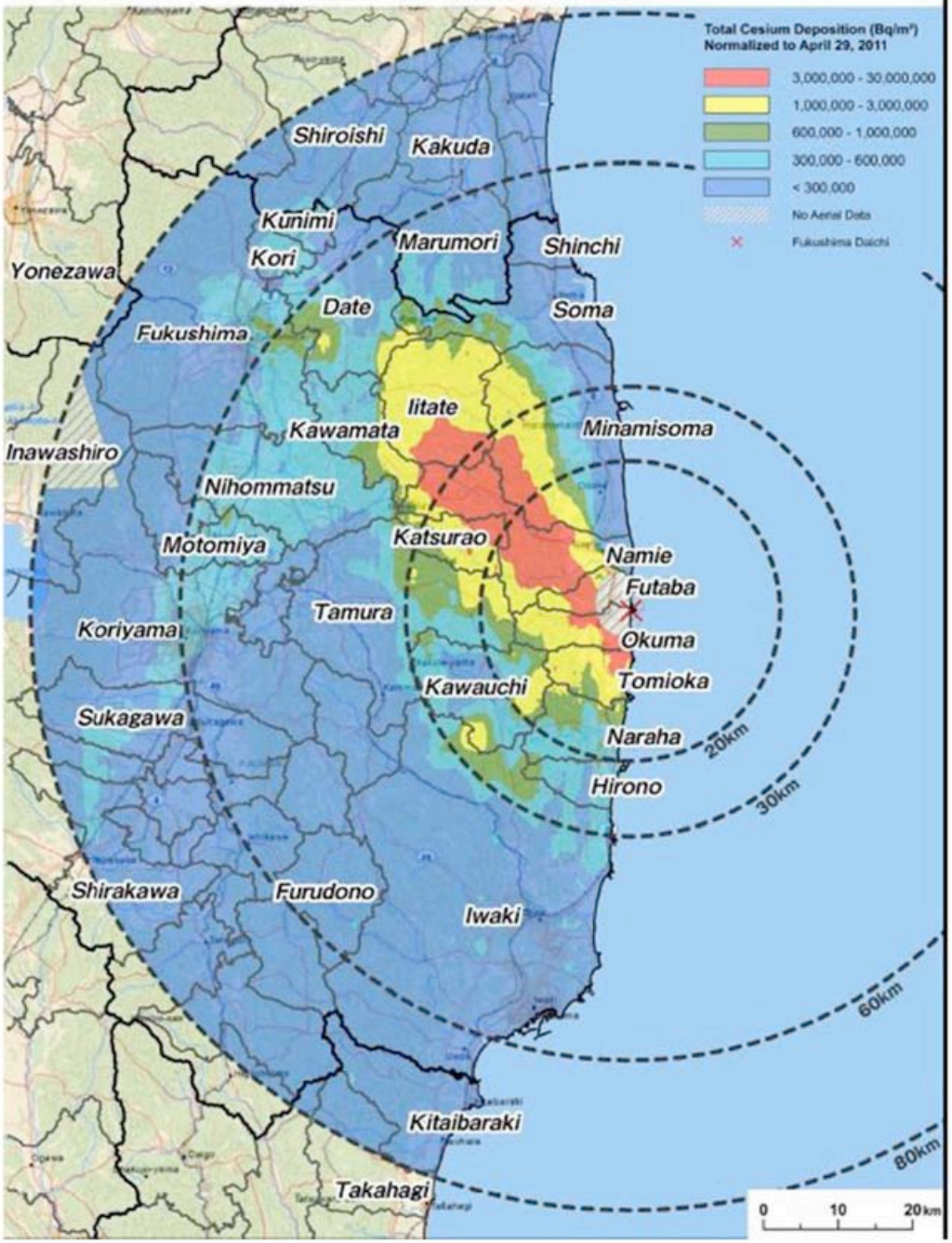
Gamma Dose Rates in 7 Prefectures
24 March – 31 May



Natural background: 0.1 microSievert/hour

Aerial Measuring Results

Joint US / Japan Survey Data



	Estimated release from Fukushima Daiichi		(Reference) Release from Chernobyl
	by NISA	by Nuclear Safety Commission	
Iodine 131 (a)	130 thousands T Bq ($1.3X10^{17}Bq$)	150 thousands T Bq ($1.5X10^{17}Bq$)	1,800 thousands T Bq ($1.8X10^{18}Bq$)
Cesium 137	6 thousands T Bq ($6.1X10^{15}Bq$)	12 thousands T Bq ($1.2X10^{16}Bq$)	85 thousands T Bq ($8.5X10^{16}Bq$)
Iodine value conversion (b)	240 thousands T Bq ($2.4X10^{17}Bq$)	480 thousands T Bq ($4.8X10^{17}Bq$)	3,400 thousands T Bq ($3.4X10^{18}Bq$)
(a) + (b)	**370 thousands T Bq ($3.7X10^{17}Bq$)**	**630 thousands T Bq ($6.3X10^{17}Bq$)**	**5,200 thousands T Bq ($5.2X10^{18}Bq$)**

INES level 7 equivalent : over 10 thousands Tera Becquerel (T Bq) (over $10^{16}Bq$)

Source: Nuclear and Industrial Safety Agency

Radiation

NISA's report to IAEA said 130 PBq of I-131 and 6 PBq of caesium-137 had been actually released, giving an "iodine-131 equivalent" figure of 370 PBq. The NSC estimated that 12 PBq of Cs-137 had been released, giving an "iodine-131 equivalent" figure of 630 PBq to 5 April. This is about ten percent of the Chernobyl figure.
NISA in June increased this estimate to 770 PBq.

The NSC said that most radioactive material was released from the unit 2 suppression chamber during two days from its apparent rupture early on 15 March. It said that about 154 TBq/day was being released on 5 April, but that this had dropped to about 24 TBq/d over three weeks to 26 April.

