The 2011 off the Pacific coast of Tohoku Pacific Earthquake and the seismic damage to the NPPs

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ISOE Bureau

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Nuclear and Industrial Safety Agency (NISA)
Japan Nuclear Energy Safety Organization (JNES)

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Note: Some data in this material may not be correct. Especially, all the plant parameters were lost during some period in the accident and some parameters are apparently inconsistent among them.

1. Outline of earthquake and nuclear reactors

Source: Fire and Disaster Management Agency

1-1. 2011 off Tohoku Pacific Earthquake

Fukushima Dai-ichi NPP

Fukushima Dai-ni NPP

- **Occurred 14:46 March 11, 2011**
- **Magnitude:9.0 Mw**
- **Epicenter location: 38° 6”N and 142° 51”E, and 24km in depth**
- **It is said that the height of tsunami attacked Fukushima NPP was more than 14m**

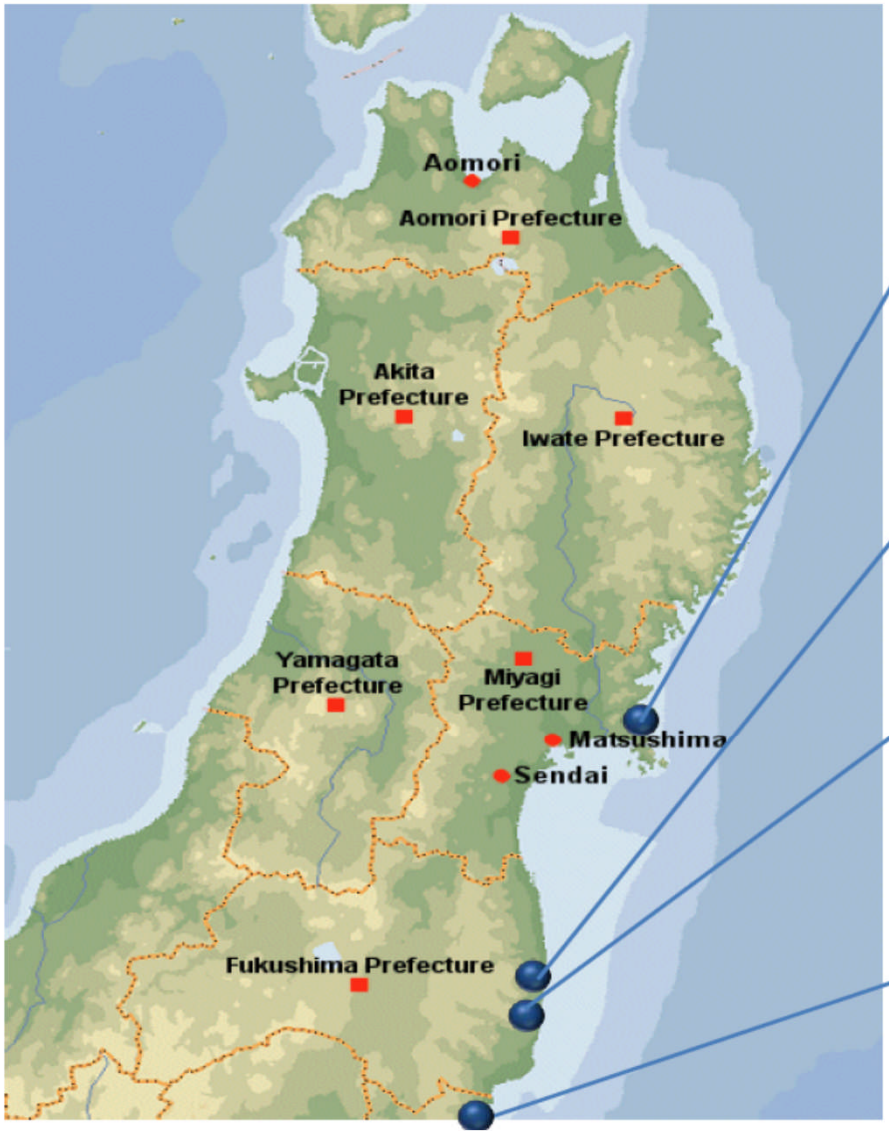
1-2. Tsunami after the earthquake

- **East coast of northern area in the main island of Japan is seriously damaged**
- **As of April 18, 13,802 people are dead and 14,129 people are missing**

Source: Fire and Disaster Management Agency

1-3. Nuclear reactors near epicenter of the earthquake

Location of the Nuclear Installations



Onagawa
- Unit1: 524 MW, 1984-
- Unit2: 825 MW, 1995-
- Unit3: 825 MW, 2002-

Fukushima Ⅰ
- Unit1: 460 MW, 1971-
- Unit2: 784 MW, 1974-
- Unit3: 784 MW, 1976-
- Unit4: 784 MW, 1978-
- Unit5: 784 MW, 1978-
- Unit6: 1,100 MW, 1979-

Fukushima Ⅱ
- Unit1: 1,100 MW, 1982-
- Unit2: 1,100 MW, 1984-
- Unit3: 1,100 MW, 1985-
- Unit4: 1,100 MW, 1987-

Tokai Ⅱ (1,100 MW, 1978-)

1-4. Automatic shut-down of nuclear reactors

●11 reactors were automatically shut-down

- Onagawa Unit 1,2,3
- Fukushima Dai-ichi (I) Unit 1,2,3
- Fukushima-Dai-ni (II) Unit 1,2,3,4
- Tokai Dai-ni (II)

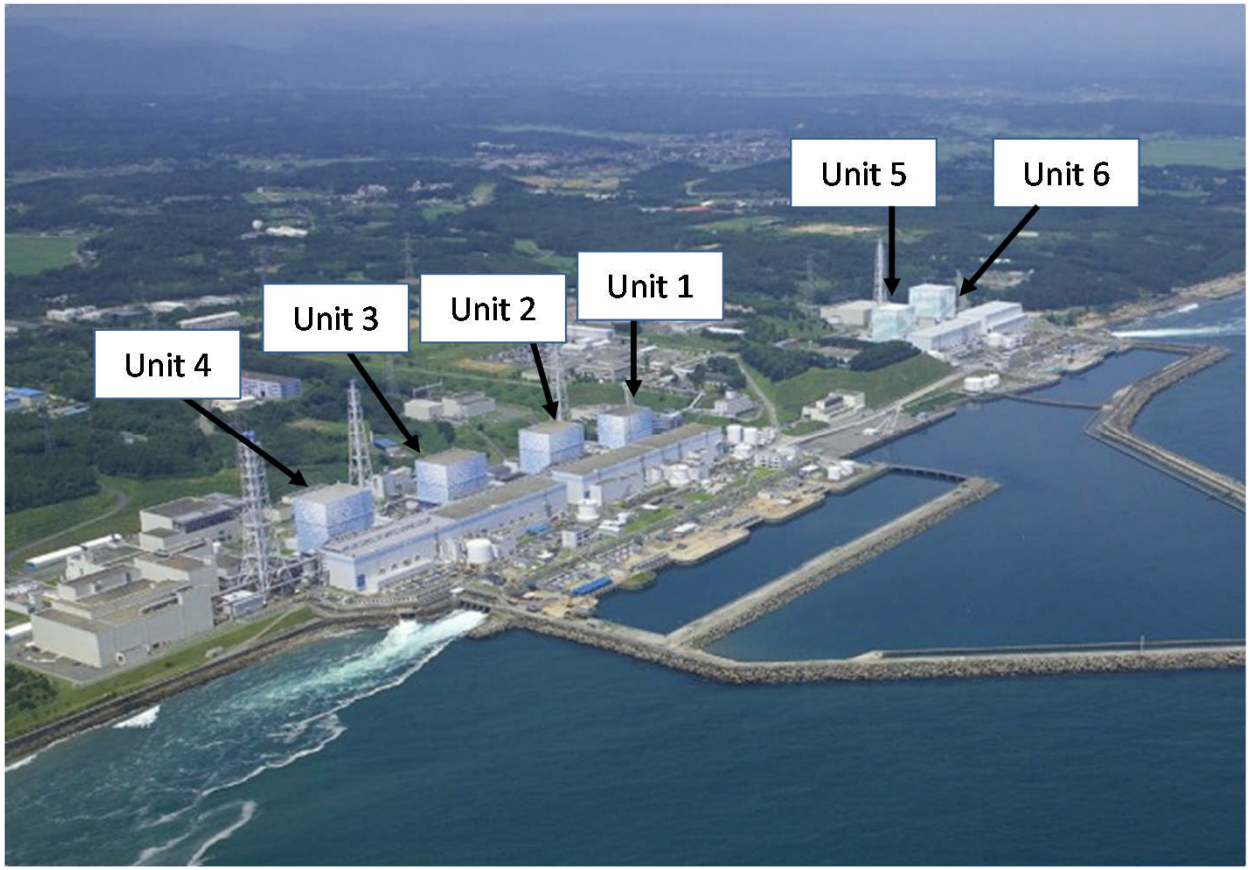
●3 reactors were under periodic inspection

- Fukushima Dai-ichi (I) Unit 4,5,6

-After the automatic shut-down, the Unit 1-3 at Onagawa Nuclear Power Station, the Unit 3 at Fukushima II Nuclear Power Station, and the Unit at Tokai II Nuclear Power Station have been cold shut down safely.

-As for the unit 1,2,4 at Fukushima II Nuclear Power Station, the operator of the station reported NISA nuclear emergency situation because the temperature of the suppression pools became more than 100 ℃, but afterward the three units have been cold shut down.

2. Outline of Fukushima Dai-ichi NPP



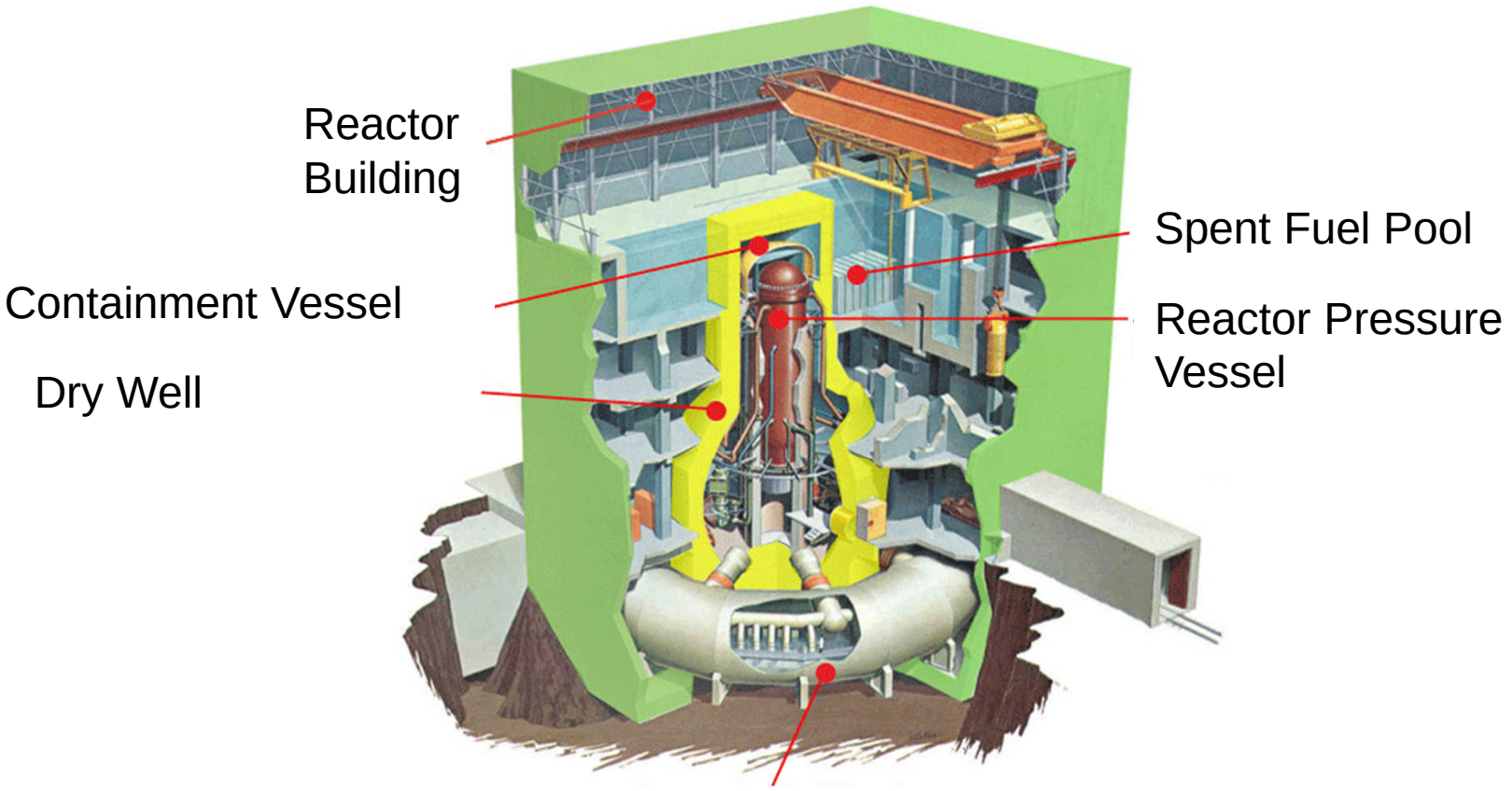
2-1. Summary of Fukushima Dai-ichi NPP

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	BWR-5
PCV Model	Mark-1	Mark-1	Mark-1	Mark-1	Mark-1	Mark-2
Electric Output (MWe)	460	784	784	784	784	1100
Max. pressure of RPV	8.24MPa	8.24MPa	8.24MPa	8.24MPa	8.62MPa	8.62MPa
Max. Temp of the RPV	300℃	300℃	300℃	300℃	302℃	302℃
Max. Pressure of the CV	0.43MPa	0.38MPa	0.38MPa	0.38MPa	0.38MPa	0.28MPa
Max. Temp of the CV	140℃	140℃	140℃	140℃	138℃	171℃(D/W) 105℃(S/C)
Commercial Operation	1971,3	1974,7	1976,3	1978,10	1978,4	1979,10
Emergency DG	2	2	2	2	2	3*
Electric Grid	275kV × 4				500kV × 2	
Plant Status on Mar. 11	In Operation	In Operation	In Operation	Refueling Outage	Refueling Outage	Refueling Outage

* One Emergency DG is Air-Cooled

Source: Application document of license for establishment of NPP

2-2. Overview of Mark-1 Type BWR (Unit 1,2,3 and 4)



出典：http://nei.cachefly.net/static/images/BWR_illustration.jpg

3. Accident progression & countermeasures

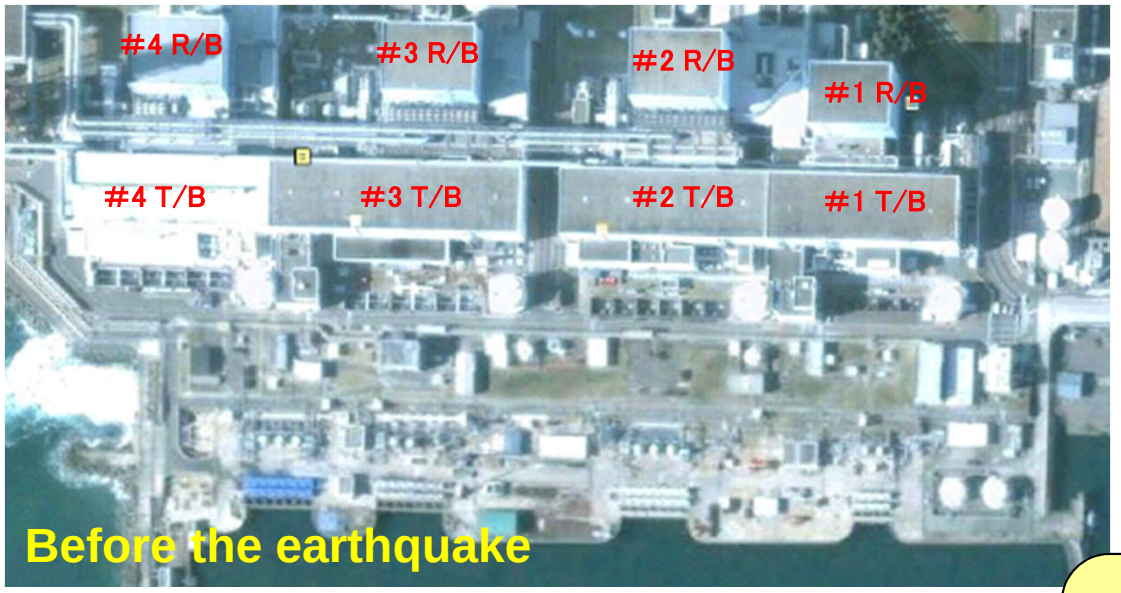
3A. Reactor related accident

3B. Accident at Spent Fuel Pools

3C .Leakage of radioactive water

3D. INES rating

3A-1. Satellite view of Fukushima Dai-ichi NPP)

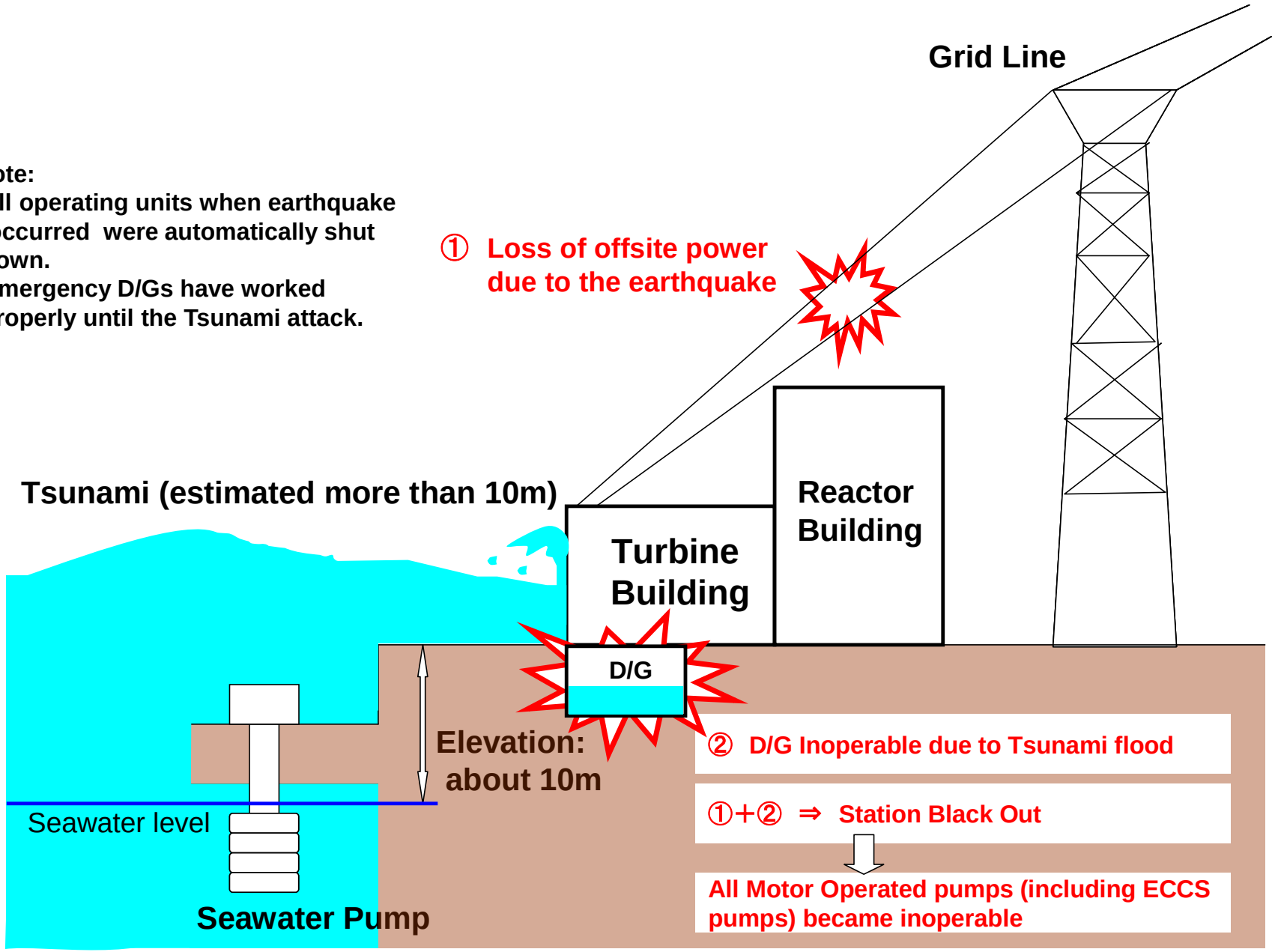


Many structures facing the bay are destroyed

Source: Google Earth

3A-2. Major root cause of the damage

Note:
- **All operating units when earthquake occurred were automatically shut down.**
- **Emergency D/Gs have worked properly until the Tsunami attack.**



3A-3. Accident Progression at Unit 1 Reactor

3A-4. Chronology of Unit 1 after the earthquake(1/2)

●*Unit 1*

11th
- ●Under operation, Automatic shutdown by the earthquake
- ●Loss of A/C power
- ●Loss of water injection function

12th
- ●Unusual increase of PCV pressure
- ●Started to vent
- ●Sound of explosion
- ●Started of injection of seawater and borated water to the core

22nd
- ●Rise of reactor temperature (383℃) → Drop (26th 05:00 144.3℃)

23rd
- ●Water supply line in addition to the Fire Extinguish line. Switched to water supply line only.(Flow rate: 7m^3/h)

24th
- ●Lighting in the Central Control Room was recovered.

25th
- ●Started fresh water injection

29th
- ●Switched to the water injection to the core using a temporary motor operated pump.

31st
- ●Started to transfer the stagnant water from the Condensate Storage Tank(CST) to the Surge Tank of Suppression Pool Water(SPT)

3A-4. Chronology of Unit 1 after the earthquake(2/2)

●*Unit 1(Continued)*

April 3rd
- ●The power supply to the temporary motor-driven pump was switched from the temporary power supply to the external power supply
- ● Started to transfer the water from the Condenser to CST

6th
- ●Started the operation for the injection of nitrogen to PCV

9th
- ●Started the using highly pure nitrogen generator in the injection of nitrogen to PCV

10th
- ●Completed transferring the water from the Condenser to CST

11th
- ●Loss of external supply due to an earthquake occurred and water injection to the Reactor core and nitrogen injection to PCV were suspended.⇒Resumed.