Environmental effect	• Radiation levels:
	  • South side of office building: 1050 μSv/hour at 30 March 15:00 JST
	  • Main gate: 163 μSv/hour at 30 March 15:00 JST
	  • West gate: 75 μSv/hour at 30 March 15:00 JST
	• Radioactive material has been detected in milk and agricultural products from Fukushima and neighboring prefectures, prompting government limits on shipments and intake from some areas
	• Radioactive iodine has been found in tap water in some prefectures, temporarily exceeding the legal limit for infant consumption
	• Radioactive iodine, caesium, ruthenium, and tellurium have been detected in seawater samples in the vicinity of the station
	• Radiation levels higher than 1000 mSv were detected at the surface of water accumulating in the piping tunnel outside the Unit 2 building on 27 March
	• Plutonium was detected in soil samples near the station on 28 March

Evacuation radius	20 km from Nuclear Power Station (NPS), but 30 km should consider leaving as of 25 March[335]

Monitoring of public and workers

- As of April 27: 175045 people had been screened (NISA)

- Internal+ External doses received by emergency workers until the end of March 2011 (TEPCO):
  - 2 workers: 200-250 mSv.
  - 8 workers: 150-200 mSv
  - 11 workers: 100-150 mSv.
  - Other workers: below 100 mSv.

Status at 4 June

- 30 workers had received doses over 100 mSv,
- two of them over 200 mSv,
- two, both control room operators in the first few days who had not been wearing breathing apparatus, had possibly received over 250 mSv due to inhaling iodine-131 fume.

There were up to 245 workers on site.
Recovery workers are wearing personal monitors, with breathing apparatus and protective clothing which protect against alpha and beta radiation.
So far about 40% of some 3,700 workers at the Daiichi plant have received internal check-ups for radiation exposure.

No radiation casualties (acute radiation syndrome) had been reported, and few other injuries, though higher than normal doses are being accumulated by several hundred workers on site.

Status at 7 June

No harmful health effects were found in 195,345 residents living in the vicinity of the plant who were screened as of May 31.

All the 1,080 children tested for thyroid gland exposure showed results within safe limits

Monitoring of drinking water
2 May

- I-131 and Cs-137 detected in 2-6 prefectures respectively and remain far below restriction levels in all 47 prefectures.

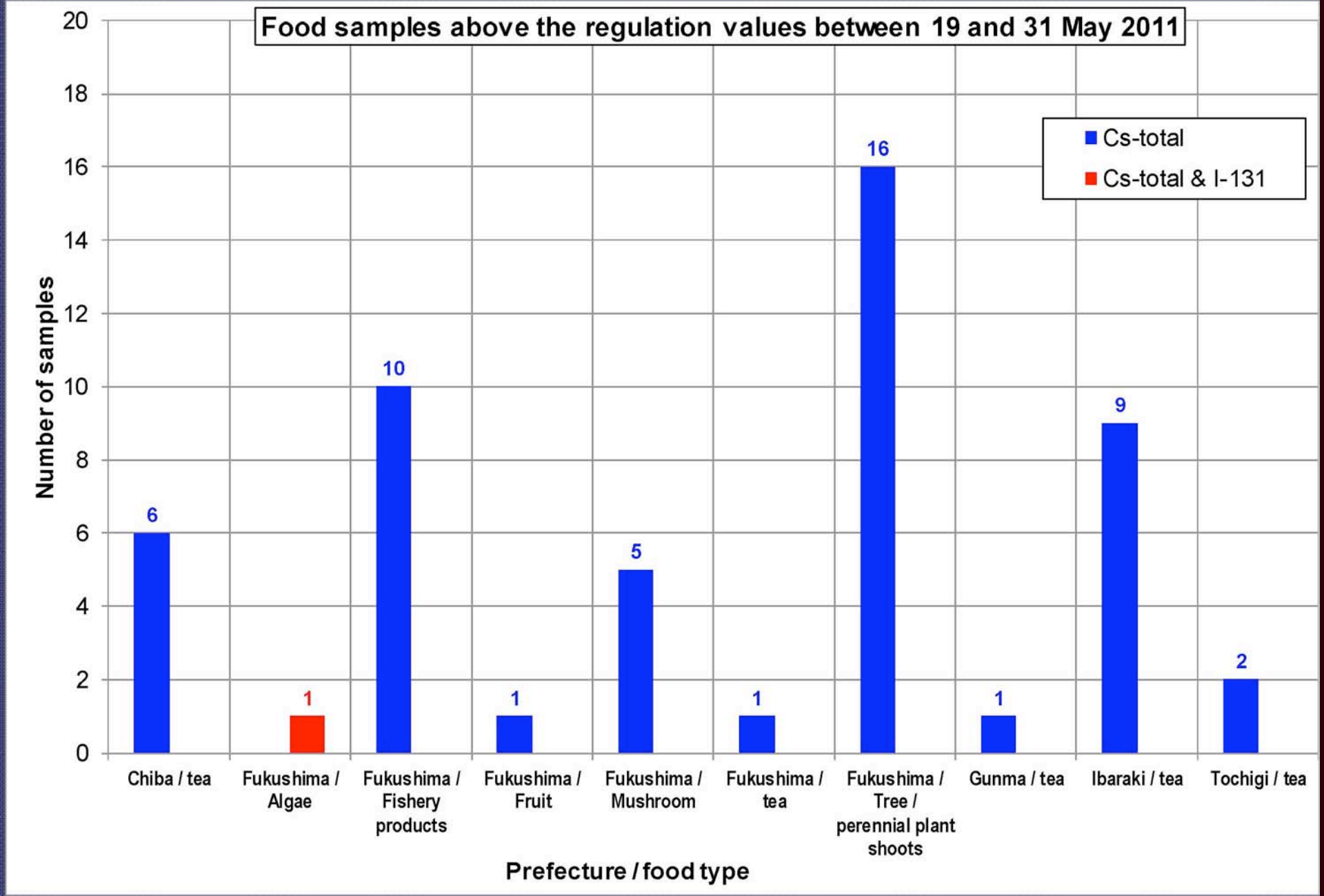
- Recommendations for restrictions for infants based on I-131: Still in place in 1 village of Fukushima prefecture as precautionary measure.

Protective actions

- Drinking water: All restriction lifted
- The Government of Japan has announced evacuation measures:
  - Beyond distances of 30 km from Fukushima Nuclear Power Plants
  - NISA: evacuation of the “Planned Evacuation Zones” within Iitate village and Kawamata town commenced on 15 May.