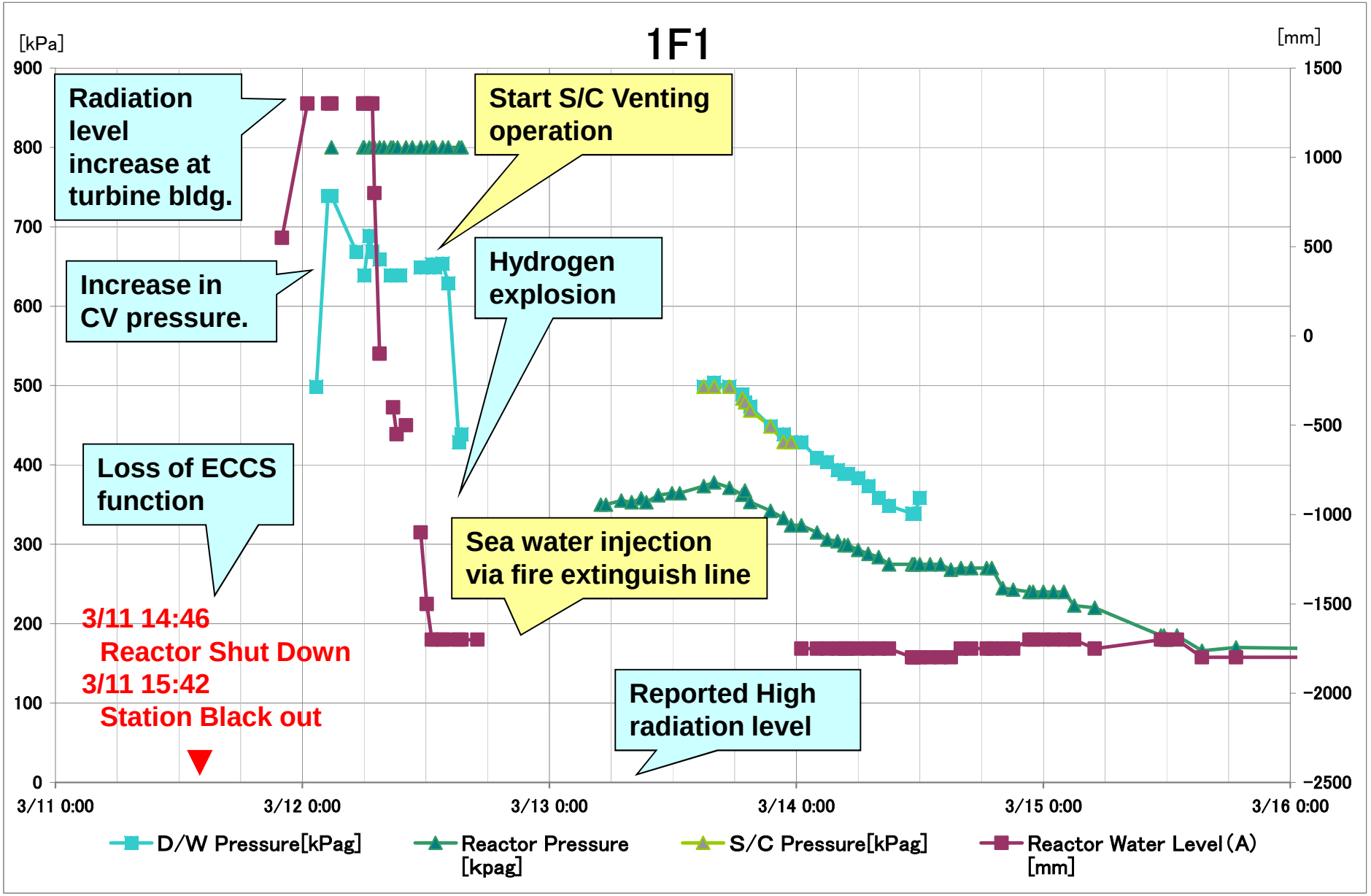
17th
- ●Confirmed the situation in the reactor building using an unmanned robot

18th
- ●Stopped the water injection into the reactor core to replace the current hose with a new one.

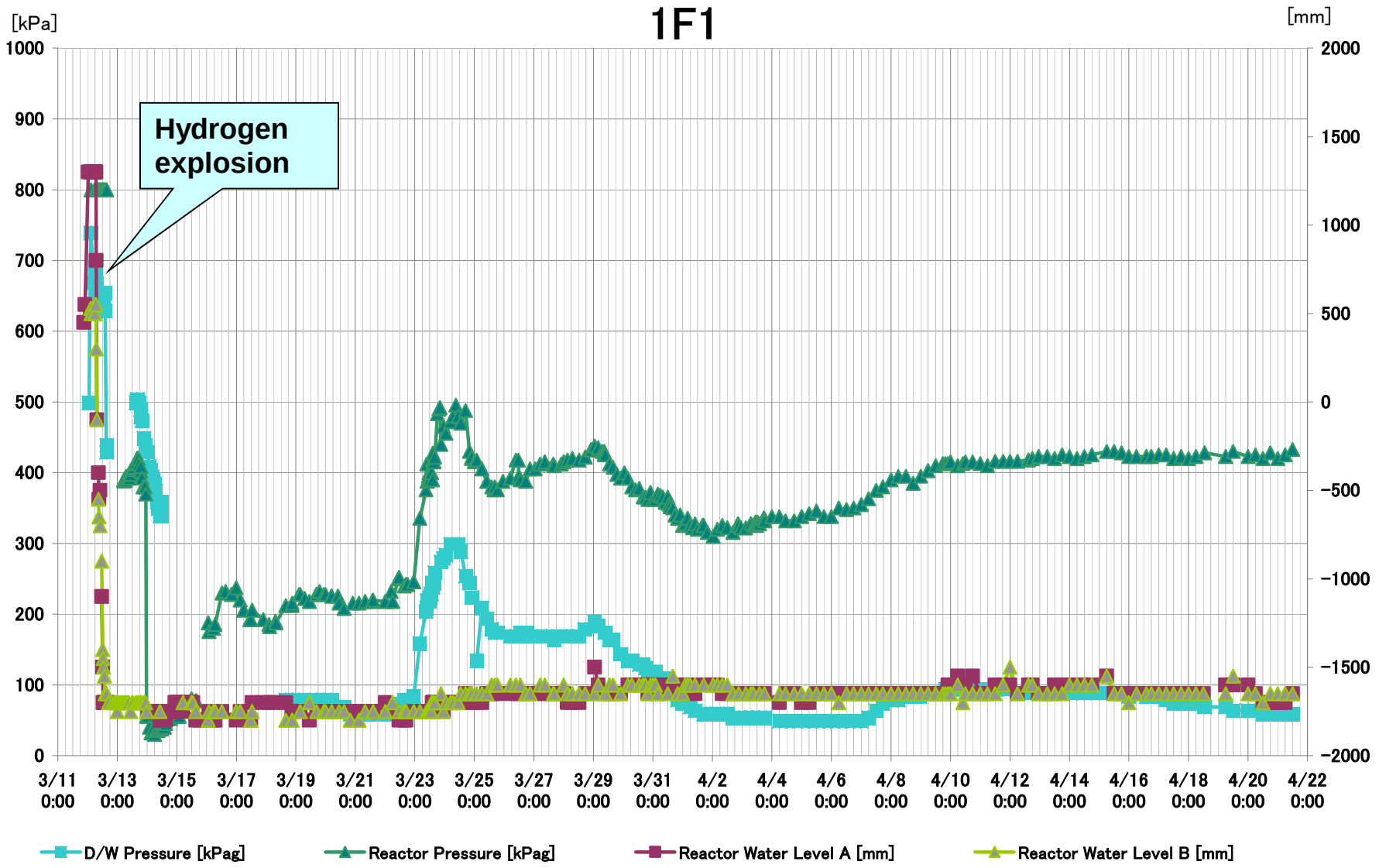
19th
- ●Completed the work of strengthening connection of the power suplies between Unit 1-2 and Unit3-4.

Fresh water is being injected to the spent fuel pool and the reactor(As of April 22nd)

3A-5. Trend data of Unit1 until March15

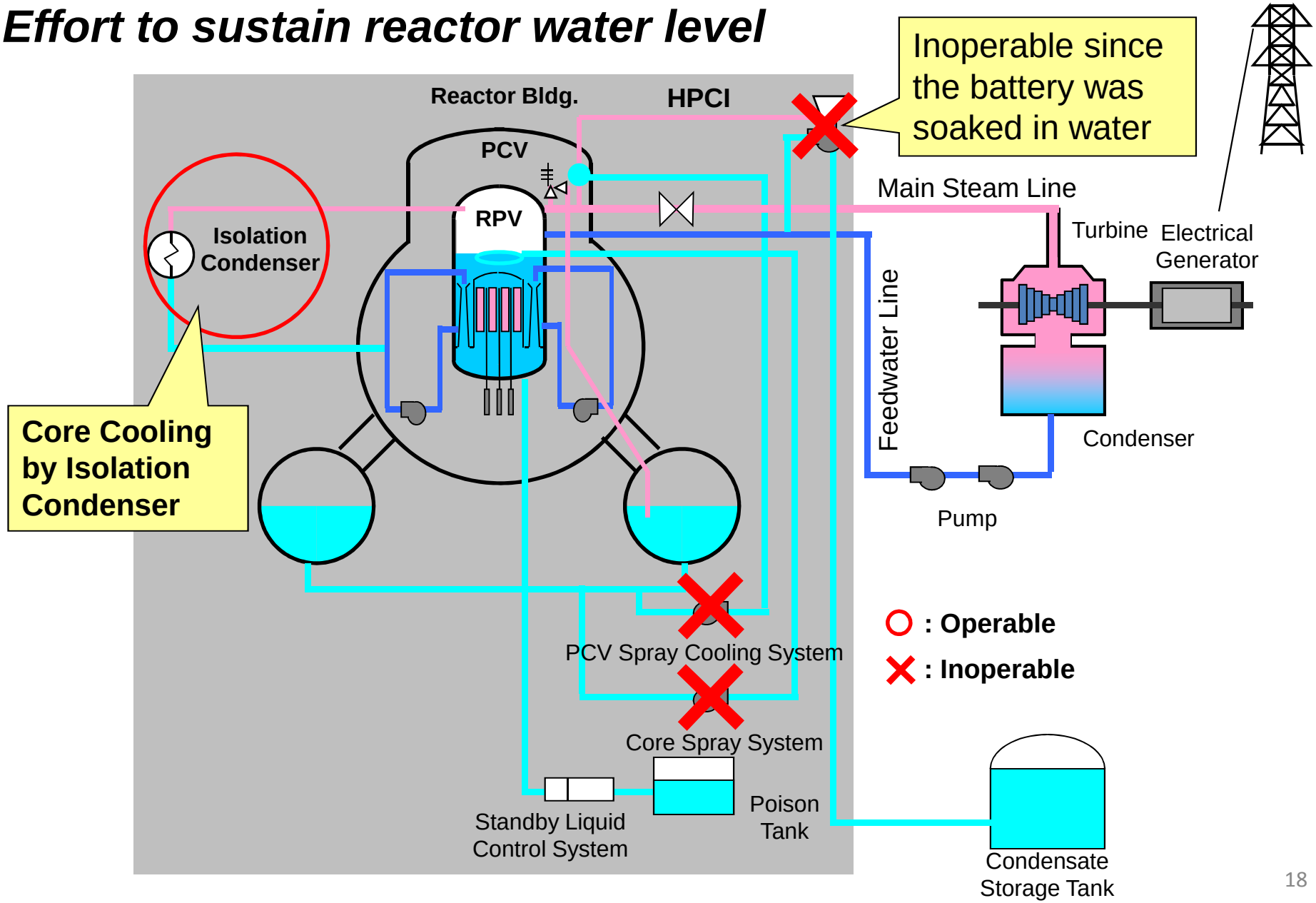


3A-6. Trend data of Unit1 until April21



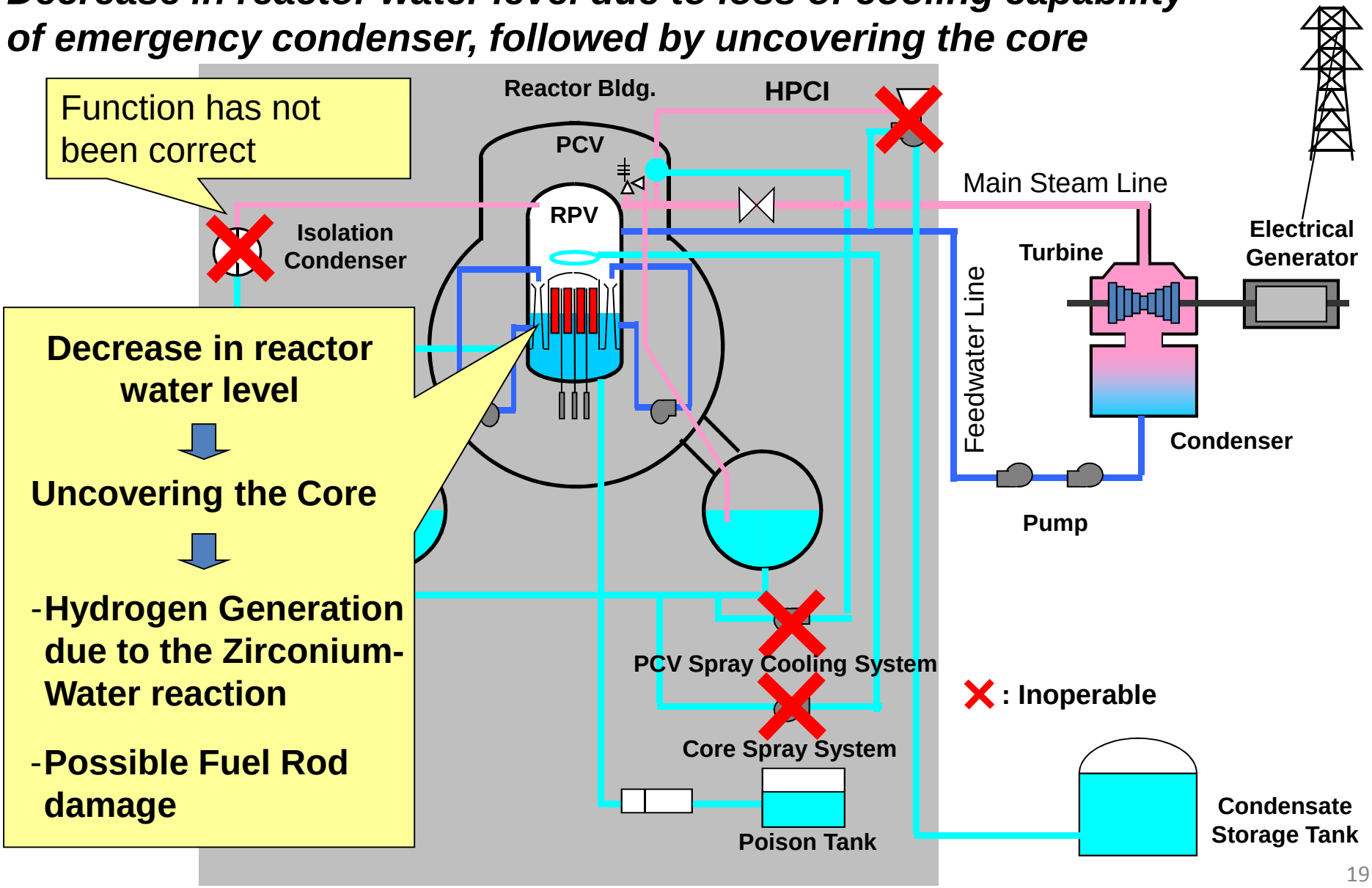
3A-7. Accident progression at Unit1(1/3)

Effort to sustain reactor water level



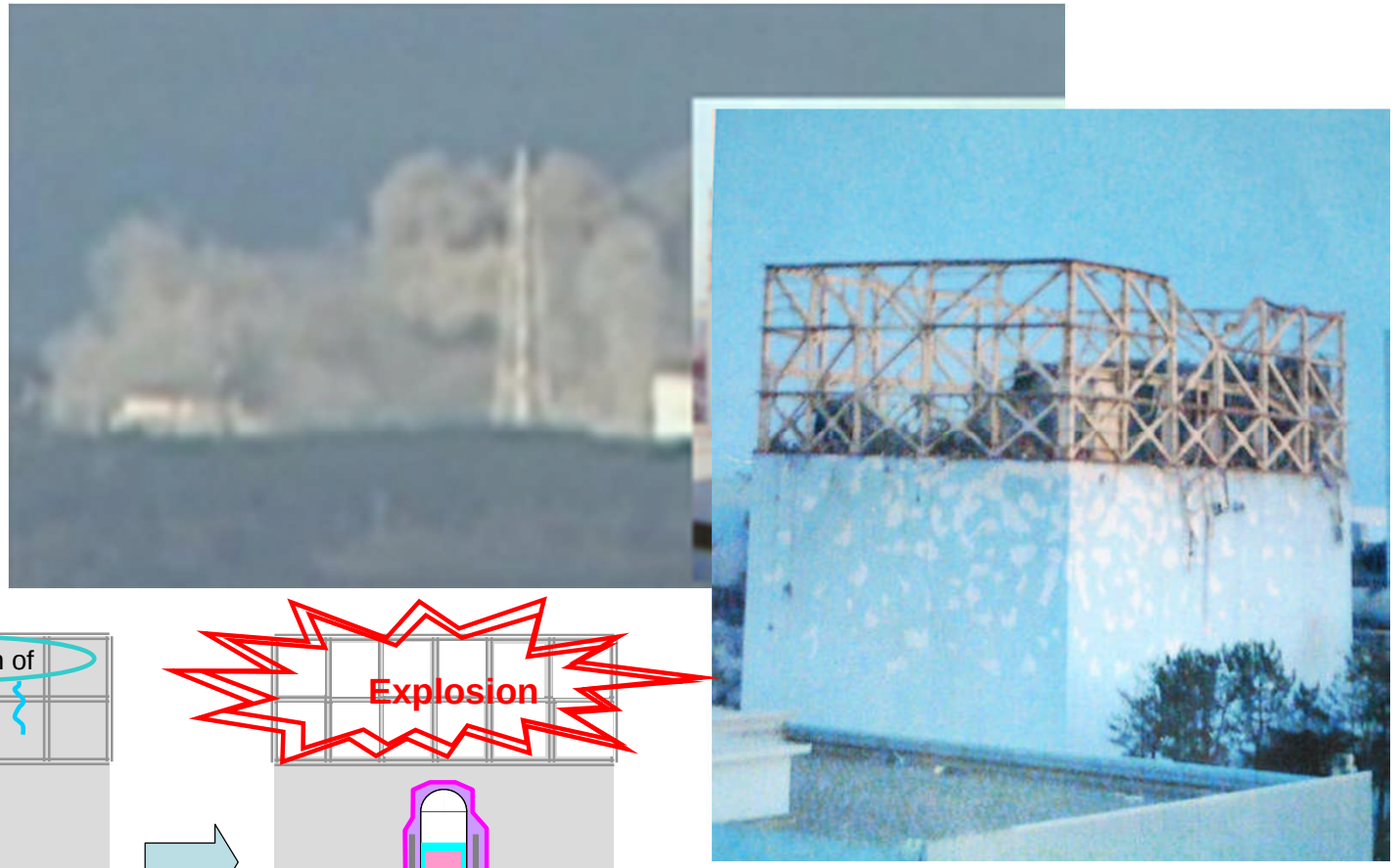
3A-7. Accident progression at Unit1(2/3)

Decrease in reactor water level due to loss of cooling capability of emergency condenser, followed by uncovering the core



3A-7. Accident progression at Unit1(3/3)

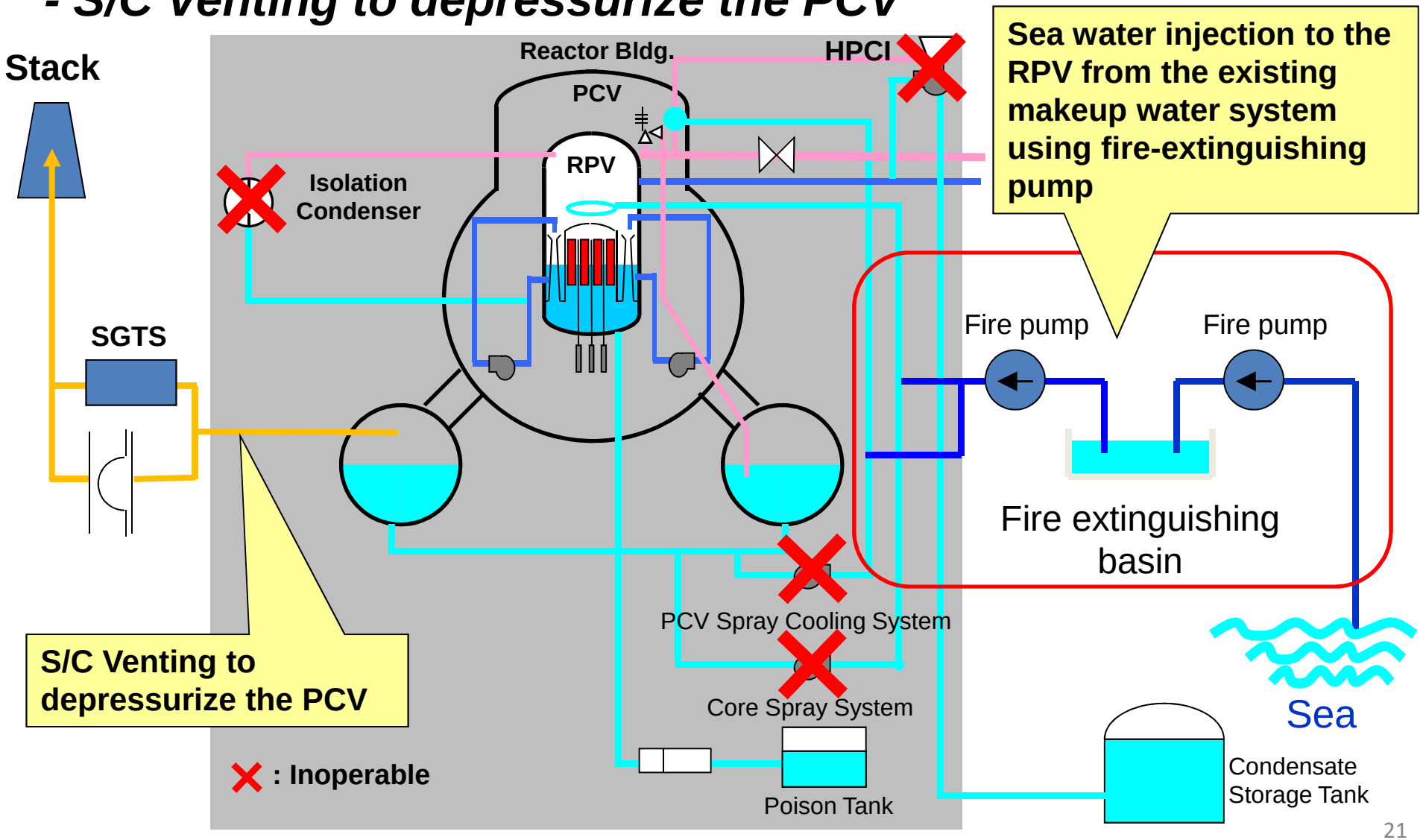
Hydrogen explosion in the operation floor



3A-8. Countermeasures at Unit1(1/3)

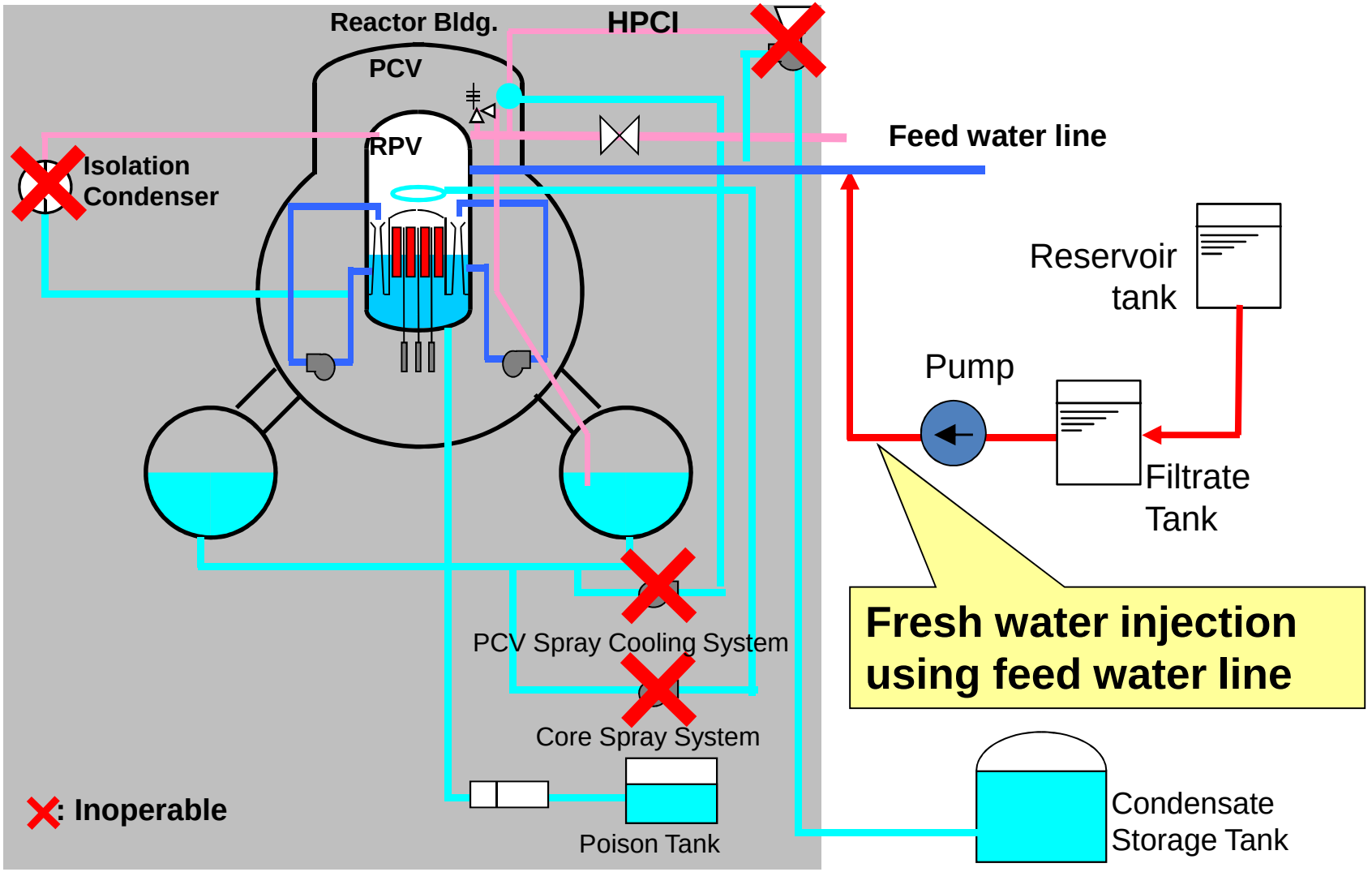
- Sea water injection using fire water pump

- S/C Venting to depressurize the PCV



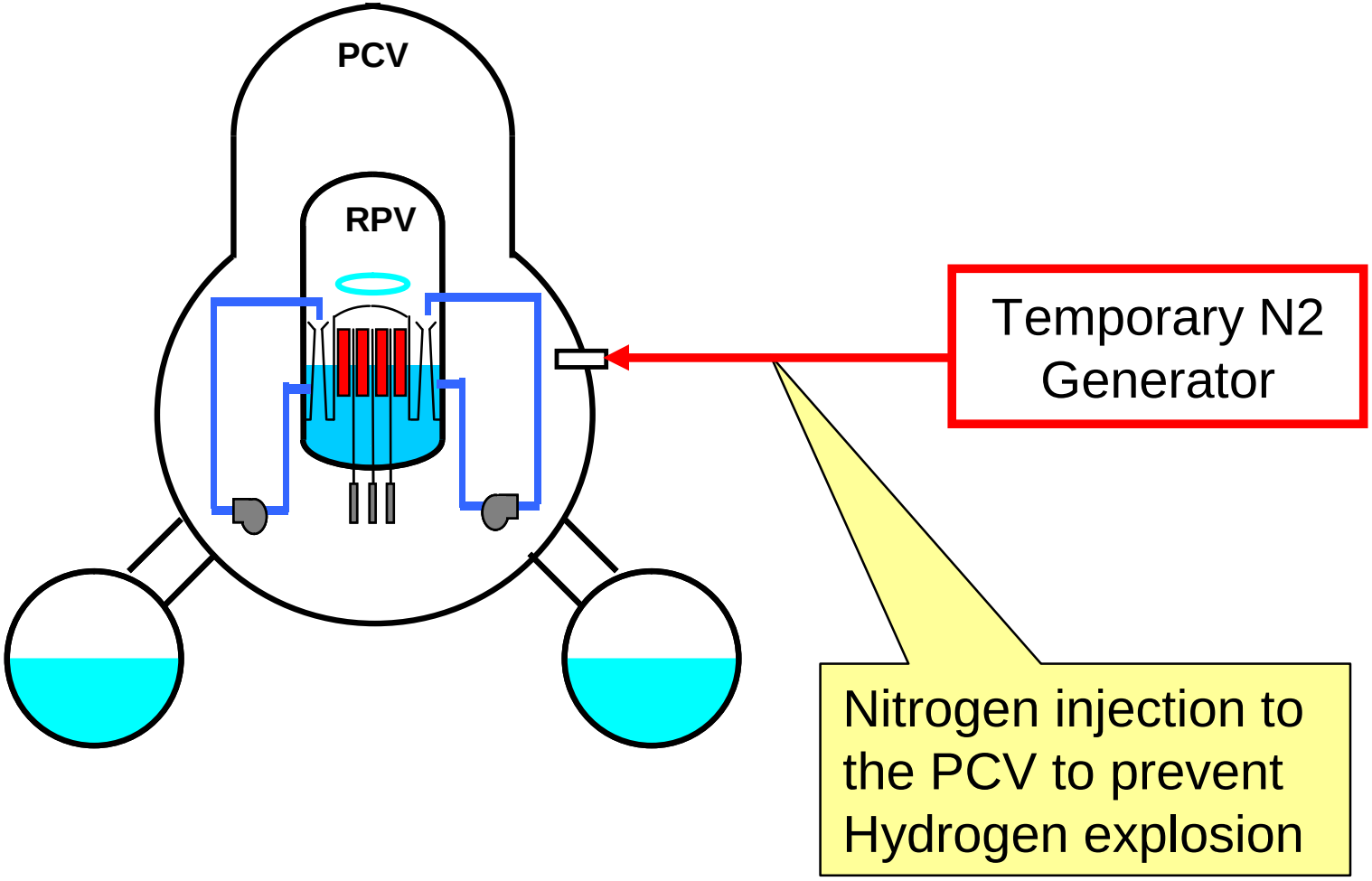
3A-8. Countermeasures at Unit1(2/3)

- Switched to fresh water injection on May 25th

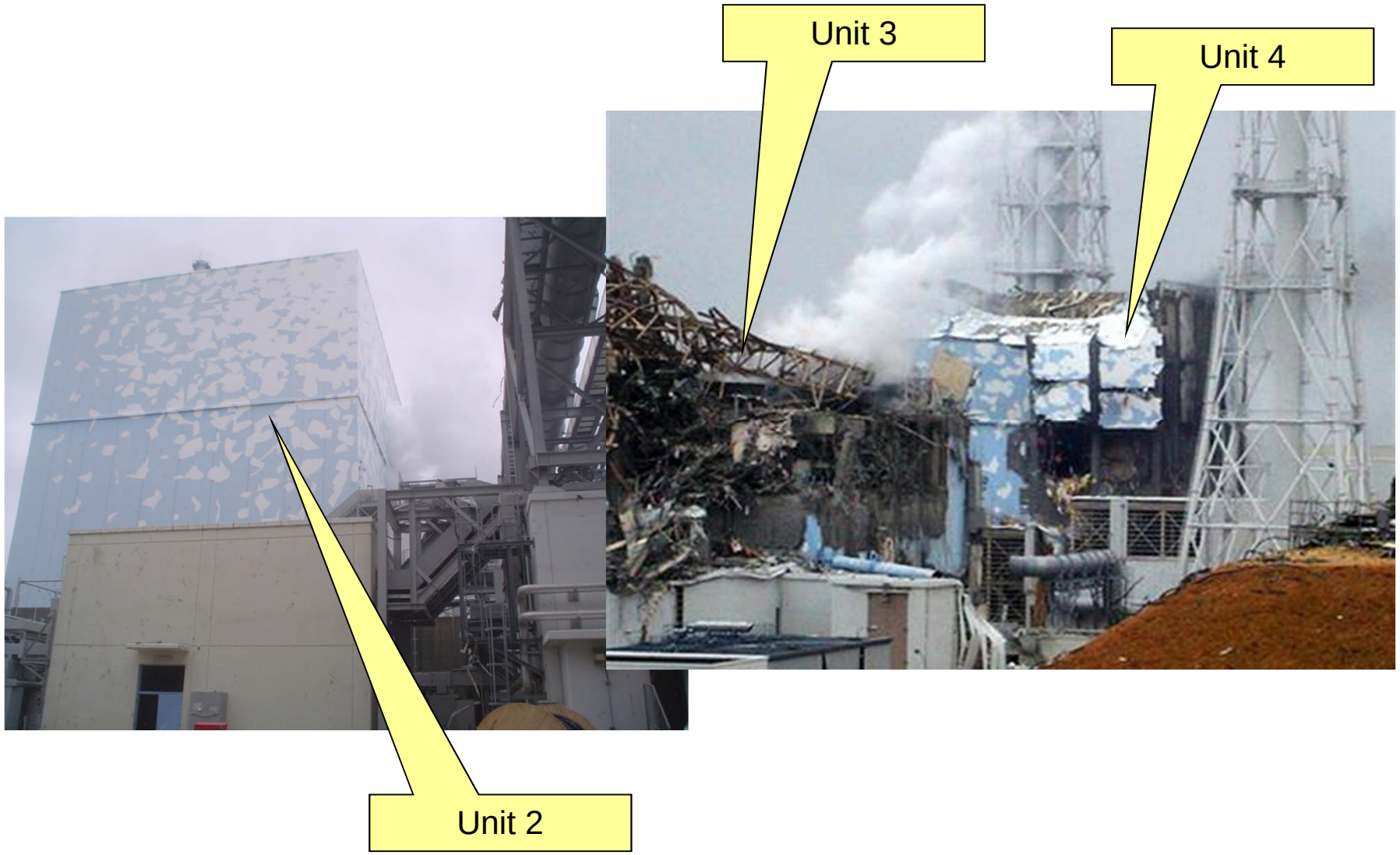


3A-8. Countermeasures at Unit1(3/3)

- Nitrogen injection to the PCV (since April 6th)



3A-9. Accident Progression at Unit2 through 6



3A-10. Chronology of Unit2 after the earthquake(1/4)

● *Unit 2*

11th
- ●Under operation, Automatic shutdown by the earthquake
- ● Loss of A/C power
- ● Loss of water injection function

14th
- ● Loss of water cooling function
- ● Unusual increase in PCV pressure

15th
- ● Sound of explosion
- ● Possible damage of the suppression chamber

20th
- ● Injection of about 40 tons of seawater into SFP through fire extinguishing system.
- ● Injection of seawater to the Spent Fuel Pool (SFP)

21st
- ● White smoke generated

22nd
- ● Injection of seawater to the Spent Fuel Pool (SFP)

25th
- ● Injection of seawater to SFP

3A-10. Chronology of Unit2 after the earthquake(2/4)

● *Unit 2(Continued)*

26th ●Lighting in the Central Control Room was recovered

27th ●Switched to the water injection to the core using a temporary motor-driven pump.

29th ●The Seawater injection to the Spent Fuel Pool using the Fire Pump Truck was switched to the fresh water injection using the temporary motor-driven pump

●In order to prepare for transferring the stagnant water on the basement floor of turbine building to the Condenser, the water in the Condensate Storage Tank is being transferred to the Surge Tank of Suppression Pool Water.

30th ●The injection pump was switched to the Fire Pump Truck. However, because cracks were confirmed in the hose (12:47 and 13:10 March 30th), the injection was suspended. The injection of fresh water resumed at 19:05 March 30th.

31st ●White smoke was confirmed to generate continuously.

●Fresh water is being injected to the spent fuel pool and the RPV

3A-10. Chronology of Unit2 after the earthquake(3/4)

● *Unit 2(Continued)*

April 1st	●Freshwater injection to SFP via FPC using temporary motor-driven pump
2nd	●The water, of which the dose rate was at the level of more than 1,000mSv/h ,was confirmed to be collected in the pit located near the intake Channel of Unit2. ●Started to transfer the water from the condenser to the CST
3rd	●The power supply to the temporary motor-driven pump was switched from the temporary power supply to the external power supply.
4th	●Freshwater injection to SFP via FPC using the temporary motor-driven pump.
5th	●Tracer is confirmed to outflow through the permeable layer around the pit into the sea.
9th	●Completed transferring the water form the Condenser to CST.
11th	●Loss of external supply was suspended.⇒Resumed
12th	●Transfer from the trench of the turbine building to the Condenser
13th	●Suspended the transfer for checking leaks, etc ●Freshwater injection to SFP via FPC using the temporary motor-driven pump

3A-10. Chronology of Unit2 after the earthquake(4/4)

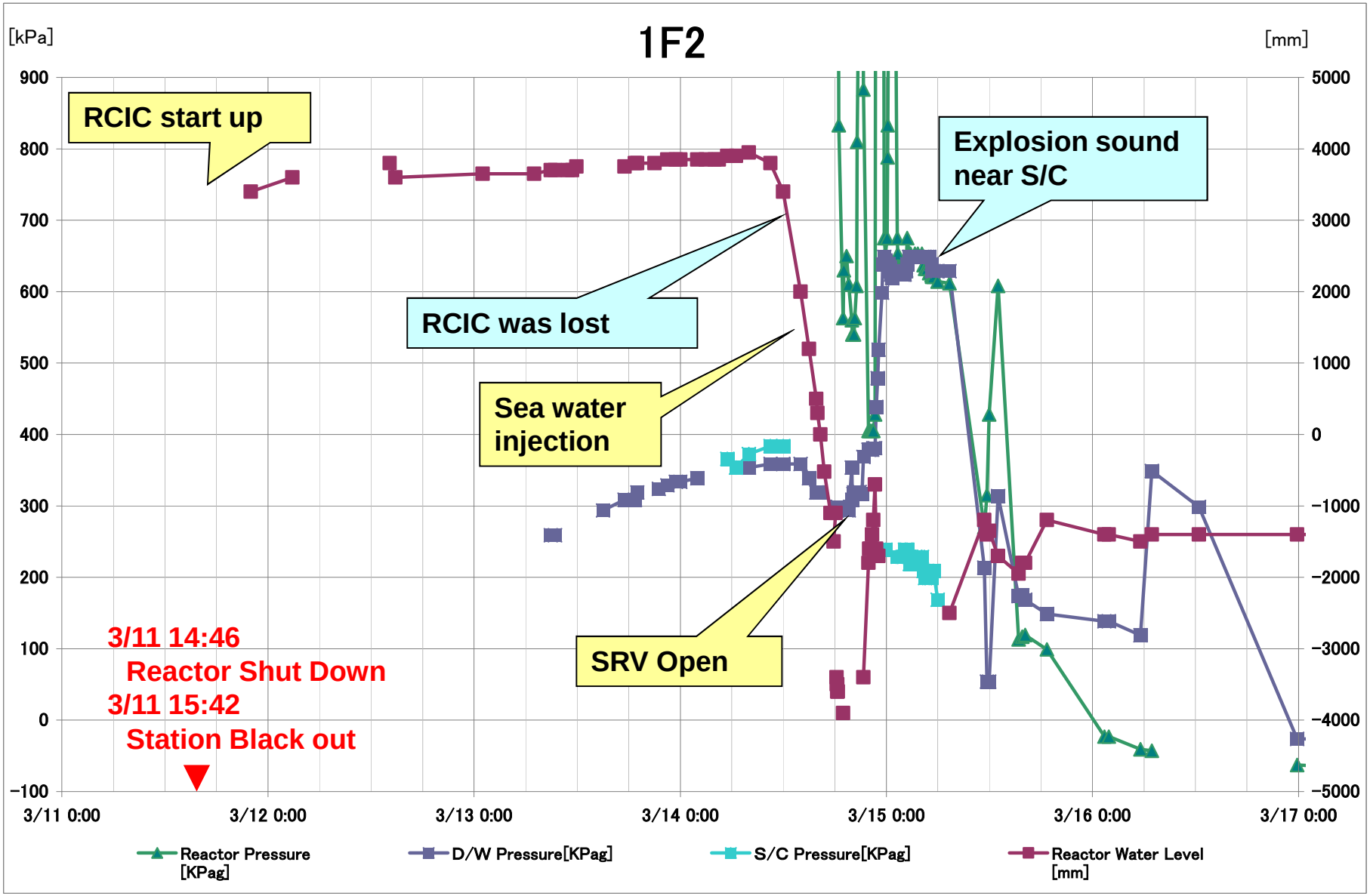
●*Unit 2(Continued)*

18th
- ●Confirmed the situation in the reactor building using unmanned robot
- ●Stopped the water injection into the reactor core to replace the current hose with a new one.
- ●Injected coagulant(soluble glass) into the power cable trench

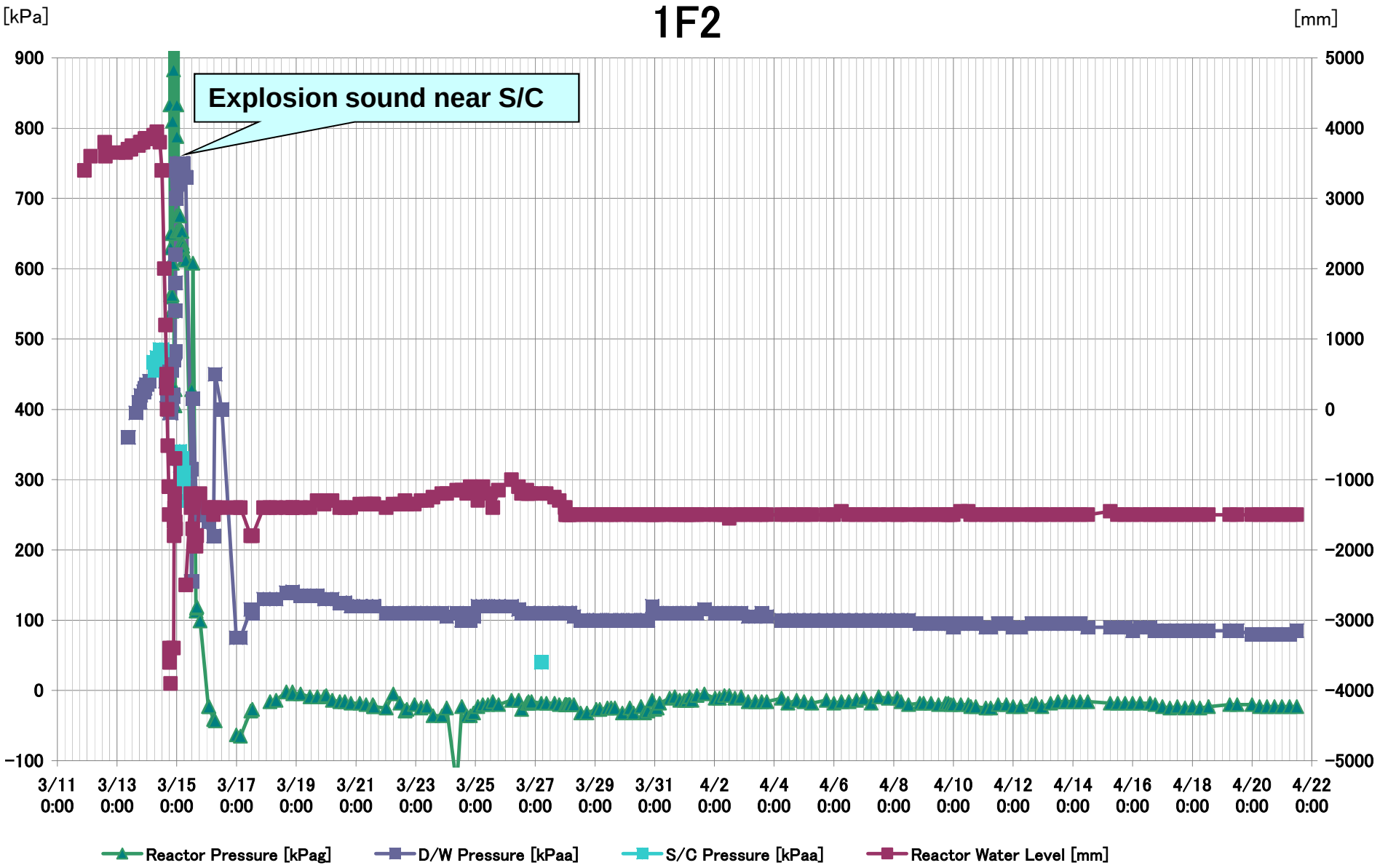
19th
- ●Started transfer the stagnant water with high-level radioactivity from the trench of the turbine building to the buildings of radioactive water treatment facilities
- ●Completed the work of strengthening connection of the power supplies between Unit1-2 and Units3-4
- ●Injected freshwater to SFP via FPC using the temporary motor-driven pump

Fresh water is being injected to the spent fuel pool and the reactor(As of April 22nd)

3A-11. Trend data of Unit2 until March17



3A-12. Trend data of Unit2 until April21



3A-13. Chronology of Unit3 after the earthquake(1/3)

●*Unit 3*

11th
- ●Under operation, Automatic shutdown by the earthquake
- ● Loss of A/C power

13th
- ● Loss of water injection function
- ● Started to vent

14th
- ●Unusual increase in PCV pressure
- ●Sound of explosion

16th
- ●White smoke generated

17th
- ●Water discharge by the helicopters of Self-Defense Force(4 times)
- ●Water spray from the ground by High pressure water-cannon trucks (Police: once, Self-Defense Force: 5 times)

18th
- ●Water spray from the ground by same trucks (Self-Defense Force: 6 times)

Water spray from the ground by US water-cannon trucks (US armed force:1 time)

19th
- ●Water spray from the ground by High pressure water-cannon trucks by Hyper Rescue Unit of Tokyo Fire Department.