Food Monitoring and Food Restrictions (Reported 19 – 31 May)

- 818 samples from 18 prefectures
- Over 40% of monitoring is in Fukushima prefecture
- Over 93% of samples indicated Cs-134 /Cs-137 or I-131 were not detected or were below the Japanese regulation values
- Less than 7% were above the Japanese regulation values for Cs-134 /Cs-137 and/or I-131
- Restrictions on the distribution and/or consumption of specific foods in certain areas of Fukushima and Ibaraki prefectures remain in place


Food samples above the regulation values between 19 and 31 May 2011
Cs-total
Cs-total & I-131
Number of samples
0
2
4
6
8
10
12
14
16
18
20
6
1
10
1
5
1
16
1
9
2
Chiba / tea
Fukushima / Algae
Fukushima / Fishery products
Fukushima / Fruit
Fukushima / Mushroom
Fukushima / tea
Fukushima / Tree / perennial plant shoots
Gunma / tea
Ibaraki / tea
Tochigi / tea
Prefecture / food type

Marine Environment Monitoring

Assessment of IAEA Environment Laboratories on Data from the Marine Environment provided by Japan

Update 1 June 2011

IAEA Environment Laboratories, Monaco
H. Nies, M. Betti, I. Osvath, E. Bosc

IAEA
International Atomic Energy Agency

General comments

- The contamination of the marine environment has occurred both through atmospheric fallout or washout with precipitation, and through discharges of contaminated water into the sea
- Discharge to the marine environment decreased significantly over time since end of March; concluding from the near field concentration measurements, up to now, more than 99 % of the activity was discharged between 28th of March and 11th of April.
- There is a further continuous discharge of contaminated water into the marine environment with variable activities and activity ratios between I-131 and the two dominating radio-caesium nuclides.
- TEPCO and MEXT are continuing to conduct programmes for sea water sampling and to perform measurements. Also marine food and several sediment stations are now monitored.

Marine discharges due to leaking cable pit at Unit 2

In a news release issued on 25 April, NISA has communicated their evaluation of a report submitted by TEPCO on April 21 in relation to water containing radionuclides with high activity that flowed out from Unit 2 of Fukushima Daiichi Nuclear Power Station.

The outflow rate is estimated to have been approximately 4.3 m^3/h.
Concentration values, estimated from measurements, are:

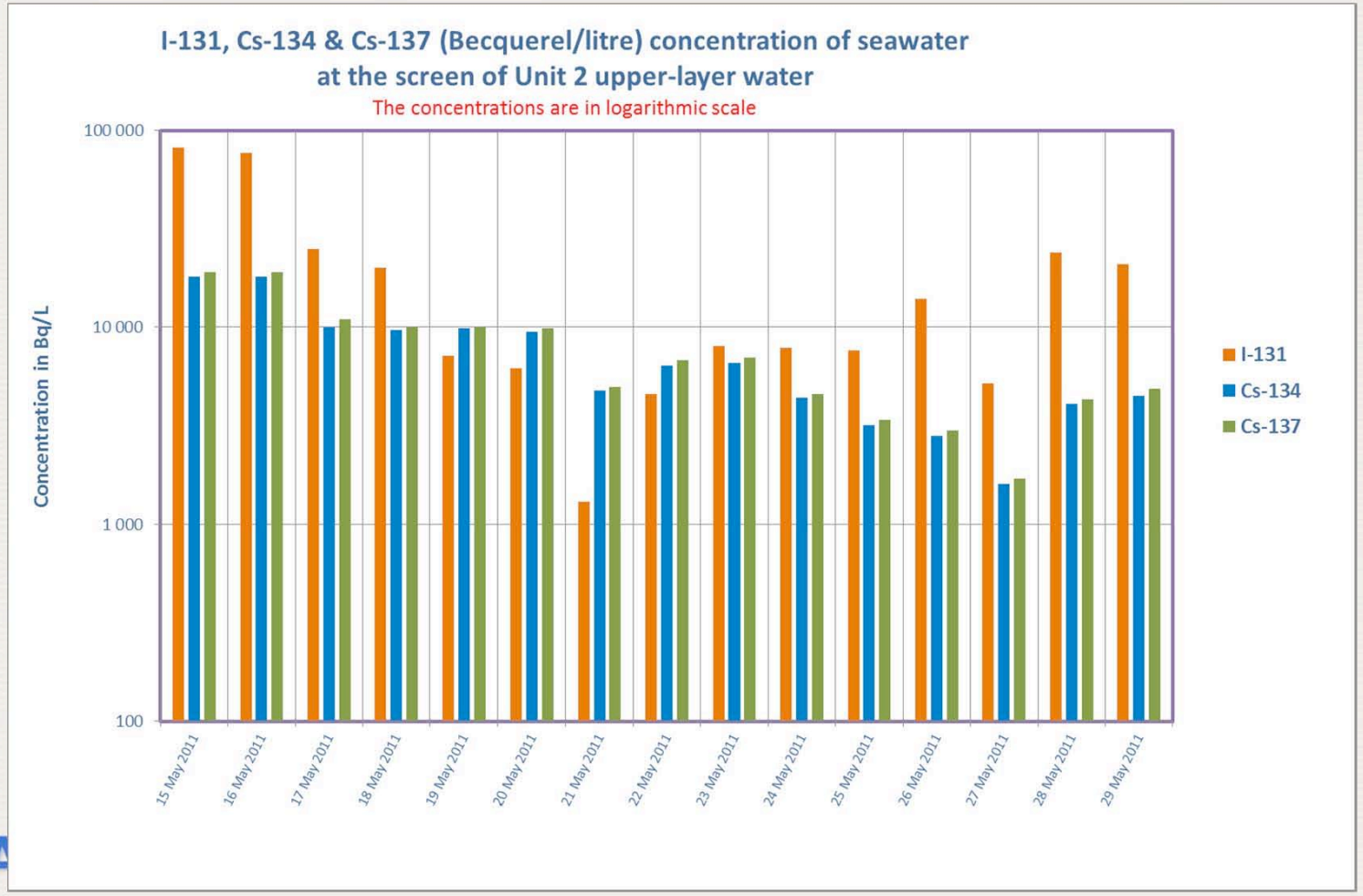
I-131: 5.4 GBq/L
Cs-134: 1.8 GBq/L
Cs-137: 1.8 GBq/L

leading to an estimated overall amount of total release of about **4.7 PBq** **(4.7×10^{15} Bq)**

Activity concentration in sea water at the screen of Unit 2

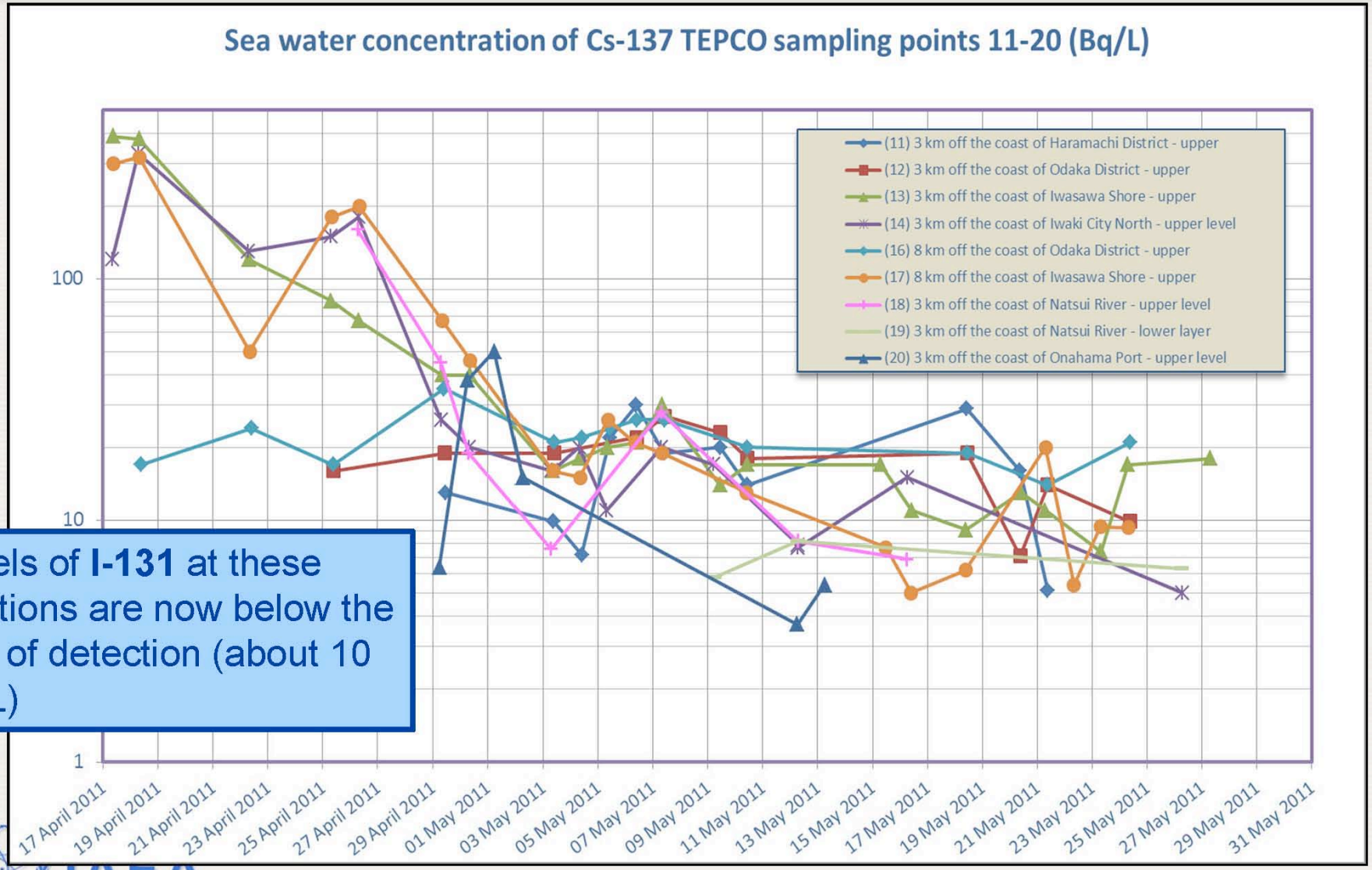
The activity concentrations of I-131, Cs-134 and Cs-137 (in Bq/L) in sea water at the screen of Unit 2 from 15 May 2011 until 29 May 2011

Concentration levels end of March/ beginning of April were about three orders of magnitude higher



IAEA

Concentrations in sea water at sampling locations of TEPCO 11 - 20



Levels of **I-131** at these locations are now below the limit of detection (about 10 Bq/L)