3A-13. Chronology of Unit3 after the earthquake(2/3)

●*Unit 3(Continued)*

20th	●Sprayed by Hyper Rescue Unit of Tokyo Fire Department
22nd	●Lighting in the Central Control Room was recovered.
23rd	●Injection of seawater to the SFP
24th	●Injection of seawater to the SFP
25th	●Water spray (Emergency fire support team ●Started fresh water injection
27th	●Water spray by Concrete Pump Truck
28th	●Switched to the water injection to the core using a temporary motor-driven pump ●In order to prepare for transfer the stagnant water on the basement floor of turbine building to the Condenser, the water in the Condensate Storage Tank is being transferred to the Surge Tank of Suppression Pool Water
April 3rd	●The power supply to the temporary motor-driven pump was switched from the temporary power supply to the external power supply.

3A-13. Chronology of Unit3 after the earthquake(3/3)

●*Unit 3(Continued)*

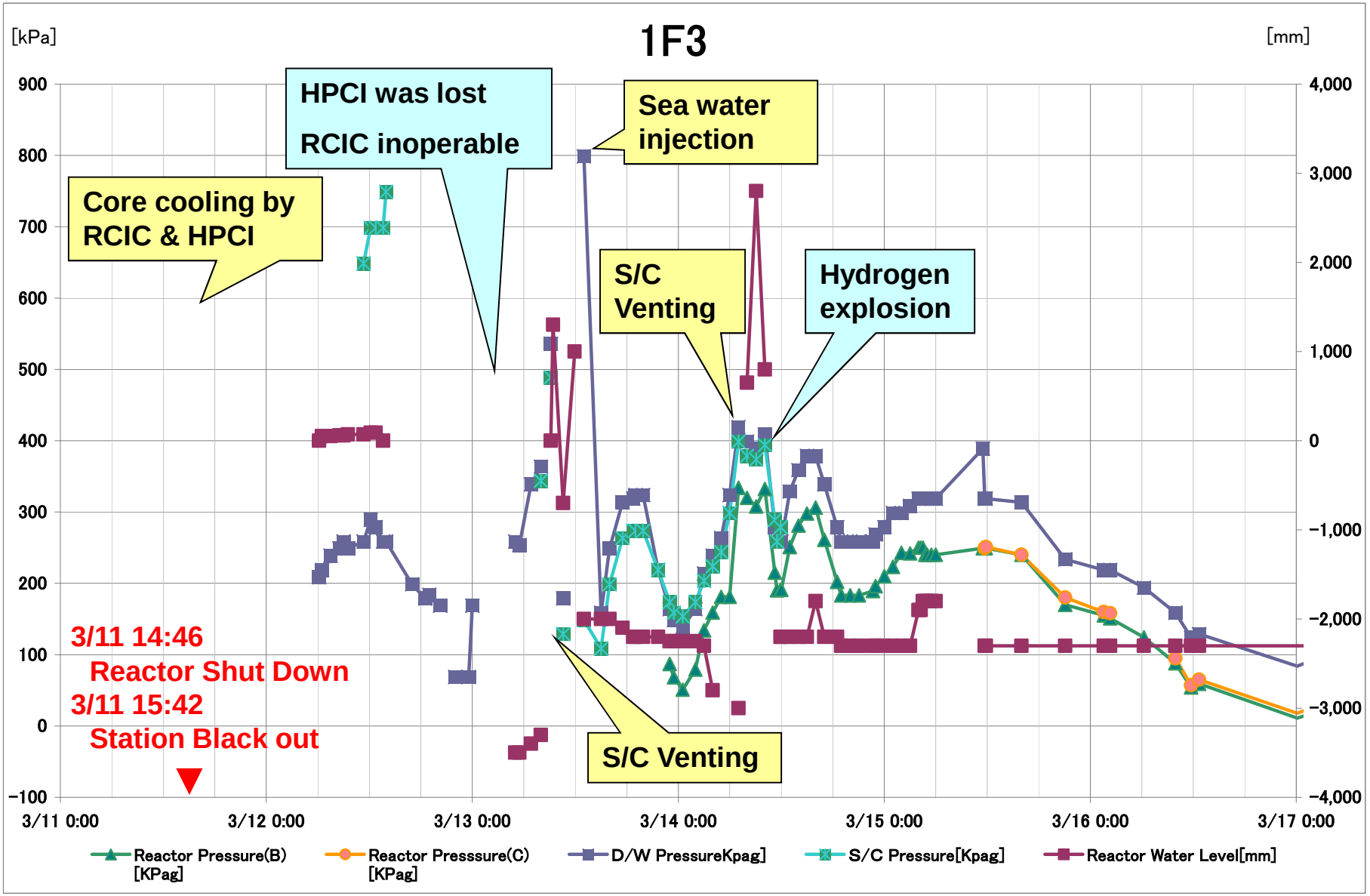
17th ●Confirmed the situation in the reactor building using unmanned robot.

18th ●Stopped the water injection into the reactor core to replace the current hose with a new one

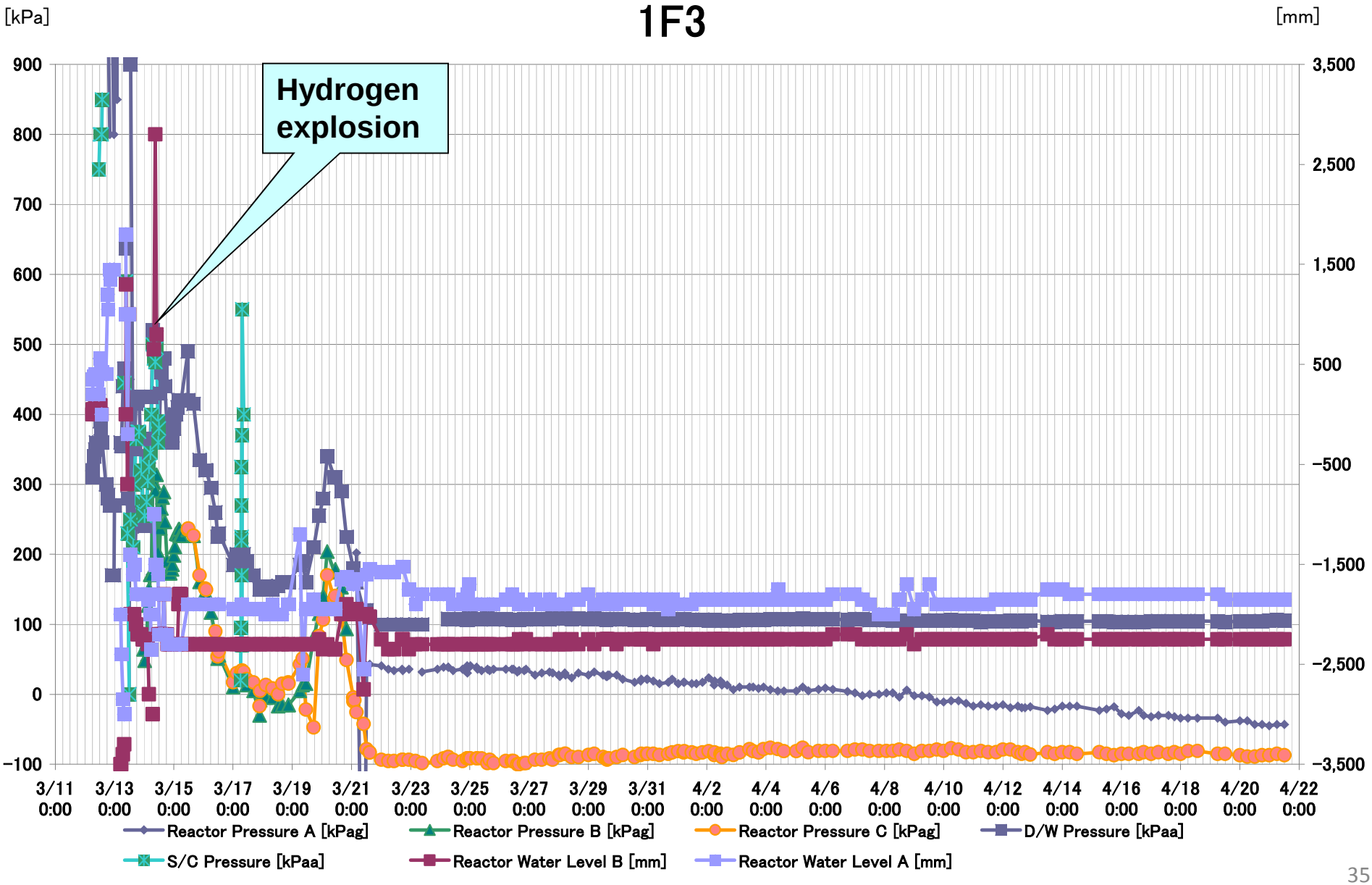
19th ●Completed the work of strengthening connection of the power supplies between Units1-2 and Units3-4

Fresh water is being injected to the spent fuel pool and the reactor(As of April 22nd)

3A-14. Trend data of Unit 3 until March 17



3A-15. Trend data of Unit 3 until April 21



3A-16. Chronology of Unit4 after the earthquake

●*Unit 4*

14th	●Water temperature in the Spent Fuel Pool, 84℃
15th	●Damage of wall in the 4th floor confirmed ●Fire occurred in the 3rd floor (12:25 extinguished)
16th	●Fire occurred. TEPCO couldn't confirm any fire on the ground.
20th	●Water spray over the spent fuel pool by Self Defense Force
21st	●Water spray over the spent fuel pool by Self Defense Force
22nd-24th	●Water spray (Concrete Pump Track (3 times)
25th	●Injection of seawater to SFP via the Fuel Pool Cooling Line (FPC) ●Water spray (Concrete Pump Truck)
27th	●Water spray (Concrete Pump Truck)
29th	●Lighting in the Central Control Room was recovered.
April 12th	●Sampled the water in SFP
19th	●Completed the work of strengthening connection of the power supplies between Units1-2 and Units3-4

No fuel is in the reactor. Fresh water is being injected to the spent fuel pool (As of April 22nd)

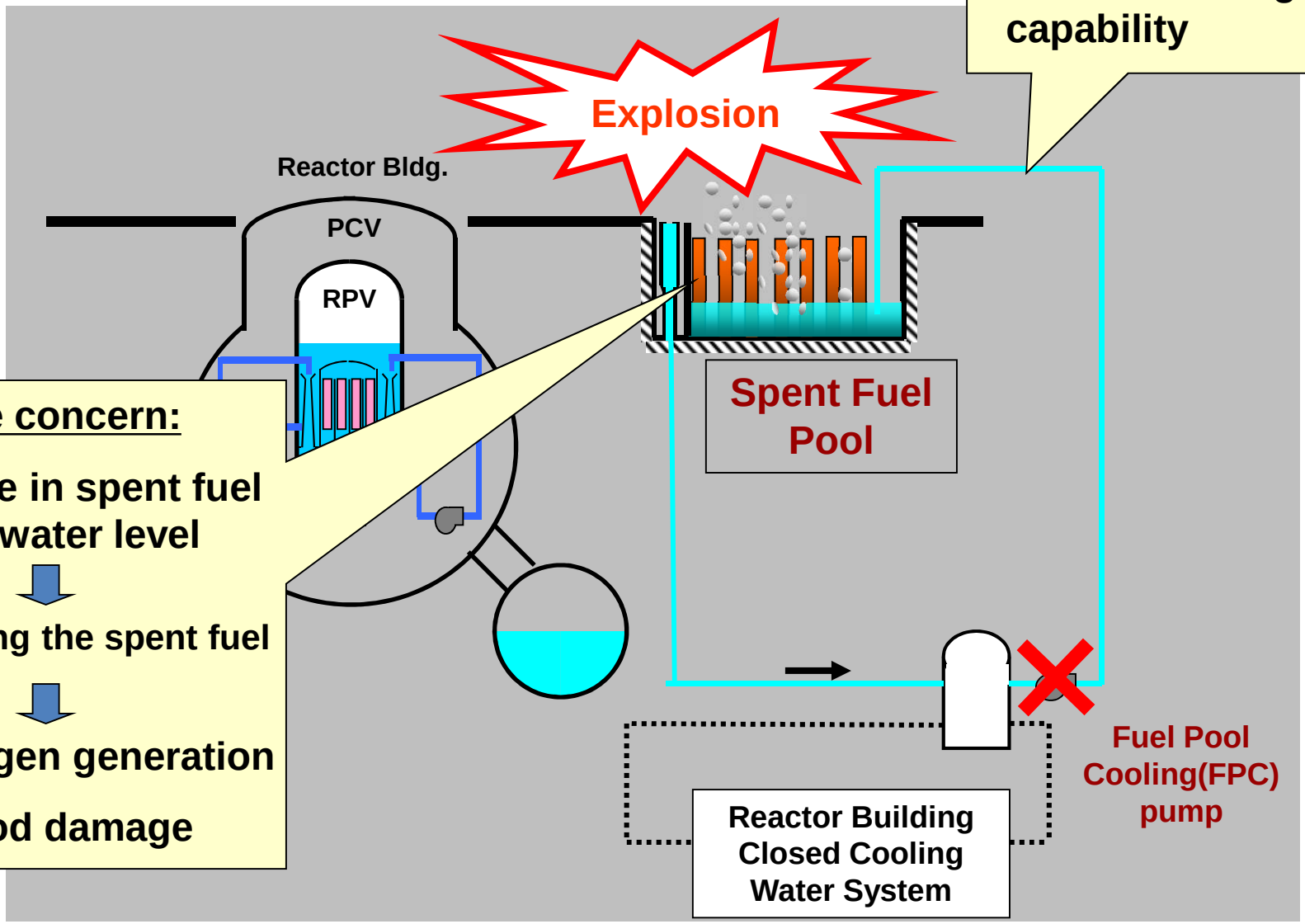
3A-17. Chronology of Unit 5&6 after the earthquake

● *Unit 5&6*

20th	●Unit 5 under cold shutdown (Water temperature of reactor water is less than 100℃) ●Unit 6 under cold shutdown (Water temperature of reactor water is less than 100℃)
21st	●Water spray over the Common Spent Fuel Pool started
22nd	●Recovering power supply of unit 5 and 6 is completed.
24th	●The power was started to be supplied. Cooling also started
30th	●Bach up power of Unit 6 is in working condition and external power was supplied to Unit 5 as of March 30th
April 4th	●Discharged the ground water with low-level radioactivity in the Sub Drain Pit to the sea(Unit5 and 6)
19th	●Transferred stagnant water under the base of the turbine building to the condenser for measuring the amount it.(Unit6)
20th	●The pump for RHR was temporarily stopped in order to change the position of the hose of temporary RHR Seawater System.

Unit5 & 6 is under cold shut down(As of April 22nd)

3B-1. Possible concerns about Spent Fuel Pool



3B-2. Status of the Fuel as of March11, 2011

Unit	1	2	3	4	5	6
Number of Fuel Assembly in the Core	400	548	548	-	548	764
Number of Spent Fuel Assembly in the Spent Fuel Pool	292	587	514	1,331	946	876
Number of New Fuel Assembly in the Spent Fuel Pool	100	28	52	204	48	64
Water Volume (m^3)	1,020	1,425	1,425	1,425	1,425	1,497

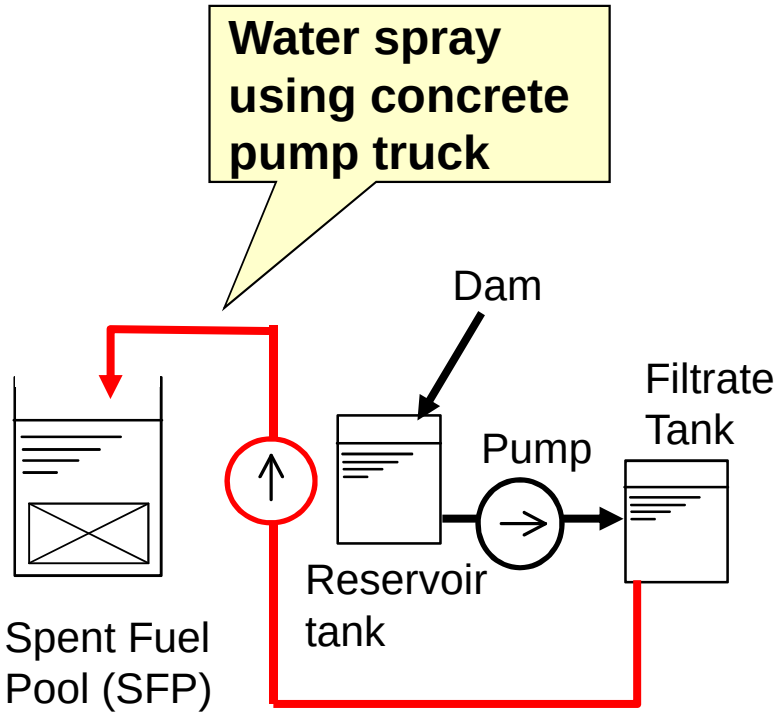
Condition of the fuel in the Spent Fuel Pool

Unit 1	Unit 2	Unit 3	Unit 4
-Most recent shut down was on Sep.27,2010	- Most recent shut down was on Nov.18,2010	- Most recent shut down was on Sep.23,2010	-Most recent shut down was on Nov.29,2010 -All fuel assembly was removed from the core and located in the pool due to the core shroud replacement

3B-3. Measures taken to cool the Spent Fuel Pool(1/3)