IAEA

Sediment monitoring stations

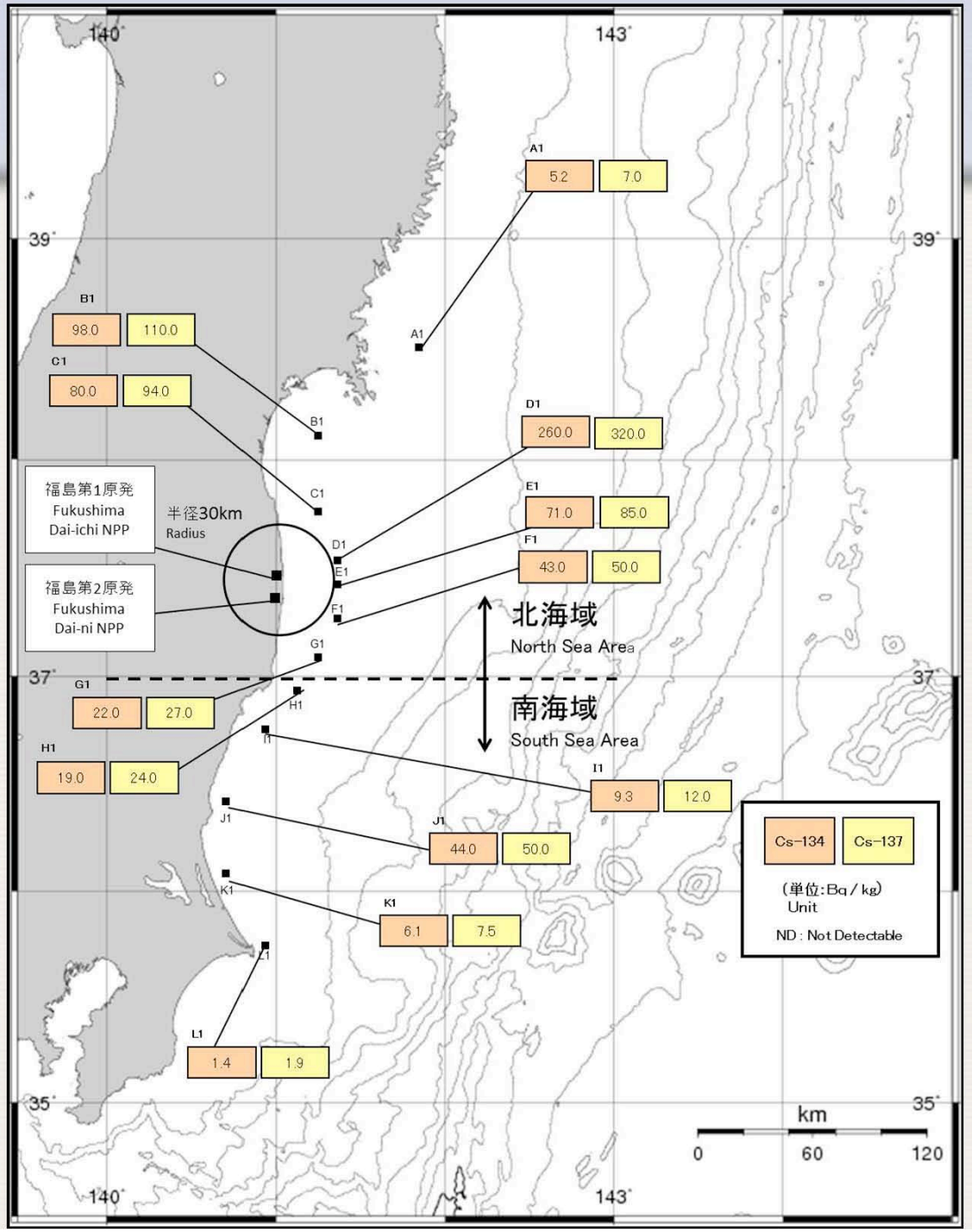
Highest levels are detected near the coast. The contamination of the sea floor indicates some adsorption on particles and removal from the water column into the sediment.

Cs-134	Cs-137

(単位:Bq / kg)
Unit

ND : Not Detectable

Detection limits:
I-131: ~ 1 Bq/kg
Cs-134: ~ 1 Bq/kg
Cs-137: ~ 0.8 Bq/kg



IAEA

Conclusions on the impact to the marine environment

- The highest levels of radioactive substances are still measured close to the Nuclear Power Stations Fukushima, namely at the screen of Unit 2, 30 m, 330 m and 10 km near-shore. The levels showed a decreasing trend until beginning of May but remained relatively constant since then.
- Higher activities are also found in surface sediments near the discharge areas of the NPPs.
- Concentration data from about 30 km off-shore are lower and most of the analyses were below the limit of detection at the applied methods (about 10 Bq/L).
- There is a continuous outflow of contaminated water from the site, which keeps the levels on the monitoring stations of TEPCO near the shore relatively constant.

Conclusions

- In recent days, a significant increase of **I-131** and - to a less extent Cs-134/Cs-137 - near the discharge area was observed
- Further dilution in the Pacific will lead to lower concentrations of longer lived radionuclides. Traces from the releases from Fukushima NPPs will be taken up by the **Kuroshio-** current system in the north Pacific and transported across the Ocean.
- It will be possible to follow these traces – mainly Cs-137 and Cs-134 - over the next few years in the northern Pacific
- IAEA environmental Laboratories in Monaco is invited to be part of international teams to measure these impact to the Pacific, however IAEA-EL will support and co-ordinate initiated environment assessment studies

Marine Environment Monitoring

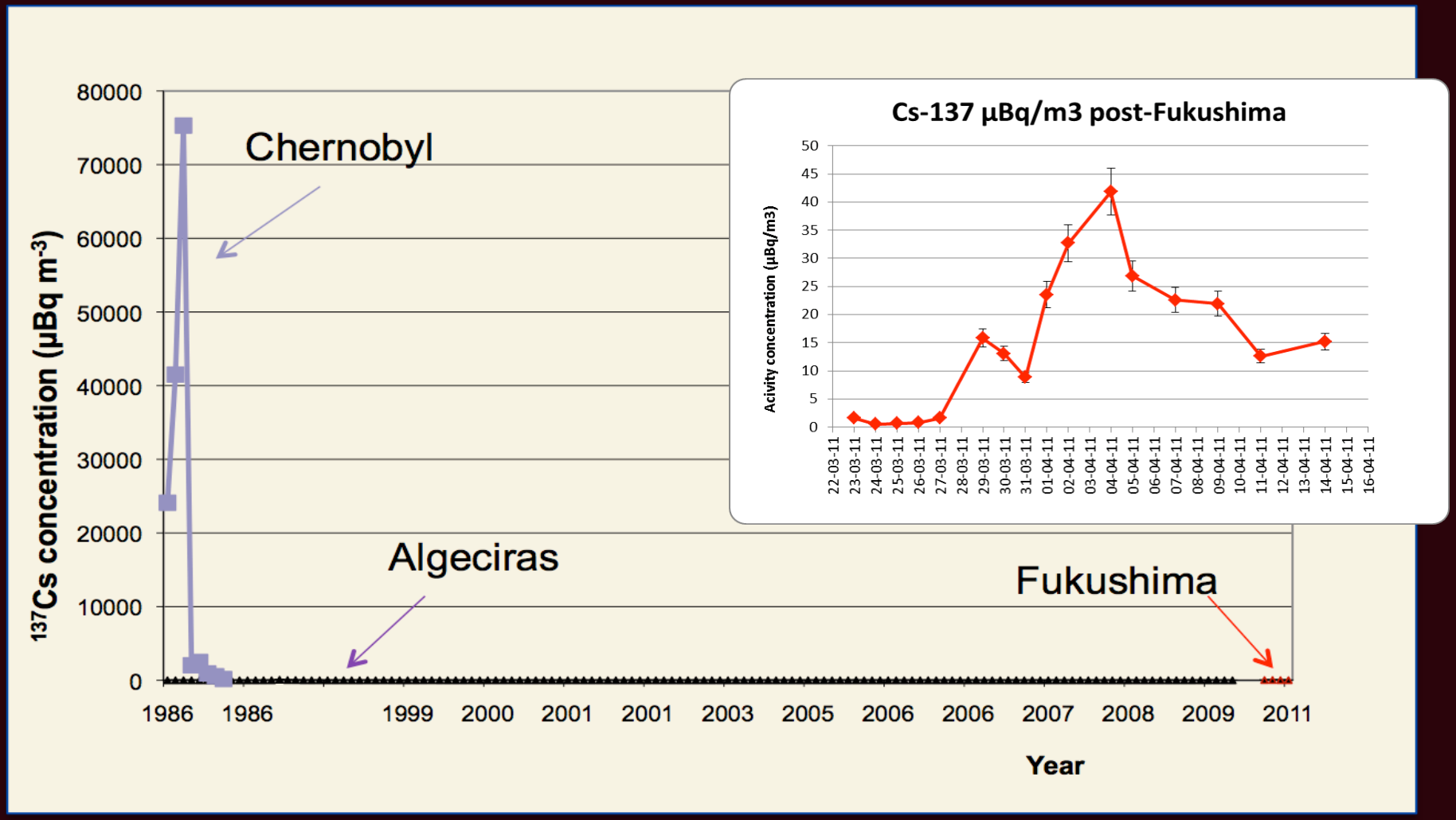
Assessment of IAEA Environment Laboratories on Data from the Marine Environment provided by Japan