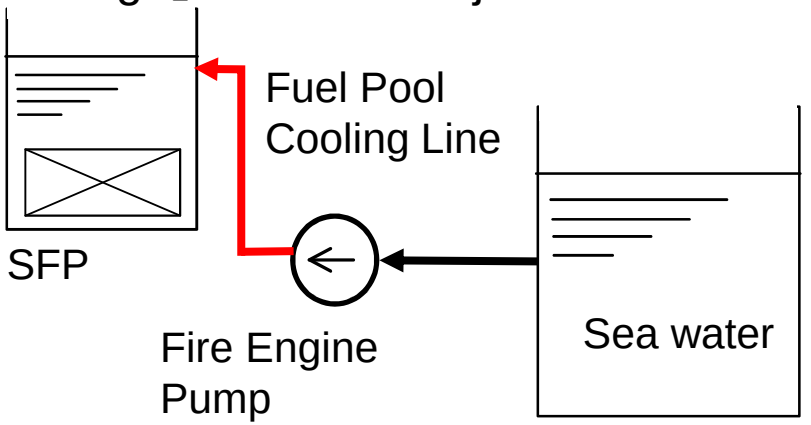
Unit 1

Fresh water injection

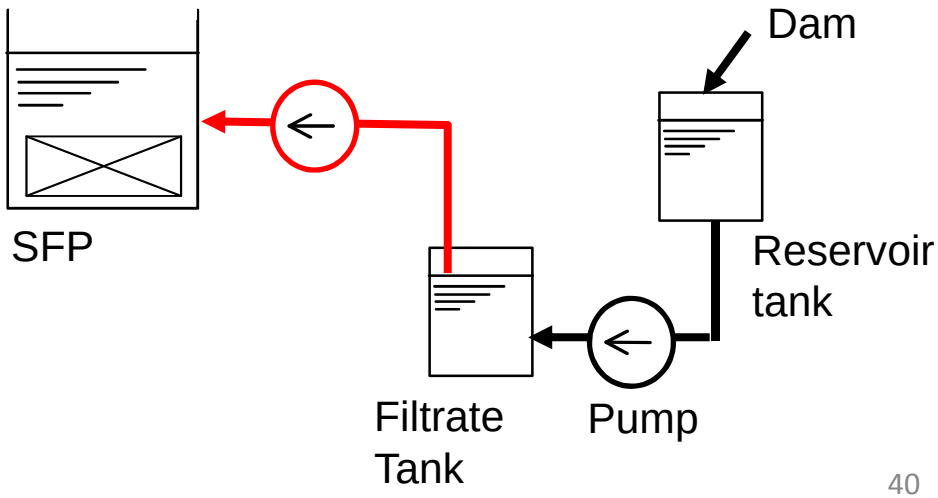


Unit 2

【1st Stage】Sea water injection



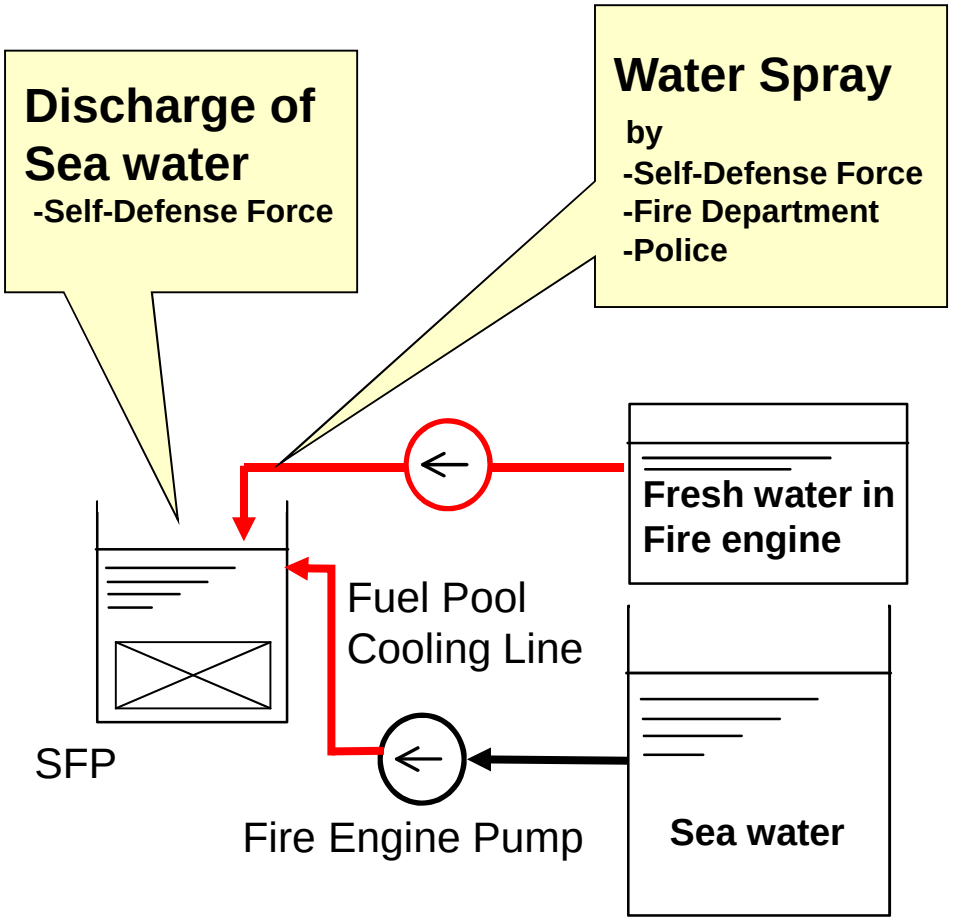
【2nd Stage】Fresh water injection



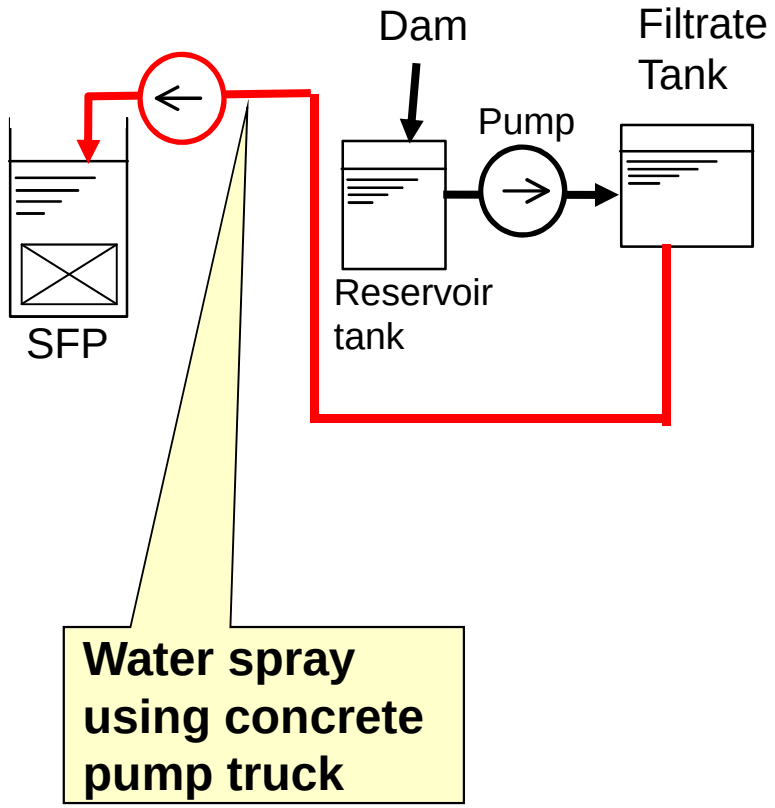
3B-3. Measures taken to cool the Spent Fuel Pool(2/3)

Unit 3

【1st Stage】Sea water injection



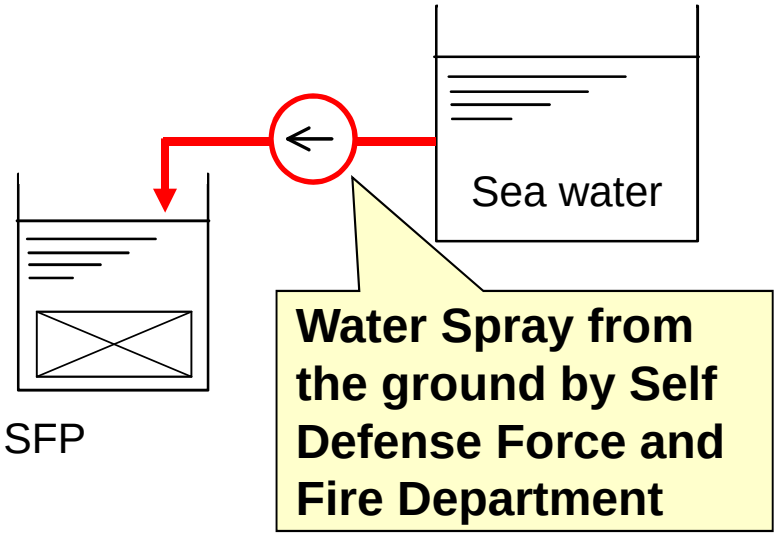
【2nd Stage】Fresh water injection



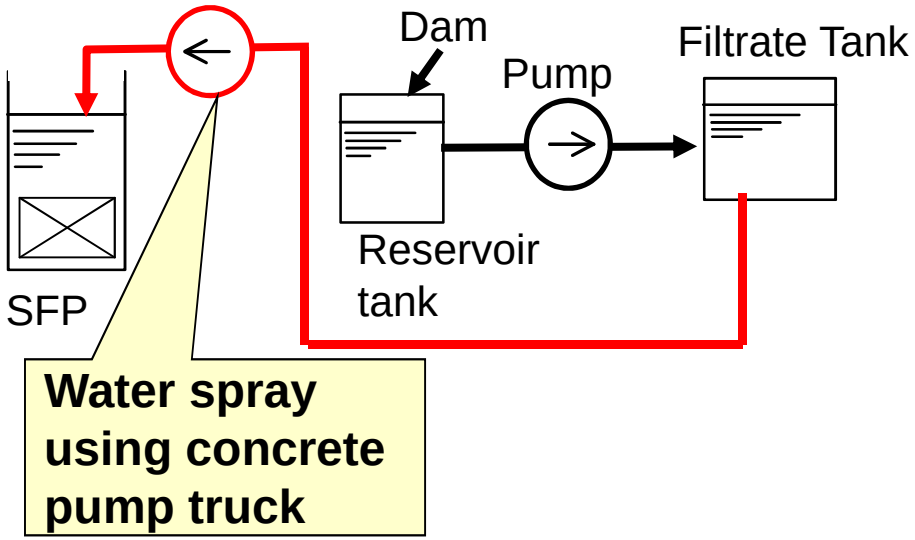
3B-3. Measures taken to cool the Spent Fuel Pool(3/3)

Unit 4

【1st Stage】Sea water injection



【2nd Stage】Fresh water injection



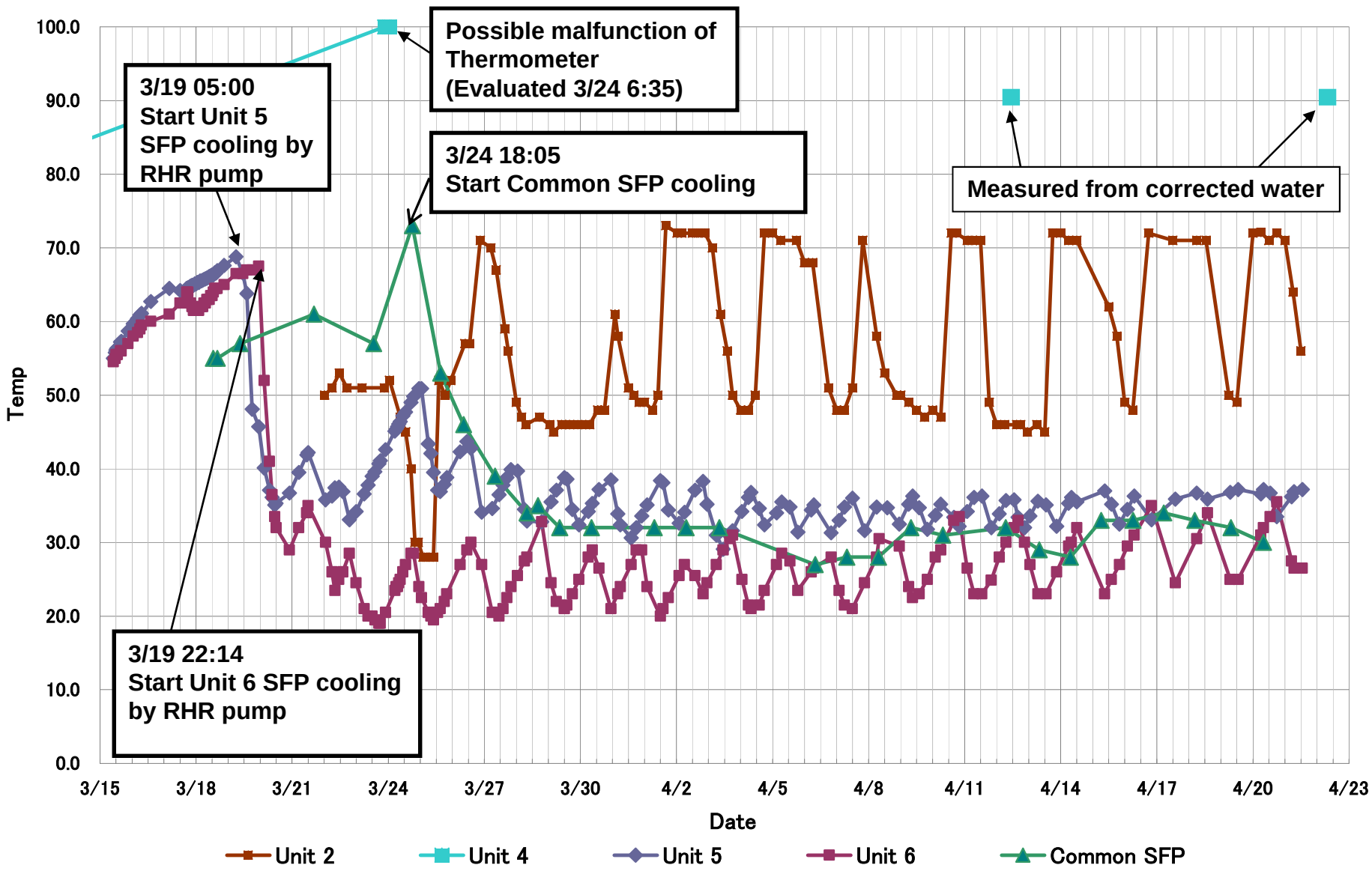
Note: Sampling of SFP water

Analysis result of water in the SFP of Unit 4 (Date of Collection 4/12)

Detected Nuclides	Half life	Density (Bq/cm^3)
Cesium 134	Approx. 2 Years	88
Cesium 137	Approx. 30 Years	93
Iodine 131	Approx. 8 Days	220

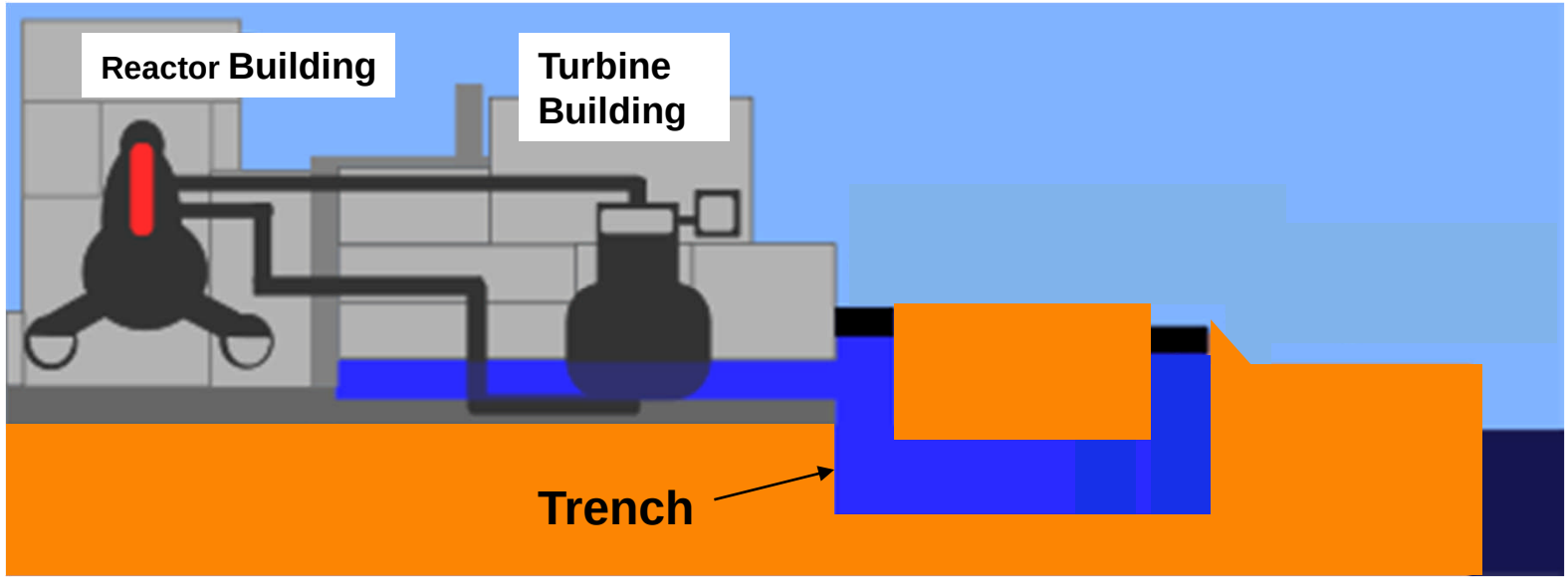
-Cause of reactor building damage to be investigated continuously

3B-4. Temperature trend of Spent Fuel Pool



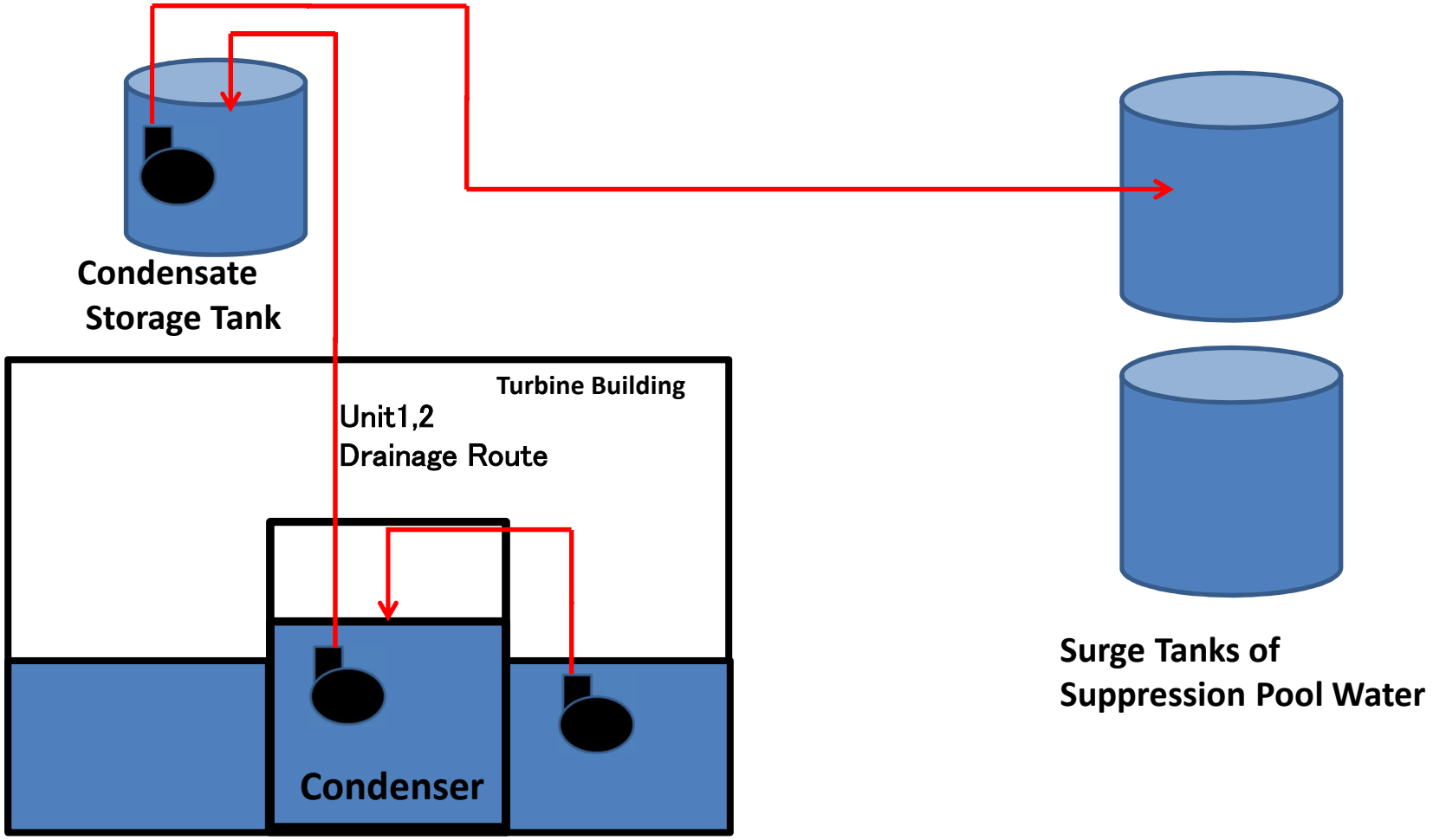
3C-1. Water leakage in turbine buildings and trenches

-Highly radioactive water was found in turbine building and trenches at Unit1, 2 and 3



Side view of the Fukushima trenches (*Source: Wikipedia)*

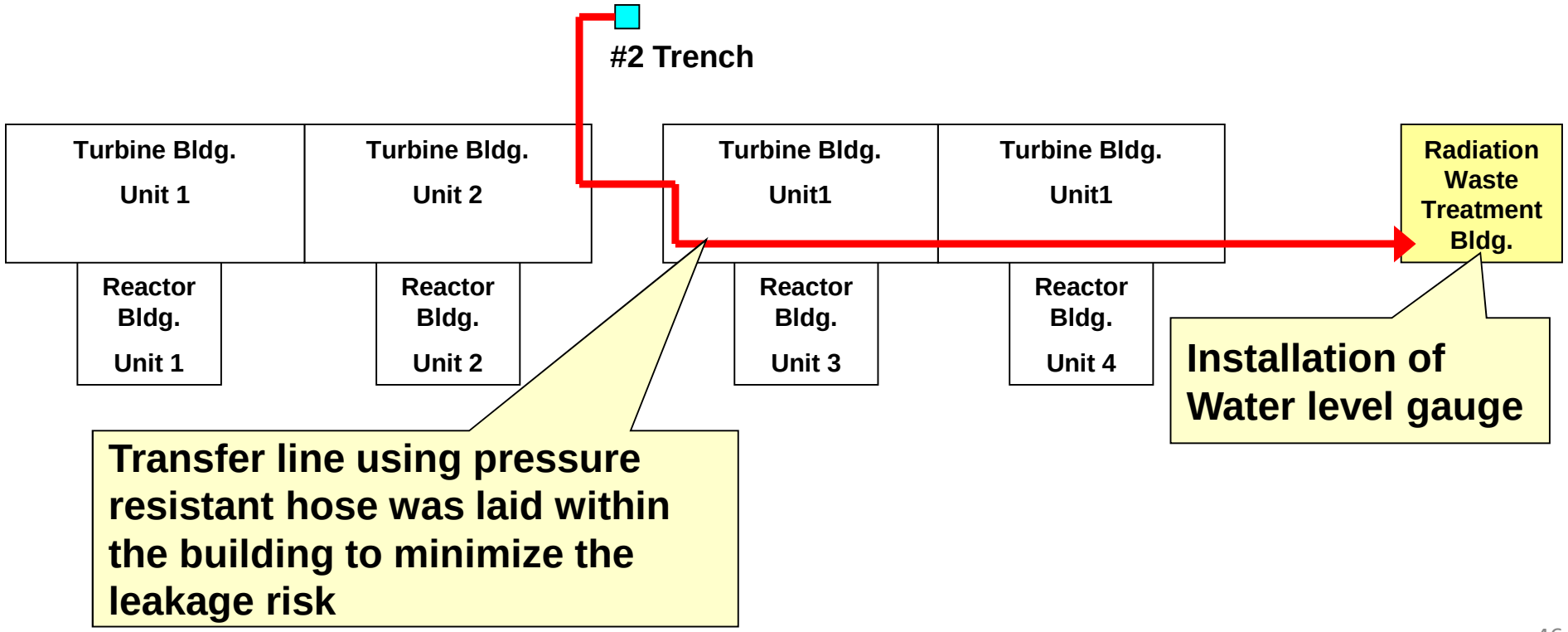
3C-2. Measures to remove the radioactive water



3C-3. Transferring radioactive water to the radiation waste bldg

-Extremely highly radioactive water in the turbine building of Unit 2 has been transferred to the radiation waste treatment building.

-To execute this operation, radioactive water originally stored radiation waste treatment building and was discharged into the sea. (Total Quantity of radioactivity : 0.15 tera Bq)



3C-4. Leakage of highly radioactive water from Unit2

On April 2nd, the outflow from the crack with a length of around 20 cm in the concrete portion of the lateral surface of the pit into the sea was confirmed.

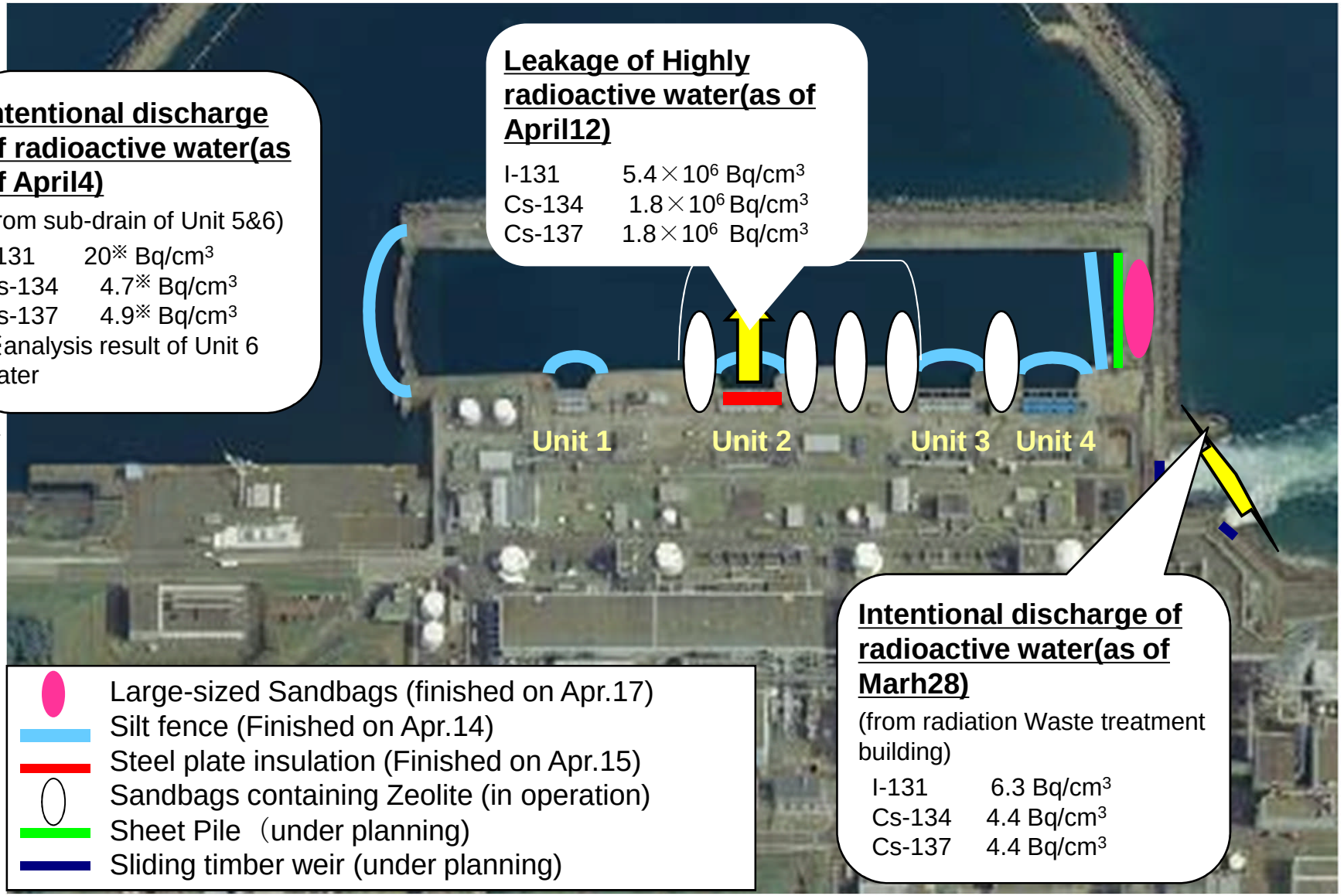
TEPCO's estimation;
Amount of spilled water: 520 tons
Quantity of radioactivity : 4700 teraBq
I-131: 2800 teraBq
Ce-134: 940 teraBq
Ce-134: 940 teraBq

Countermeasures

-Drilled a hole into the pit and injected water glass (sodium silicate) into the pit.

-On April 6, the outflow was confirmed to stop.

3C-5. Measures to prevent the spread of radioactive water



→Strengthing the monitoring(please refer to page 87)

3D-1. INES Rating

- **NISA issued provisional INES ratings , based on “What is known” at the time.**
- **At first, following units were rated as Level 3 based on “Defense in Depth” criteria about 10 hours later from the earthquake.**
  - **Fukushima dai-ichi unit 1, 2 and 3, Fukushima dai-ni Unit 1, 2 and 4**
- **In the evening on March 12, the rating of Fukushima dai-ichi Unit 1 was re-evaluated to Level 4 base on the “Radiological Barriers and Control” criteria.**
- **On March 18, Fukushima dai-ichi Unit 1, 2 and 3 were re-rated to Level 5 based on “Radiological Barriers and Control” criteria because the fuel damage was highly possible. Fukushima dai-ichi Unit 4 was evaluated to Level 3 based on the “Defense in Depth” criteria.**
- **On April 12, Fukushima Dai-ichi NPP was revised Level 7 based on the “People and Environment” criteria, as a result of discharged estimation.**
- **Official rating will be done after cause and countermeasures are identified.**

3D-2. Bases of rating at Level7

	Assumed amount of the discharge from Fukushima Dai-ichi		(Reference) Amount of the discharged from the Chernobyl accident
	NISA's estimation *1	NSC's estimation*2	
^{131}I…(a)	$1.3*10^{17}$Bq	$1.5*10^{17}$Bq	$1.8*10^{18}$Bq
^{137}Cs	$6.1*10^{15}$Bq	$1.2*10^{16}$Bq	$8.5*10^{16}$Bq
(Converted value to ^{131}I)*3 …(b)	$2.4*10^{17}$Bq	$4.8*10^{17}$Bq	$3.4*10^{18}$Bq
(a)+(b)	$3.7*10^{17}$Bq	$6.3*10^{17}$Bq	$5.2*10^{18}$Bq

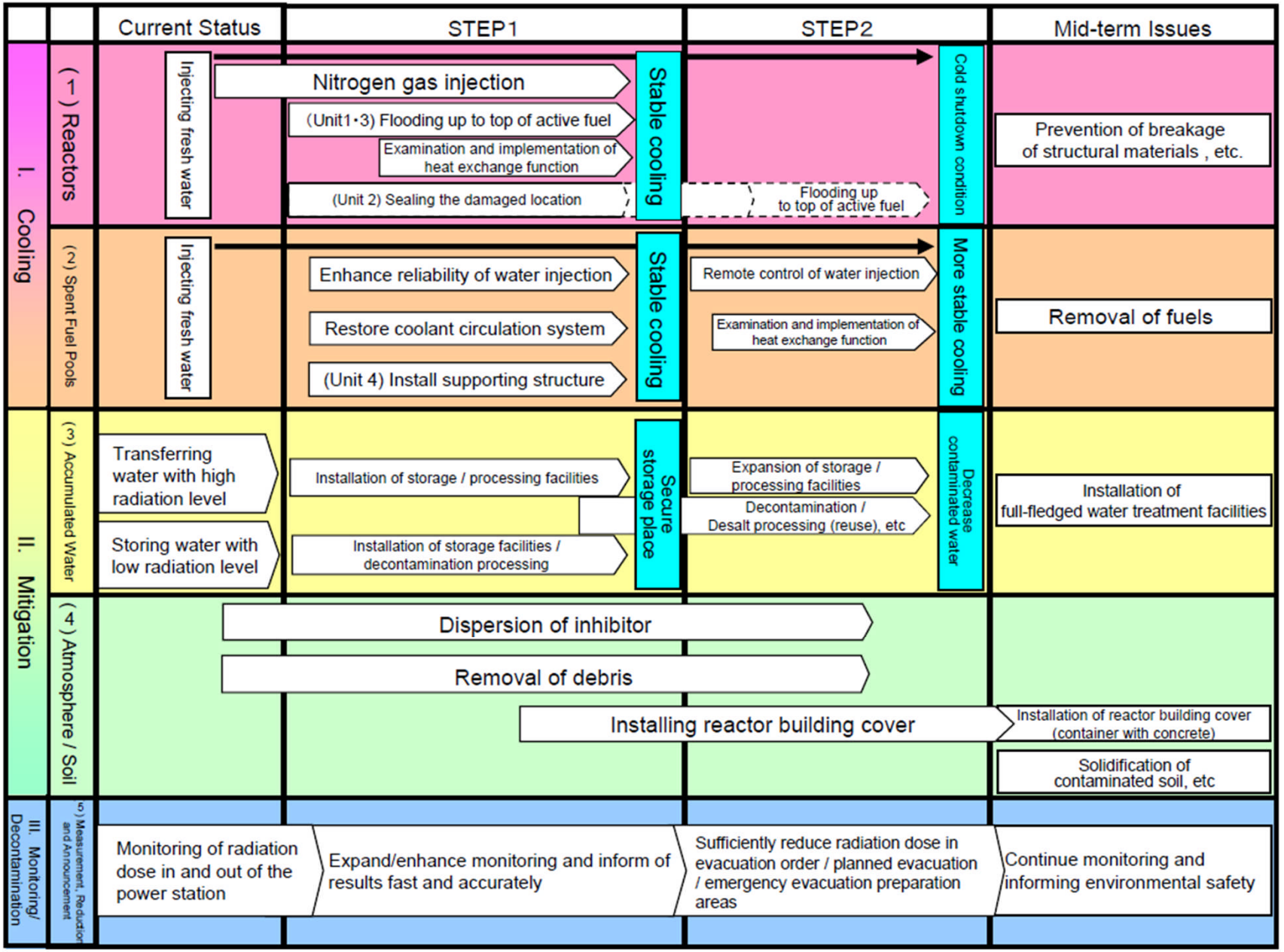
(notes)
*1: Estimation by NISA is based on the numerical analysis of accident transient
*2: NSC calculated backward of monitoring data to estimate the amount of discharge
*3: multiplication factor of radiological equivalence to ^{131}I is 40

4. TEPCO’s roadmap

4-1. TEPCO's Roadmap(1/2)

	Step１ （About 3 months）	Step２ （Minimum about 6 to 9 Months）
Target	Steady Reduction of Radiation Dose	Controlling Radiation Release and Significant Reduction of Radiation Dose
Reactors	Stable Cooling (Water Filling over the fuel)	Achieving the State of Cold Shutdown
Spent Fuel Pools	Stable Cooling	Keeping the Sufficient Water Level for More Stable Cooling (Remote Operation)
Radioactive Contaminated Water	Prevention of Outflow to the out of the Site	Processing and Decreasing the Contaminated Water
Radioactive Contaminated Atmosphere/Soil	Prevention of Spread	Covering Up the Entire Reactor Building

4-1. TEPCO's Roadmap(2/2)



4-2. Government's response to TEPCO's proposal

- The Government will request TEPCO to ensure the implementation of this roadmap steadily and as early as possible. To this end, the Nuclear and Industrial Safety Agency and others will make regular follow-up, monitoring of the progress of the works and necessary safety checks.

- The Government will request TEPCO to ensure the mobilization and deployment of workers, the procurement and preparation of equipment and materials, and the arrangement of accommodation and other facilities, which are necessary to ensure implementation of the roadmap

- At the end of Step2, the release of radioactive materials will be under control. At this stage, the government will review the "Deliberate Evacuation Area" and the "Evacuation Prepared Area". Up until that time, we will consider the details of review criteria, and will decontaminate the widest possible area/

5. Immediate measures enhancing Nuclear Safety

5-1. Immediate measures enhancing Nuclear Safety

- **On the Implementation of Emergency Safety Measures at Other Power Plants drawn from the 2011 Accident at Fukushima Dai-ichi and Dai-ni Nuclear Power Stations (March 30th)**

  →(Please refer to next page)

- **Measures Regarding Emergency Diesel Generators(April 9th)**

- **Ensuring external power supply to NPPs and reprocessing facilities(April 15th)**

5-2. Emergency Safety measures

Phase	Emergency Safety Measures	Drastic measures
	Short term	Medium-to-Long term
Expected completion	Approx. 1 month （around mid-April）	Decide as per debate at Accident Investigation Commission, etc.
Target（Required standard）	Depending on tsunami, prevent core damage and occurrence of spent-fuel damage even when 1) all alternate-current power sources, 2) seawater cooling function, and 3) spent-fuel pool cooling function are lost.	Prevent occurrence of disasters taking into account “anticipated tsunami height” to be set by referencing tsunami that caused recent disaster.
Examples of specific measures	Securing equipment: ・Deploy power-supply vehicles (to cool reactors and spent-fuel pools). ・Deploy fire engines (to supply coolant water). ・Deploy fire hoses (to secure water-feeding path from fresh-water tank, sea-water pit, etc.). Developing manual: ・Develop implementation procedures for emergency measures utilizing above-mentioned equipment. Training: ・Implementation of training on emergency measures based on implementation procedures manual.	Securing equipment ・Build seawalls. ・Deploy watertight doors. ・Devise other necessary equipment-related measures. *To be followed by implementation of equipment-related improvements as necessary (e.g.: secure spare air-cooled diesel generators, sea water pump motors). Develop manual Conduct training
Confirmation by NISA, etc.	・Approval of amendment of ministerial ordinance to ensure effectiveness of emergency safety measures as well as operational safety program that incorporates those measures. ・Rigorous vetting of implementation status of emergency safety measures by means of inspection, etc.	
Operators’ response	・Efforts under way to procure equipment. (Locations to set them up also being secured). ・Manual compiled anew drawing on recent accident. Training being implemented. ・Strive to improve emergency safety measures continuously, even after their confirmation, to ensure their reliability.	

5-3. NISA's actions for TEPCO's roadmap

- **Nitrogen injection to the PCV to prevent Hydrogen explosion (April 6th)**

- **Implementation of seismic safety evaluation of nuclear reactor building and deliberation of measures to be taken(April 13th)**

- **Regarding the transfer of waste water with high-level radioactivity to the Radioactive Waste Treatment Facilities(April 19th)**

6. Action taken by the government

6. Action Taken by the Government(1/9)

March 11th, 2011

14:46 ●Set up of the NISA Emergency Preparedness Headquarters (Tokyo) immediately after the earthquake

19:03 ●Government declared the state of nuclear emergency. (Establishment of Government Nuclear Emergency Response Headquarters and Local Emergency Response Headquarters)

21:23 ●Directives from Prime Minister to the Governor of Fukushima Prefecture and heads of towns were issued regarding the eventoccurred at Fukushima Daiichi NPS, TEPCO, in accordance with the Acton Special Measures Concerning Nuclear Emergency Preparedness as follows:
- Direction for the residents within 3km radius from Unit 1 to evacuate
- Direction for the residents within 10km radius from Unit 1 to stay in-house

24:00 ●Vice Minister of Economy, Trade and Industry, Ikeda arrived at the Local Emergency Response Headquarters

6. Action Taken by the Government(2/9)

March 12nd, 2011

05:44 ●Residents within 10km radius from Unit 1 of Fukushima Dai-ichi NPS shall evacuate by the Prime Minister Direction

07:45 ●Directives from Prime Minister to the Governor of Fukushima Prefecture and heads of towns were issued regarding the event occurred at Fukushima Dai-ni NPS, TEPCO, pursuant to Act on Special Measures Concerning Nuclear Emergency Preparedness as follows:

- Direction for the residents within 3km radius from Fukushima Dai-ni NPS to evacuate
- Direction for the residents within 10km radius from Fukushima Dai-ni NPS to stay in-house

17:39 ●Prime Minister directed evacuation of the residents within the 10 km radius from Fukushima-Dai-ni NPS

18:25 ●Prime Minister directed evacuation of the residents within the 20km radius from Fukushima Dai-ichi NPS

20:05 ●Considering the Directives from Prime Minister and pursuant to the Nuclear Regulation Act, the order was issued to inject seawater to Unit 1 of Fukushima Dai-ichi NPS and so on.

6. Action Taken by the Government(3/9)

March 13th, 2011

09:30 ●Directive was issued for the Governor of Fukushima Prefecture and heads of towns in accordance with the Act on Special Measures Concerning Nuclear Emergency Preparedness on the contents of radioactivity decontamination screening.

March 15th, 2011

05:30 ●Prime Minister, Kan expressed to establish The Joint Headquarters to Fukushima Dai-ichi NPS accident

10:30 ●According to the Nuclear Regulation Act, Minister of Economy, Trade and Industry issued the directions as follows.
- -For Unit 4: To extinguish fire and to prevent the occurrence of re-criticality
- -For Unit 2: To inject water to reactor vessel promptly and to vent Drywell

11:00 ●Prime Minister directed the in-house stay area. -In-house stay was additionally directed to the residents in the area from 20 km to 30 km radius from Fukushima Dai-ichi NPS considering reactor situation

22:00 ●According to the Nuclear Regulation Act, Minister of Economy, Trade and Industry issued the following direction.
- - For Unit 4: To implement the injection of water to the Spent Fuel Pool.

March 20th, 2011

23:30 ●Directive from Local Emergency Response Headquarters to the Prefectural Governor and the heads of cities, towns and villages was issued regarding the change of the reference value for the screening level for decontamination of radioactivity

6. Action Taken by the Government(4/9)

March 21st, 2011

07:45 ●**Directive titled as "Administration of the stable Iodine" was issued from Local Emergency Response Headquarters to the Prefectural Governor and the heads of cities, towns and villages.**

16:45 ●**Directive titled as "Ventilation for using heating equipments within the in-house evacuation zone" was issued from the Head of Local Emergency Response Headquarters to the Prefectural Governor and the heads of cities, towns and villages.**

17:50 ●**Directive from the Head of Government Nuclear Emergency Response Headquarters to the Prefectural Governors of Fukushima, Ibaraki, Tochigi and Gunma was issued, which directs the above-mentioned governors to issue a request to relevant businesses and people to suspend shipment of spinach, Kakina (a green vegetable) and raw milk for the time being.**

March 25th, 2011

●**NISA directed orally to the TEPCO regarding the exposure of workers at the turbine building of Unit 3 of Fukushima Dai-ichi NPS occurred on March 24th, to review immediately and to improve its radiation control measures.**

6. Action Taken by the Government(5/9)

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March 25th, 2011

- Since there was a mistake in the evaluation regarding the concentration measurement of radioactive materials, NISA directed TEPCO orally to prevent the recurrence of such a mistake

13:50
- Receiving the suggestion by the special meeting of Nuclear Safety Commission, NISA directed TEPCO orally to add the sea water monitoring points and carry out the groundwater monitoring.
- Regarding the delay in the reporting of the water confirmed outside of the turbine buildings, NISA directed TEPCO to accomplish the communication in the company on significant information in a timely manner and to report it in a timely and appropriate manner.

March 29th, 2011

- In order to strengthen the system to assist the nuclear accident sufferers, the “Team to Assist the Lives of the Nuclear Accident Sufferer” headed by the Minister of Economy, Trade and Industry was established

March 30th, 2011

- Directions as to implement the emergency safety measures for the other power stations considering the accident of Fukushima Dai-ichi and Dai-ni NPSs in 2011 was issued and handed to each electric power company and the relevant organization.

6. Action Taken by the Government(6/9)

March 31st, 2011

- Regarding the break-in of the propaganda vehicle to Fukushima Dai-ni NPS on 31 March, NISA directed TEPCO orally to take the carefully thought-out measures regarding physical protection, etc.
- NISA alerted TEPCO to taking the carefully though-out measures regarding radiation control for workers.

April 1st, 2011

- NISA strictly alerted TEPCO to taking appropriate measures concerning the following three matters regarding the mistake in the result of nuclide analysis.

-Regarding the past evaluation results on nuclide analysis, all the nuclides erroneously evaluated should be identified and the re-evaluation on them should be promptly carried out.

- The causes for the erroneous evaluation should be investigated and the thorough measures for preventing the recurrence should be taken.
- Immediate notification should be done in the stage when any erroneous evaluation results, etc. are identified.

April 2nd, 2011

- Regarding the outflow from the area around Unit2 of Fukushima NPPs, NISA directed TEPCO orally for the followings:

- to carry out nuclide analysis of the liquid sampled,
- to confirm whether there are other outflows from the same parts of the facilities
- to strengthen monitoring through sampling water at more points around the facilities concerned.

6. Action Taken by the Government(7/9)

April 4th, 2011

- On the imperative execution of the discharge to the sea as an emergency measure, NISA requested the technical advice of NSC and directed TEPCO to do the followings:
  - to survey and confirm the impact of the spread of radioactive materials caused by the discharge, by ensuring continuity of the sea monitoring and enhancing it
  - to disclose required information
  - to enhance the strategy to minimize the discharge amount.

April 6th, 2011

12:40 ● On the implementation of the nitrogen injection to PCV of Unit 1, NISA directed TEPCO on the following points.

- Properly control the plant parameters, and take measures appropriately to ensure safety in response to changes in the parameters.
- Establish and implement an organizational structure and so on that will ensure the safety of the workers who will engage in the operation.
- Through the judicious and further enhanced monitoring, TEPCO shall survey and confirm the impact of the release and spreading of radioactive materials due to the nitrogen injection, and strive to disclose information.

April 9th, 2011

- NISA issued the letters of direction titled "Regarding the Treatment of Emergency Power Generating Facilities in Terms of Safety Regulations (Directions)" to each Electricity Utility and other organizations concerned.

6. Action Taken by the Government(8/9)

April 10th, 2011

- NISA issued the direction regarding collection of report that should include the necessity, the evaluation of safety and the policy of ensuring the permanent storage and treatment facilities for the waste water and so on, concerning the transfer of the stagnant water with high-level radioactivity in Fukushima Dai-ichi NPS to the Radioactive Waste Treatment Facilities.

April 13th, 2011

- Regarding the buildings of Fukushima Daiichi NPS, NISA directed TEPCO to report the result of implementation on seismic safety evaluation as well as the result of consideration on the measurement of effective seismic reinforcement work, etc.,
- NISA directed TEPCO to implement detailed analysis and consideration regarding the tsunami caused by the 2011 Tohoku District - off the Pacific Ocean Earthquake.
- NISA directed Tohoku Electric Power Co. Inc. to report the analysis of seismic data observed when the 2011 Earthquake off the Coast of Miyagi Prefecture occurred around 23:32 on 7 April and the assessment on seismic impact on the facilities that are important from the seismic safety viewpoints.

April 14th, 2011

- NISA directed TEPCO orally to strengthen the monitoring of the Sub Drain (the groundwater collected and controlled in the facilities) of Units 1 and 2.

6. Action Taken by the Government(9/9)

April 15th, 2011

- NISA directed General Electricity Utilities and other organizations concerned to consider the measures to ensure reliability on external power supply due to the temporary loss of external power supply at NPSs, etc.

April 18th, 2011

- Regarding the transfer of the stagnant water with high-level radioactivity to the Radioactive Waste Treatment Facilities, NISA accepted(18th) and confirmed(19th) the report from TEPCO in accordance with the direction for the collection of report issued on 10th April.

April 21st, 2011

- The prime Minister issued the following instruction in relation to the accident at Fukushima Dai-ni NPS to the Governer of Fukushima pref. and heads of towns:
  - Instruction to change the evacuation area from within 10km radius to within 8km radius from Fukushima Dai-ni NPS.
- The prime Minister issued the following instruction in relation to the accident at Fukushima Dai-ichi to the Governer of Fukushima Pref. and heads of towns:
  - Instruction to establish a restricted area as the area within 20km radius from Fukushima Dai-ichi NPS, and to prohibit the access to the area or to order to leave the area to any persons other than those engaged in emergency response measures, excluding the case that the mayor of the city or town or the head of the village permits the temporary access.

7. Impacts on public & environment

7-1. Evacuation & Sheltering during the accident(1/3)

- At 21:23 on March11, residents within 3km radius from Unit1 of Fukushima Dai-ichi NPP shall evacuate by the Prime Minister Directive.

- At 5:44 on March 12, residents within 10km radius from Unit1 of Fukushima Dai-ichi NPP shall evacuate by the Prime Minister Directive.