Update 1 June 2011

IAEA Environment Laboratories, Monaco
H. Nies, M. Betti, I. Osvath, E. Bosc

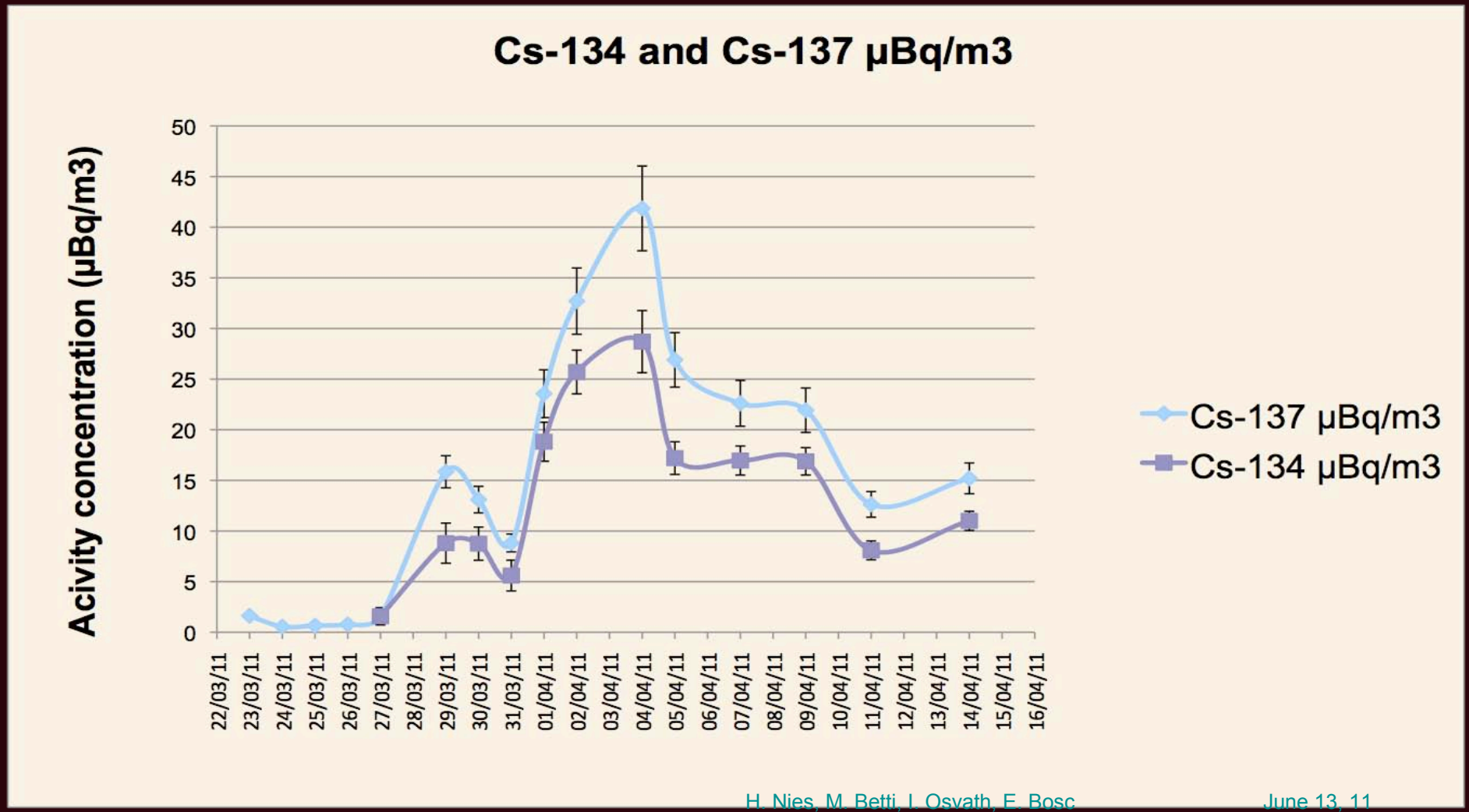
IAEA
International Atomic Energy Agency

Cs-137 in atmospheric aerosols in Monaco from 1986 to 2011

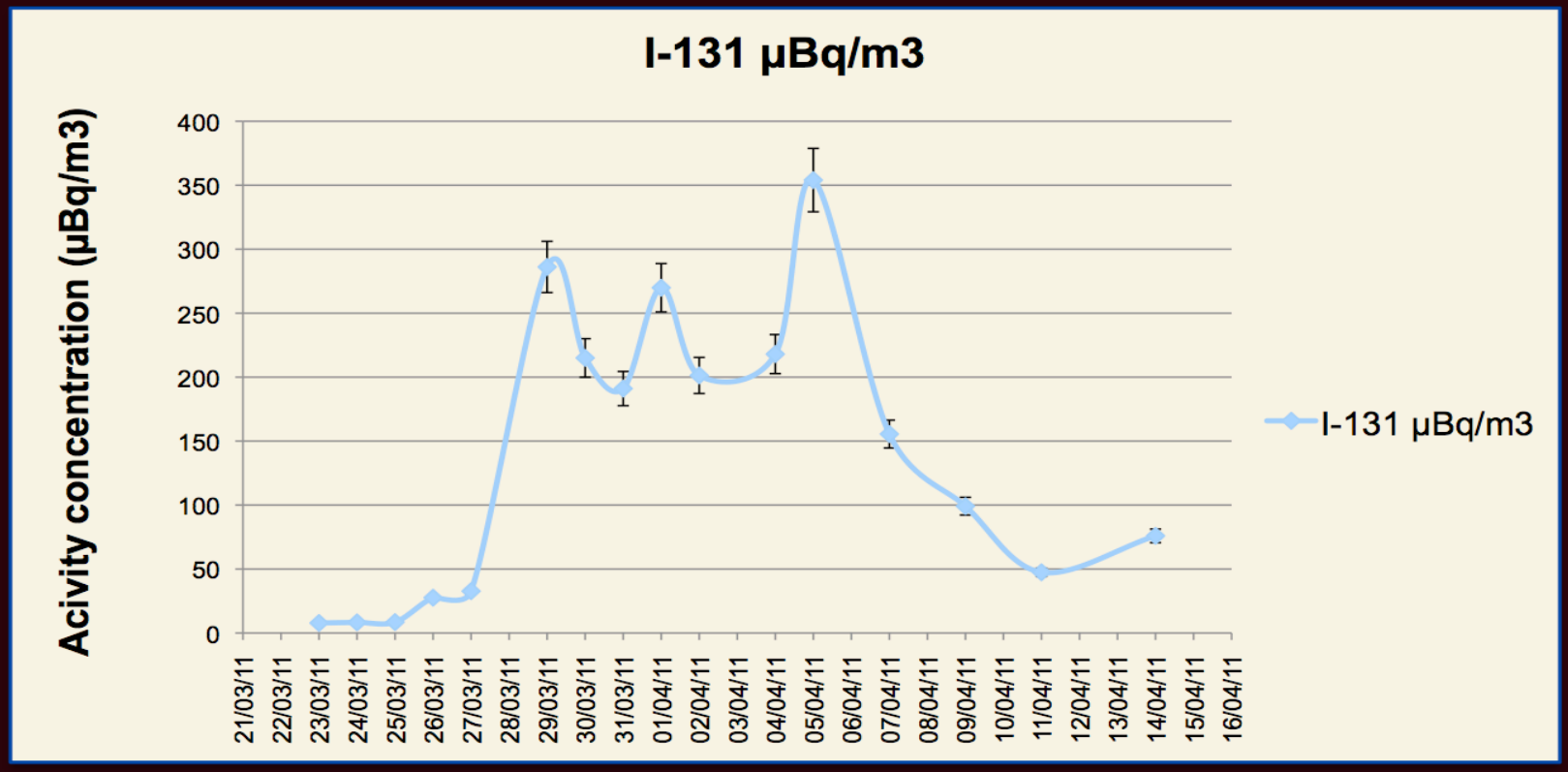


Note: maximum values measured in March-April 2011, after the Fukushima accident, are about 2000 lower than those measured in May-June 1986, after the Chernobyl accident.

Radio-Cesium in atmospheric aerosols measured in Monaco after the Fukushima accident



Iodine-131 in atmospheric aerosols measured in Monaco after the Fukushima accident



Comparison between levels of radionuclides in atmospheric aerosols measured in Monaco after Chernobyl and Fukushima accidents

Maximum levels measured after the Fukushima accident (March-April 2011) are much lower than those measured after the Chernobyl accident (May-June 1986)

I-131	120 times lower
Cs-134	700 times lower
Cs-137	2000 times lower

Levels are similar to those measured elsewhere in Europe (France, Italy, Germany)

Tepco's remediation plan

Tepco published a 6- to 9-month plan (updated on 17 May)

~ Cooling reactors

In units 1 to 3 the priority is now to establish water circulation through the RPVs recycling contaminated water via a treatment plant. In unit 2 the damaged containment will be sealed with grout, before similarly flooding. New heat exchanger circuits will be built for all three units. Cold shutdown target in 6-9 months. The plan does not mention removal of fuel from the reactors.

~Cooling and removing spent fuel

For all four units water injection will be improved to the spent fuel ponds in each reactor building and cooling circulation for heat removal restored, with new or restored heat exchangers. A support structure will be built under unit 4 pond. Fuel will then be removed to central storage on site.

~ Managing contaminated water

Further storage capacity will be installed, along with treatment plant to enable recycling. Slightly contaminated water will be treated. "Full-fledged" treatment plant will follow. Mitigation of groundwater contamination is a high priority.

~ Countermeasures against aftershocks and further tsunamis

Temporary tide barriers are being built, generators are being moved to higher ground, and back-up water injection lines are envisaged.

~ Minimising release of radioactive materials to atmosphere

Dust-suppressing polymer resin will continue to be applied, and debris removed to improve working conditions on site. A light temporary structure will then be built over reactor buildings 1, 3 & 4, followed by more substantial structures.

~ Preparing for return of evacuees

Monitoring will be expanded and the evacuation zone will be decontaminated where required so that evacuees can return as soon as possible.

~ Decommissioning units 1-4.

This would generally involve removing the fuel and then sealing them for a decade or two while the activation products in the steel of the reactor pressure vessel decay.They can then be demolished.
Removal of the very degraded fuel will be a long process in units 1-3.
The Hitachi-GE group, the Toshiba team and Areva are planning to submit a proposal.
Tepco has allocated yen 207 billion ($2.53 billion) in its accounts for decommissioning units 1 to 4.

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IAEA INTERNATIONAL FACT FINDING EXPERT MISSION OF THE NUCLEAR ACCIDENT FOLLOWING THE GREAT EAST JAPAN EARTHQUAKE AND TSUNAMI

Tokyo, Fukushima Dai-ichi NPP, Fukushima Dai-ni NPP and Tokai NPP, Japan

24 May - 1 June 2011

Preliminary Summary

Mission's preliminary conclusions fall broadly under the three specialist areas of external hazards, severe accident management and emergency preparedness.