- At18:25 on March 12, Prime Minister directed evacuation of the residents within the 20 km radius from Fukushima Dai-ichi NPP.

- On March 15th, the Local Emergency Response Headquarter issued “the direction to administer the stable Iodine during evacuation from the evacuation area (20 km radius)” to the Prefecture Governors and the heads of cities, towns and villages.

- Regarding the evacuation as far as 20 km from Fukushima Dai-ichi NPP and 10 km from Fukushima Dai-ni NPP, necessary measures have already been taken.
  - The sheltering stay in the area from 20km to 30km from Fukushima Dai-ichi NPS is made fully known to the residents concerned.
  - Cooperating with Fukushima Prefecture, livelihood support to the residents in the sheltering area are implemented.

- On March 25th, Chief Cabinet Secretary, Edano promoted voluntary evacuations for the residents within the area from 20 km to 30 km from Fukushima Dai-ichi NPS in a press conference.

7-1. Evacuation & Sheltering during the accident(2/3)

<Fukushima Dai-ichi NPPs>

(April 21st)

●The Prime Minister issued the following instruction to the Governor of Fukushima prefecture, and relevant heads of towns in accordance with the Act on Special Measures Concerning Nuclear Emergency Preparedness.

- Instruction to establish a restricted area as the area within 20km radius from Fukushima Dai-ichi NPP to prohibit the access to the area or
- to order to leave the area to any persons other than those engaged in emergency response measures, excluding the case that the mayor of the city or town or the head of the village permits the temporary access.

(April22nd)

●The Prime Minister issued the following instruction pertaining to the Governor of Fukushima prefecture, and relevant heads of towns in accordance with the provisions of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

- Instruction to lift the area of in-house stay which had been established for the sphere within 20km to 30km radius from Fukushima Dai-ichi NPS
- to establish **Deliberate Evacuation** as well as **Evacuation-Prepared Area** in case of Emergency for the residents and others to make a preparation to enable deliberate leaving, or evacuation or in-house stay all the time in case of emergency, in the subject area.

7-1. Evacuation & Sheltering during the accident(3/3)

＜Fukushima Dai-ni NPP>

(April21st)

● The Prime Minister issued the following instruction to the Governor of Fukushima prefecture, and heads of towns in accordance with the Act on Special Measures Concerning Nuclear Emergency Preparedness.(21st of April)

-Instruction to change the evacuation area from within 10km radius to within 8km radius from Fukushima Dai-ni NPS.

A) Deliberate Evacuation Area

①Basic concept

●As there is a threat that the accumulated dose since the incident may reach 20mSv within a year, the residents and others are requested to evacuate to other areas within about a month.

●The level of radiation protection of ICRP and IAEA in case of emergency exposure (20-100 mSv) was used as a reference.

②The range of the area

Iitate Village (whole area),Part of Kawamata Town (Yamagiya District), Katsurao Village (whole area excluding the area within a 20km radius), Namie Town (whole area excluding the area within a 20km radius), Parts of Minimi-Soma City

B) Evacuation-Prepared Area in Case of Emergency

①Basic concept

●Since the situation caused by the Fukushima Dai-ichi Nuclear Power Station (NPS) incident has not yet stabilized, we cannot deny the possibility of requiring such action as evacuation or in-house stay in cases of emergency hereafter.

●Thus in the Evacuation-Prepared Area in Case of Emergency, residents are required to stay in-house or urgently evacuate by themselves at any time.

②The range of the area

Tirono Town, Naraha Town (whole area excluding the area within a 20km radius), Kawauti Town (whole area excluding the area within a 20km radius), Parts of Tamura City, Parts of Minimi-Soma City

7-2. Radiation exposure to residents and workers（As of April23rd）

(Residents)

- Fukushima Prefecture has started the screening from 13 March.
- It is carried out at the evacuation sites and the 11 places(set up permanently) such as health offices.
- Up until 19 April, the screening was done to 162,126 people.
- Among them, 102 people were above the 100,000 cpm, but when measured these people again without clothes, etc., the counts decreased to 100,000 cpm and below, and there was no case which affects health

(Workers)

- To date a total of 30 people have registered exposure dose above 100mSv. Below is some case of exposure to workers:

<Laying cables operation>

- On March24, dosage above approx.170mSv was confirmed on 3 workers who were laying cables on 1st floor and basement of Unit3 Turbine Bldg. Attachment of radioactive substances on the skin of both legs was confirmed on two of them.
- Examination showed that none of the 3 had any major systemic risk. Exposure dose on the legs of the 2 was estimated to be 2～3Sv.
- While the level of leg and internal exposure did not require treatment, they were hospitalized. They were discharged on March 28.

7-3. Directives on foods and drinks

（1）Agricultural Goods(as of 08:00, 22nd of April)

●Directive from the DG of the Government Nuclear Emergency Response Headquarters to the prefectural governments was issued to suspend shipment and so on of the following products for the time being:

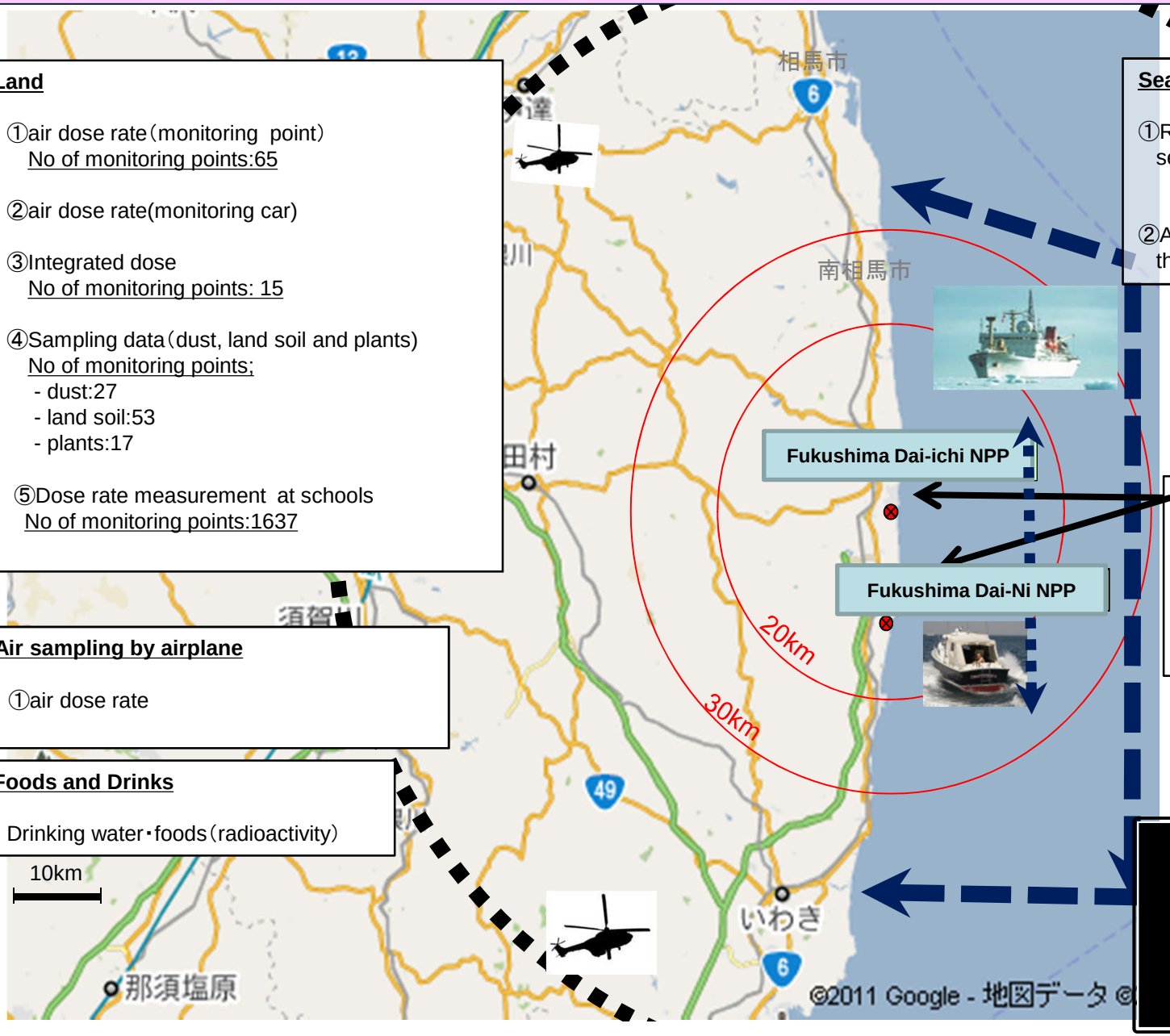
- Fukushima Pref.（spinach, kakina, raw milk, etc.）
- Some areas in other Prefs.（spinach, etc）

（2) Drinking Water(as of 08:00, 22nd of April)

Scope under restriction	Water service(Local governments requested for restriction)
All residents	None
Babies ・Water services that continue to respond to the directive	<Fukushima Prefecture> ・Iitate small water service(Iitate Village, Fukushima Prefecture)
・Tap-water supply service that continues to respond to the directive	None

8. Radiation Monitoring

8-1. Overview of radiation monitoring around the Fukushima-Daiichi NPP



Land

①air dose rate（monitoring point）
No of monitoring points:65

②air dose rate(monitoring car)

③Integrated dose
No of monitoring points: 15

④Sampling data（dust, land soil and plants)
No of monitoring points;
- dust:27
- land soil:53
- plants:17

⑤Dose rate measurement at schools
No of monitoring points:1637

Sea

①Radioactivity concentration under sea・Air dose rate over the sea (10-30km off the shore）

②Around discharge point and 15km off the shore

On site

①air dose rate and dust sampling

②radioactivity in land soil

Air sampling by airplane

①air dose rate

Foods and Drinks

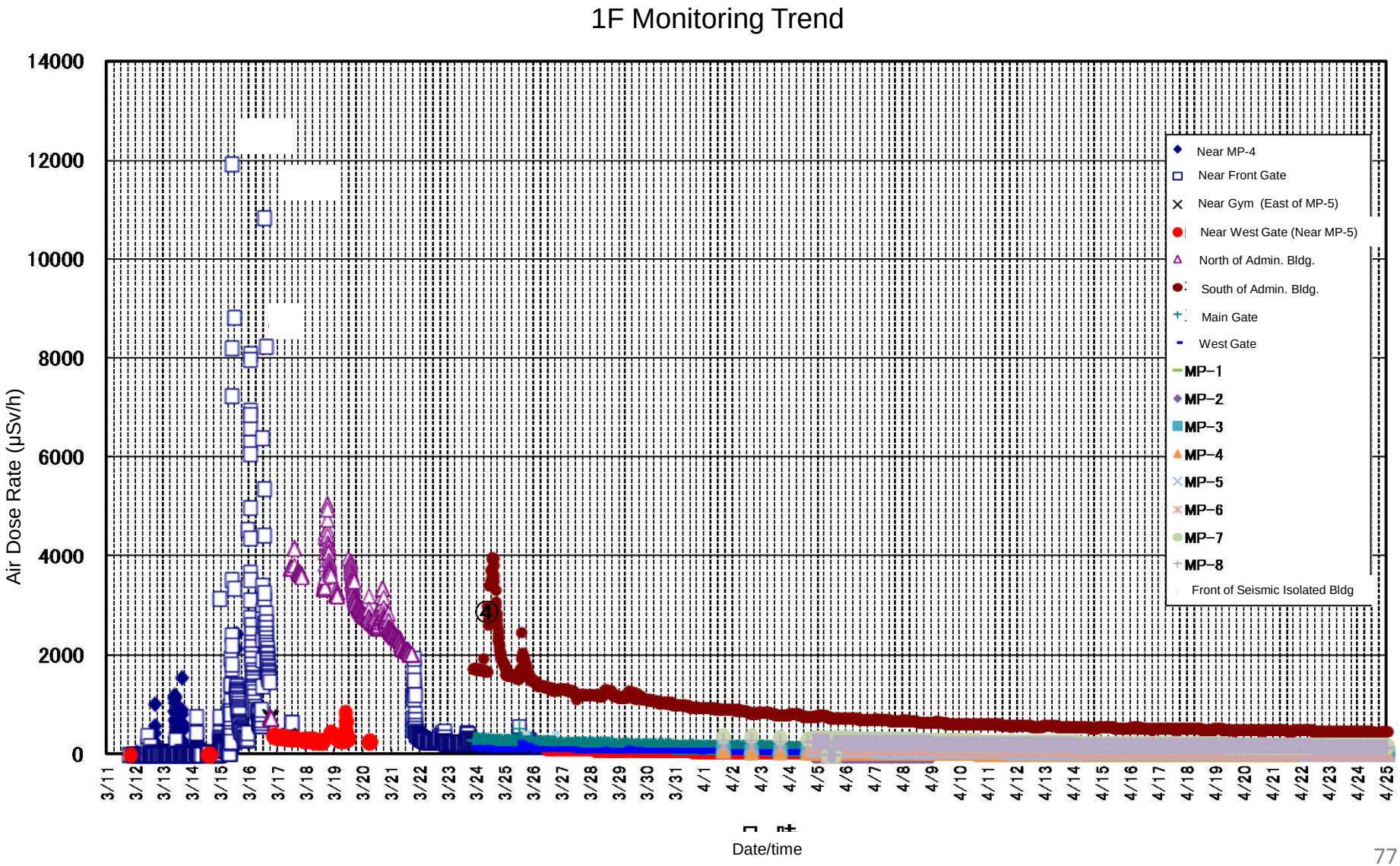
Drinking water・foods（radioactivity）

[redacted]

8-2.On-site Monitoring (1/5)

①Trend of on-site radiation level

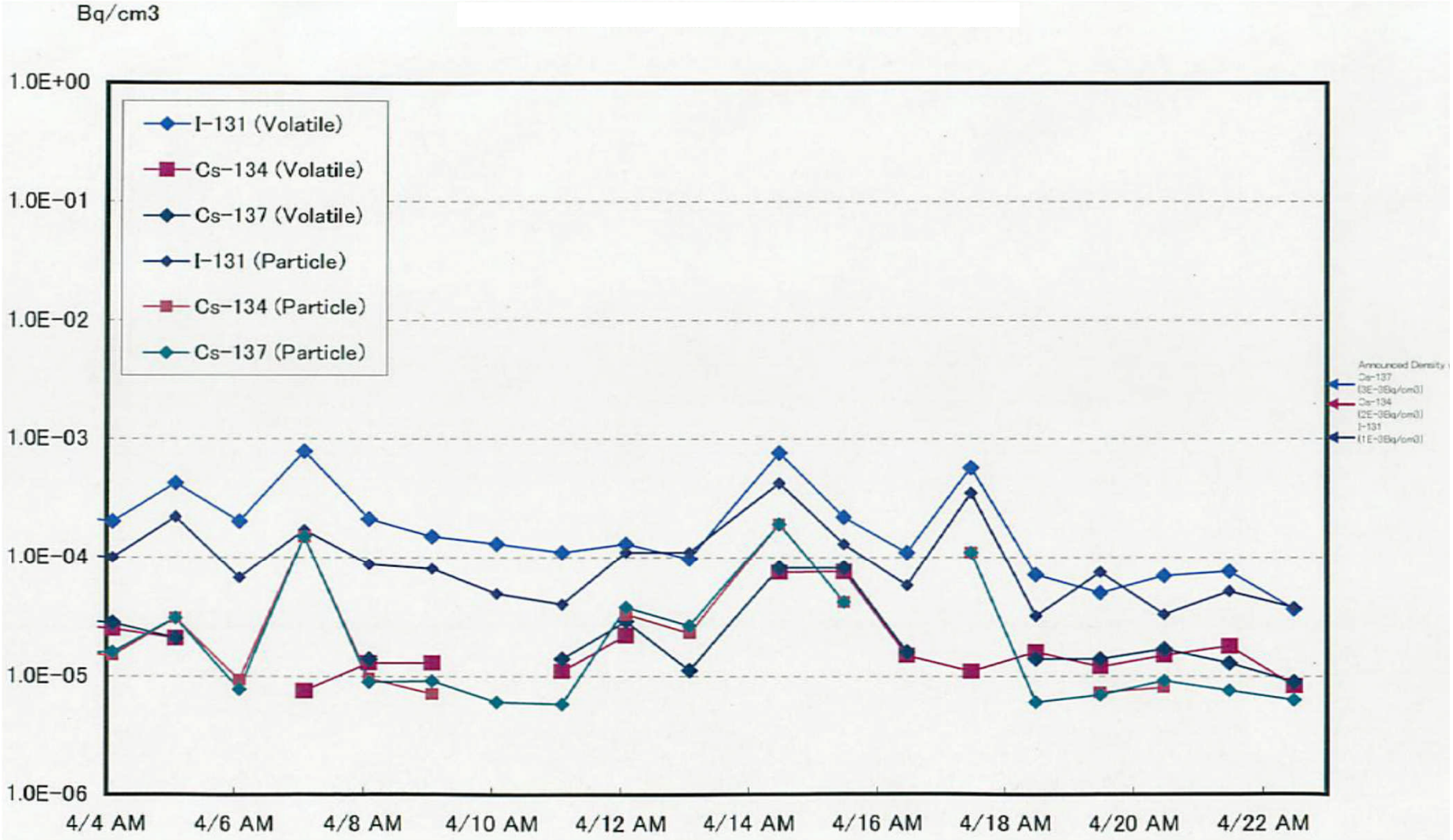
- Registered 11930μSv/h around Front Gate on March 15.



8-2.On-site Monitoring (2/5)

②Radioactive materials in the air

- TEPCO conducted nuclide analyses of radioactive materials contained in the air which were collected at the site of Fukushima Daiichi NPS.



8-2.On-site Monitoring (3/5)

③Concentration of Radioactive Materials (Soil Samples)

- Detected densities of Pu-238. 239. and Pu-240 are the same level as those of the measured fallouts in Japan in the cases of previous nuclear tests in the atmosphere.
- Since densities of Pu-238 detected in the playground and in area adjacent to industrial waste disposal facility on April 11th can be considered to be caused by the nuclear accident of this time.

(Unit: Bq/kg· Dry soil)

Sampling spot (): Distance from the stack of Unit 1, 2	Date of sampling/ Analyses organization	Pu-238	Pu-239, Pu-240
①Playground（west-northwest approx. 500m）	April 7/ JAEA	（1.3±0.24）×10^{-1}	N.D.
②Forest of wild birds（west approx. 500m）		N.D.	N.D.
③Adjacent to industrial waste disposal facility（south-southwest approx. 500m）		N.D.	N.D.
①Playground（west-northwest approx. 500m）	April 11/	（1.2±0.12）×10^{-1}	（5.9±0.78）×10^{-2}
②Forest of wild birds（west approx. 500m）		N.D.	(1.2±0.38)×10^{-2}
③Adjacent to industrial waste disposal facility（south-southwest approx. 500m）		（8.3±0.94）×10^{-2}	(3.2±0.56)×10^{-2}
Soil in *		N.D.～1.5×10^{-1}	N.D.～4.5

*: Ministry of Education, Culture, Sports, Science and Technology "Environmental Radiation Database," 1978 - 2008

8-2.On-site Monitoring (4/5)

④Radioactive Material from Subsurface Water near the Turbine Building of 1F

- In order to verify any leakages to underground and sea, and safety, TEPCO have been implementing the sampling survey of subsurface water and seawater.

Fukushima Daiichi Nuclear Power Station : Results of Nuclide Analysis of Sub-drain

（Data summarized on April 23rd）

Place of sampling	Sub-drain of Unit1, Fukushima Daiichi	Sub-drain of Unit2, Fukushima Daiichi	Sub-drain of Unit3, Fukushima Daiichi	Sub-drain of Unit4, Fukushima Daiichi	Sub-drain of Unit5, Fukushima Daiichi	Sub-drain of Unit6, Fukushima Daiichi	Deep well, Fukushima Daiichi
Time and Date of sample collection	11:15, April 22nd, 2011	11:20, April 22nd, 2011	11:00, April 22nd, 2011	10:55, April 22nd, 2011	10:35, April 22nd, 2011	10:45, April 22nd, 2011	10:00, April 22nd, 2011
Detected Nuclides (Half-life)	Density of Sample（Bq/cm3)						
I-131 (about 8 days)	7.1E+01	5.3E+02	8.5E+00	5.3E-01	7.3E-02	3.9E-01	ND
Cs-134 (about 2 years)	3.9E+01	8.1E+00	1.0E+01	3.7E-01	1.1E-01	2.2E-01	6.9E-03
Cs-137 (about 30 years)	4.8E+01	9.3E+00	1.0E+01	4.0E-01	1.2E-01	2.4E-01	ND

8-2.On-site Monitoring (5/5)

⑤Out flow of fluid containing radioactive materials to the ocean from areas near intake canal of Fukushima Daiichi Nuclear Power Station Unit 2

- At around 9:30 am on April 2nd, 2011, TEPCO detected water containing radiation dose over 1,000 mSv/h in the pit* where power supply cables are stored near the intake channel of Unit 2. Furthermore, there was a crack of about 20 cm length on the concrete lateral of the pit, from where the water in the pit was out flowing to the
- At around 5:38 am on April 6th, TEPCO have observed stoppage of spilling of water to the ocean from the crack on the concrete lateral of the pit.