The main preliminary findings and lessons learned are:

- The Japanese Government, nuclear regulators and operators have been extremely open in sharing information and answering the many questions of the mission to assist the world in learning lessons to improve nuclear safety.
- The response on the site by dedicated, determined and expert staff, under extremely arduous conditions has been exemplary and resulted in the best approach to securing safety given the exceptional circumstances. This has been greatly assisted by highly professional back-up support, especially the arrangements at J-Village to secure the protection of workers going on sites.
- The Japanese Government's longer term response to protect the public, including evacuation, has been impressive and extremely well organized. A suitable and timely follow-up programme on public and worker exposures and health monitoring would be beneficial.

- The planned road-map for recovery of the stricken reactors is important and acknowledged. It will need modification as new circumstances are uncovered and may be assisted by international co-operation. It should be seen as part of a wider plan that could result in remediation of the areas off site affected by radioactive releases to allow people evacuated to resume their normal lives. Thus demonstrating to the world what can be achieved in responding to such extreme nuclear events.
- The tsunami hazard for several sites was underestimated. Nuclear designers and operators should appropriately evaluate and provide protection against the risks of all natural hazards, and should periodically update these assessments and assessment methodologies in light of new information, experience and understanding.
- Defence in depth, physical separation, diversity and redundancy requirements should be applied for extreme external events, particularly those with common mode implications such as extreme floods.

- Nuclear regulatory systems should address extreme external events adequately, including their periodic review, and should ensure that regulatory independence and clarity of roles are preserved in all circumstances in line with IAEA Safety Standards.

Severe long term combinations of external events should be adequately covered in design, operations, resourcing and emergency arrangements.

- The Japanese accident demonstrates the value of hardened on-site Emergency Response Centres with adequate provisions for communications, essential plant parameters, control and resources. They should be provided for all major nuclear facilities with severe accident potential. Additionally, simple effective robust equipment should be available to restore essential safety functions in a timely way for severe accident conditions.
- Hydrogen risks should be subject to detailed evaluation and necessary mitigation systems provided.

Emergency arrangements, especially for the early phases, should be designed to be robust in responding to severe accidents.

Sito con gli eventi di problemi nucleari civili e di radioattività

www-news.iaea.org/news/default.asp

2011-03-05	OVEREXPOSURE TO RADIATION WORKER	2011-01-13 2	Massachusetts General Hospital, Boston MA	Other	United States of America
2011-02-18	Level 2 incident on INES scale concerning back-up diesel generators at Tricastin nuclear power plant	2011-02-16 2	TRICASTIN-3	Power Reactor	France
2011-02-03	Hydrogen Recombiner functional testing not satisfactory	2011-01-24 0	LAGUNA VERDE-2	Power Reactor	Mexico
2011-02-03	Reactor trip due to high pressure in the reactor pressure vessel	2011-01-19 2	LAGUNA VERDE-2	Power Reactor	Mexico
2011-01-20	Reactor trip due to failure in the Main Generator	2011-01-15 0	LAGUNA VERDE-1	Power Reactor	Mexico
2011-01-12	Potential damage in riser pipe at Laguna Verde NPP U2	2010-10-22 1	LAGUNA VERDE-2	Power Reactor	Mexico
2011-01-12	Non Usual Event declared due to loss of outside power at Laguna Verde NPP U1	2010-12-02 1	LAGUNA VERDE-1	Power Reactor	Mexico
2011-01-05	Overexposure of a field radiography worker	2009-03-03 3	Argus, Jinju, Souther part of Republic of Korea	Radiation Source	Korea, Republic of
2011-01-05	Overexposure of field radiography workers	2008-11-04 2	Argus/ Yeosu, Southern part of Republic of Korea	Radiation Source	Korea, Republic of
2010-12-08	Lost or stolen sources containing Co-60	2010-11-05 1	Closed Iron foundry in Town Lublin	Other	Poland
2010-12-03	Several mine workers overexposed by X-rays	2010-12-02 2	Boliden Mineral, Gällivare	Mining/Milling	Sweden

Send Date	Event Title	Event Date / Rating	Location or Facility	Type	Country
2011-06-08	Worker Overexposure	2011-03-30 2	University of Washington, Seattle Washington	Other	United States of America
2011-06-06	Over exposure of workers beyond annual regulatory limit	2011-05-30 2	KAKRAPAR-2	Power Reactor	India
2011-04-12	Re-evaluation of INES rating: Effect to the Nuclear Facilities from the earthquake on east area of Japan	2011-04-12 7	Fukushima Daiichi	Power Reactor	Japan
2011-03-31	Inadequate setting of the auxiliary feedwater turbopump	2011-03-18 2	DOEL-4	Power Reactor	Belgium
2011-03-18	Loss of the cooling function to the ultimate heat sink due to the big tsunami	2011-03-11 3	FUKUSHIMA-DAINI-4	Power Reactor	Japan
2011-03-18	Loss of the cooling function to the ultimate heat sink due to the big tsunami	2011-03-11 3	FUKUSHIMA-DAINI-2	Power Reactor	Japan
2011-03-18	Loss of the cooling function to the ultimate heat sink due to the big tsunami	2011-03-11 3	FUKUSHIMA-DAINI-1	Power Reactor	Japan
2011-03-18	Loss of cooling function and water supplying function on the spent fuel pool due to the big tsunami.	2011-03-11 3	FUKUSHIMA-DAIICHI-4	Power Reactor	Japan
2011-03-18	The core damage by loss of all cooling function due to the big tsunami.	2011-03-11 5	FUKUSHIMA-DAIICHI-3	Power Reactor	Japan
2011-03-18	The core damage by loss of all cooling function due to the big tsunami.	2011-03-11 5	FUKUSHIMA-DAIICHI-2	Power Reactor	Japan
2011-03-12	Abnormal rise of radioactive dosage value at site boundary (INES Level 4)	2011-03-12 5	FUKUSHIMA-DAIICHI-1	Power Reactor	Japan
2011-03-12	Effect to the Nuclear Facilities from the earthquake on east area of Japan	2011-03-11 3	FUKUSHIMA-DAIICI-1,2 FUKUSHIMA-DAINI-1, Japan	Power Reactor	Japan

facciamo conto che quello che c'è scritto qua deve essere recitato, d'accordo?

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No, commissario, è tutta sbagliata come commedia, il pubblico si metterebbe a ridere, non funziona.

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