<Fukushima Daiichi Nuclear Power Station>

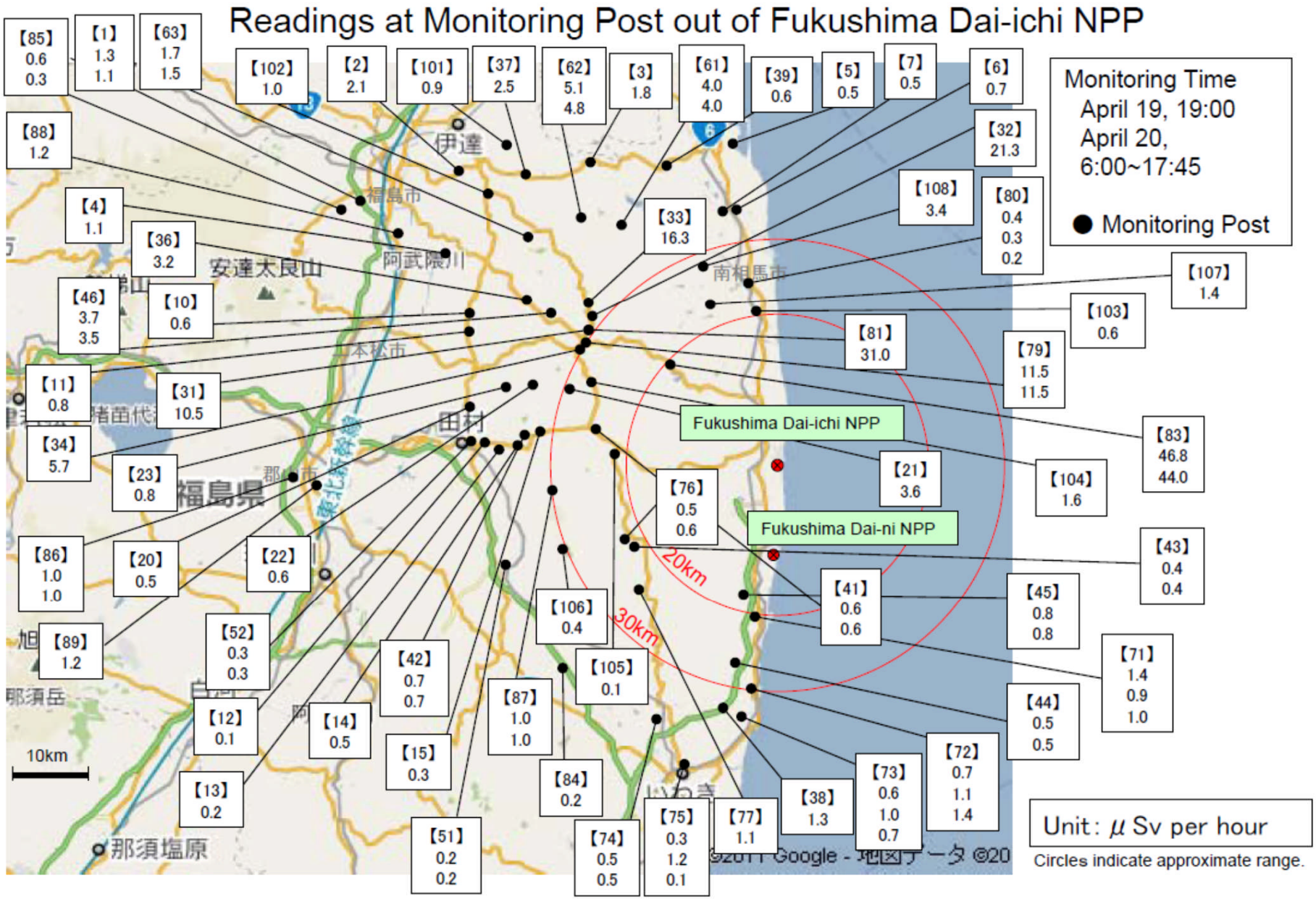
Result of Nuclide Analysis of the seawater at the shallow draft quay, Unit 2 screen, and the water intake canal of Unit 1-4

（Data summarized on April 24th)

Place of Collection	Shallow Draft Quay of 1F		Bar screen of 1F's Unit 2 (inside of the silt fence)		Bar screen of 1F's Unit 2 (outside of the silt fence)		South side of the water intake canal of 1F's Unit 1-4		North side of the water intake canal of 1F's Unit 1-4		②Density limit by the announcement of Reactor Regulation (Bq/cm3) (the density limit in the water outside of surrounding monitored areas in the section 6 of the appendix 2)
Time and date of sample collection	6:25, April 23rd, 2011		6:50, April 23rd, 2011		6:45, April 23rd, 2011		7:00, April 23rd, 2011		6:41, April 23rd, 2011		
Detected nuclide (half-life)	Density of sample（Bq/cm^3)	Scaling factor (①/②)	Density of sample（Bq/cm^3)	Scaling factor (①/②)	Density of sample（Bq/cm^3)	Scaling factor (①/②)	Density of sample（Bq/cm^3)	Scaling factor (①/②)	Density of sample（Bq/cm^3)	Scaling factor (①/②)	
I-131 (about 8 days)	4.8E-01	12	4.3E+01	1,100	1.5E+01	380	1.5E+01	380	1.6E+01	400	4E-02
Cs-134 (about 2 years)	5.8E-01	9.7	3.9E+01	650	1.0E+01	170	1.5E+01	250	1.1E+01	180	6E-02
Cs-137 (about 30 years)	6.0E-01	6.7	4.0E+01	440	1.0E+01	110	1.5E+01	170	1.1E+01	120	9E-02

8-3.Off-site Monitoring (1/5)

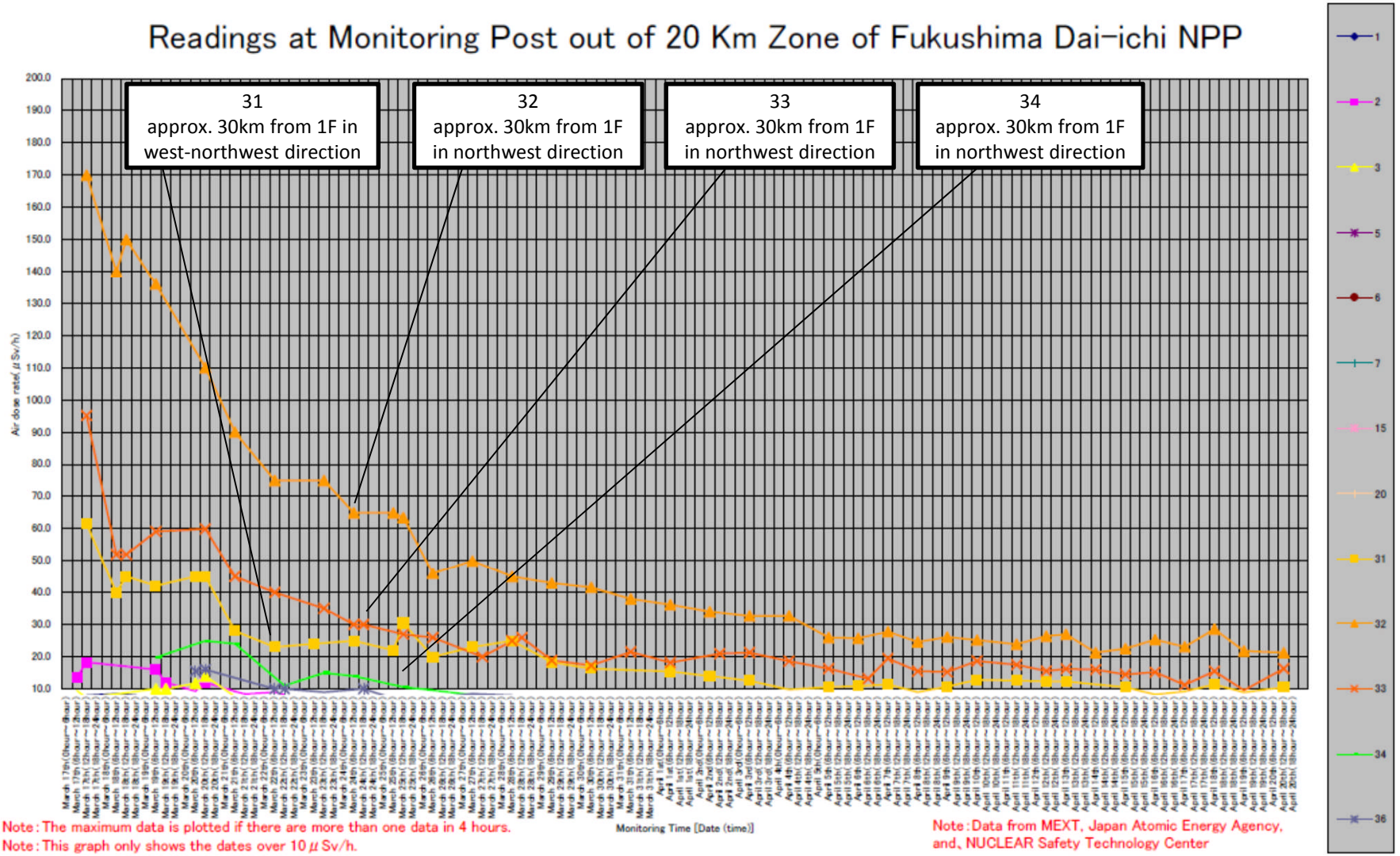
①-1 Radiation monitoring



8-3.Off-site Monitoring (2/5)

①-2 Radiation monitoring

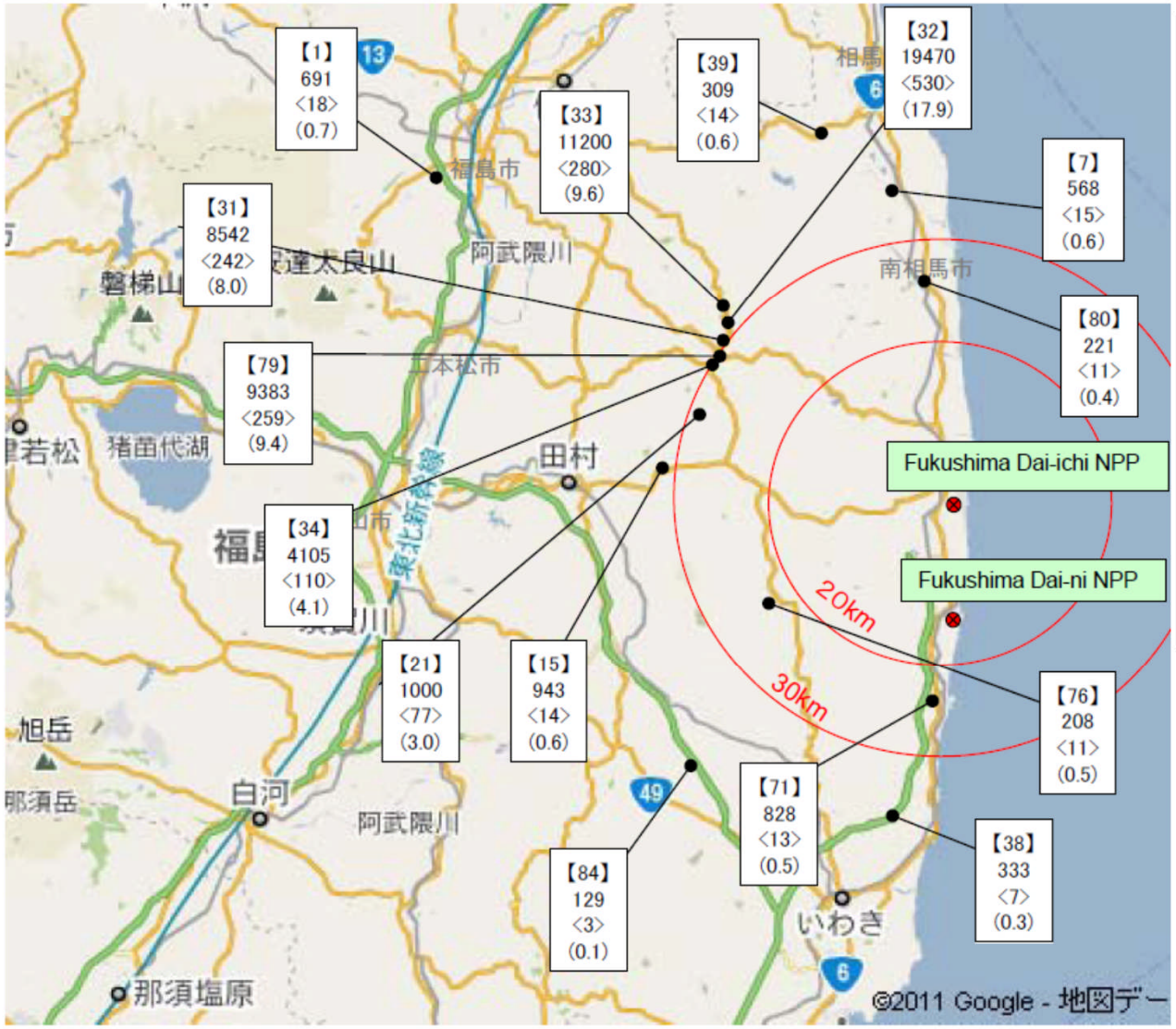
- Overall radiation level trending down since March 17th.
- The highest value recorded at Monitoring Point #32 has peaked out at approx. 170μSv/h and has been declining since, rendering no immediate health hazard.



8-3.Off-site Monitoring (3/5)

②Cumulative Doses Measured

- Radiation level cumulatively measured since March 23th topped 19,470μSv at #32, approximately 30km North West from 1F.



Monitoring Time

- March 23th～April 20th (Monitoring Post: 31、33、34)
- March 23th～April 15th , 17th ～20th (Monitoring Post: 32)
- March 23th～April 13th, 15th ～16th, 18th ～20th (Monitoring Post:7)
- March 23th～April 11th , 14th ～20th (Monitoring Post:79)
- March 23th～28th, April 3rd ～20th (Monitoring Post:71)
- March 24th～April 16th, 18th ～20th (Monitoring Post:1)
- March 24th～April 11th, 13th ～20th (Monitoring Post:15)
- March 25th～April 1st, 3rd ～20th (Monitoring Post:84)
- March 31th～ April 1st, 3rd ～20th (Monitoring Post:38)
- April 1st～April 13th , 16th, 18th ～20th (Monitoring Post:39)
- April 2nd～April 11th, 13th ～20th (Monitoring Post:76)
- April 3rd～April 13th , 15th ～16th, 18th ～20th (Monitoring Post:80)
- April 8th～April 12th, 13th ～20th (Monitoring Post: 21)

●Monitoring Post

(explanatory note)

【 Monitoring Post number】
Readings of Integrated Dose ※
<increment from the last monitoring>
(average dose per hour)

※Readings of Integrated Dose indicate that accumulation of dose from each starting date till April 20 th, for 12 days to 28 days.

Unit: μ Sv per hour

8-3.Off-site Monitoring (4/5)

③-1 Concentration of Radioactive Materials (Soil Samples)

Sampling Point		Sample	Sort or Region	Sampling Time and Date	Radioactivity Concentration (Bq/kg)		Air dose rate (μSv/h)	Note
					^{131}I	^{137}Cs		
【2-1】 (About40kmNorth/West)	Soma county Iidate village Yagisawa	Weed	Leaf Vegitable	3/18 12:20	2,520,000	1,800,000	Over 30	
		Weed	Leaf Vegitable	3/19 11:40	845,000	1,010,000	26.5	
		Weed	Leaf Vegitable	3/20 12:40	2,540,000	2,650,000	25.8	
		Weed	Leaf Vegitable	3/21 12:32	1,330,000	1,240,000	20.4	
		Weed	Leaf Vegitable	3/22 12:00	1,110,000	1,600,000	15.3	
		Weed	Leaf Vegitable	3/23 11:30	819,000	1,620,000	16.8	
		Weed	Leaf Vegitable	3/24 13:05	805,000	1,050,000	13.2	
		Weed	Leaf Vegitable	3/25 12:20	400,000	398,000	12.3	
		Weed	Leaf Vegitable	3/26 12:00	1,030,000	2,870,000	10.2	
		Weed	Leaf Vegitable	3/27 11:40	508,000	910,000	11.2	
		Weed	Leaf Vegitable	3/28 11:50	381,000	480,000	9.6	
		Weed	Leaf Vegitable	3/29 11:10	330,000	311,000	9.2	
		Weed	Leaf Vegitable	3/30 12:25	576,000	1,890,000	8.5	
		Weed	Leaf Vegitable	3/31 11:30	303,000	1,620,000	8.0	
		Weed	Leaf Vegitable	4/1 11:30	219,000	725,000	7.7	
		Weed	Leaf Vegitable	4/2 11:24	171,000	863,000	8.6	
		Weed	Leaf Vegitable	4/3 10:55	301,000	1,420,000	7.7	
		Weed	Leaf Vegitable	4/4 10:05	192,000	275,000	7.2	
		Weed	Leaf Vegitable	4/5 11:31	297,000	1,440,000	10.6	
		Weed	Leaf Vegitable	4/6 11:23	161,000	1,070,000	9.5	
		Weed	Leaf Vegitable	4/7 11:07	107,000	627,000	9.08	
		Weed	Leaf Vegitable	4/8 11:30	186,000	567,000	10.20	
		Weed	Leaf Vegitable	4/9 11:15	55,700	313,000	7.84	
		Weed	Leaf Vegitable	4/10 11:20	10,100	29,200	9.5	
		Weed	Leaf Vegitable	4/11 12:05	30,900	329,000	3.85	
		Weed	Leaf Vegitable	4/12 11:42	18,900	104,000	6.4	
		Weed	Leaf Vegitable	4/13 11:04	109,000	941,000	7.23	
		Weed	Leaf Vegitable	4/14 11:15	24,100	257,000	7.74	
		Weed	Leaf Vegitable	4/15 11:30	30,900	329,000	9.42	
		Weed	Leaf Vegitable	4/16 10:55	9,180	158,000	7.31	
		Weed	Leaf Vegitable	4/17 11:20	3,160	22,500	8.4	
		Weed	Leaf Vegitable	4/18 11:05	7,090	43,500	8.5	
		Weed	Leaf Vegitable	4/19 11:23	41,200	377,000	7.4	

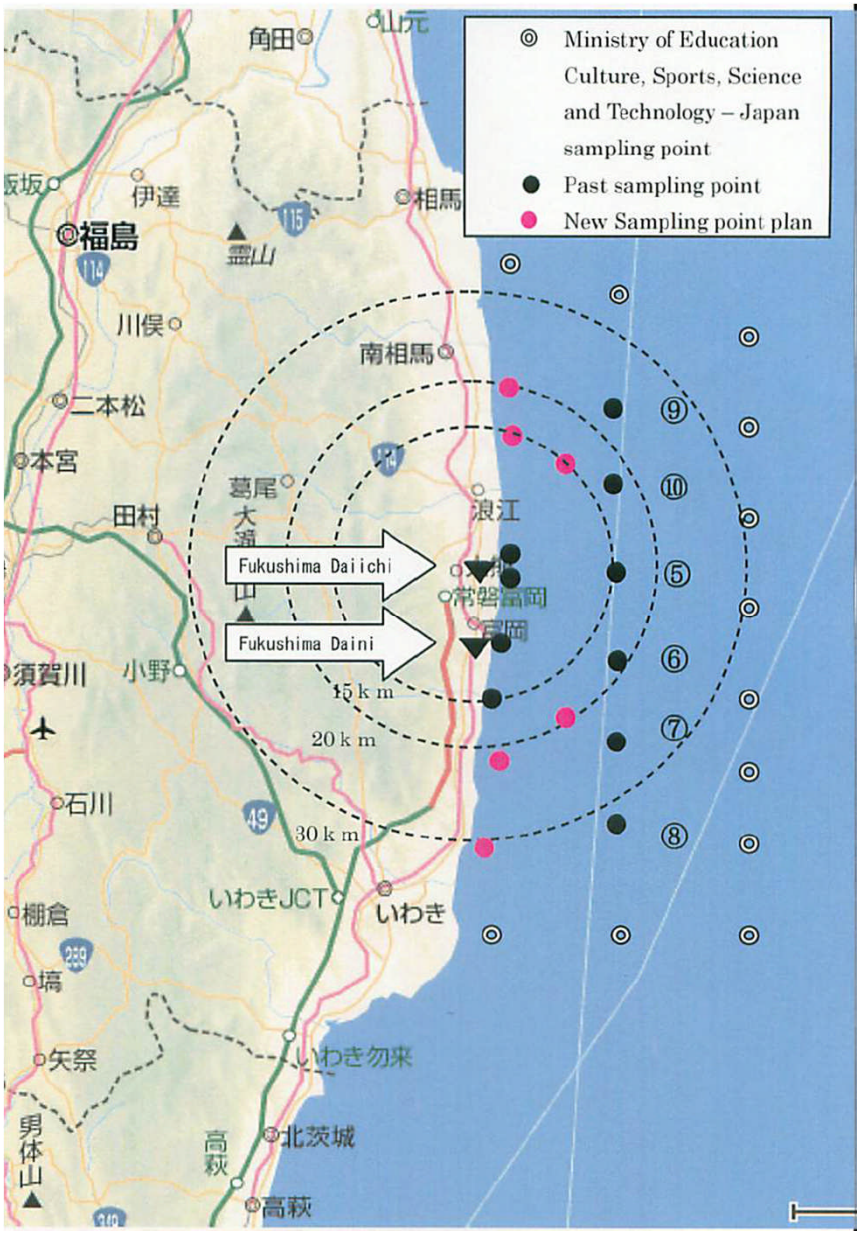
8-3.Off-site Monitoring (5/5)

③-2 Concentration of Radioactive Materials (Dust samples)

Sampling Point		Sampling Time and Date		Radioactivity Concentration (Bq/m^3)		Air dose rate (μSv/h)
				^{131}I	^{137}Cs	
【2-1】 (About40kmNorth/West)	Soma county Iidate village Yagisawa	3/21	13:00～13:20	12.80	2.37	4.1
		3/22	12:26～12:46	5.87	Not Detectable	4.2
		3/23	12:50～13:10	2.99	Not Detectable	16.8
		3/24	13:30～13:50	5.80	1.51	10.0
		3/25	12:45～13:05	5.87	Not Detectable	12.3
		3/26	12:26～12:46	5.39	1.33	7.8
		3/27	12:06～12:26	2.22	Not Detectable	11.2
		3/28	12:05～12:25	1.66	Not Detectable	9.6
		3/29	12:07～12:27	2.42	6.79	9.2
		3/30	13:22～13:42	3.47	Not Detectable	8.5
		3/31	11:50～12:10	1.74	Not Detectable	8.0
		4/1	12:00～12:20	1.78	1.69	7.7
		4/2	11:46～12:06	0.84	Not Detectable	8.6
		4/3	11:18～11:38	Not Detectable	0.78	7.7
		4/4	11:07～11:27	Not Detectable	1.36	7.2
		4/5	11:55～12:15	Not Detectable	Not Detectable	4.1
		4/6	11:45～12:05	Not Detectable	Not Detectable	3.9
		4/7	11:29～11:49	Not Detectable	Not Detectable	4.07
		4/8	11:45～12:05	0.995	Not Detectable	4.50
		4/9	11:40～12:00	1.26	Not Detectable	4.14
		4/10	14:10～14:30	Not Detectable	Not Detectable	4.2
		4/11	12:32～12:52	2.12	Not Detectable	3.85
		4/12	12:04～12:24	Not Detectable	Not Detectable	4.7
		4/13	11:25～11:45	Not Detectable	Not Detectable	3.35
		4/14	11:35～11:55	Not Detectable	0.960	4.40
		4/15	11:50～12:10	5.95	1.470	4.37
		4/16	11:17～11:37	Not Detectable	Not Detectable	4.07
		4/17	11:42～12:02	Not Detectable	0.871	3.8
		4/18	11:23～11:43	Not Detectable	Not Detectable	4.1
		4/19	11:43～12:03	Not Detectable	Not Detectable	3.7

8-4. Sea Area Monitoring (1/5)

① Sampling Point of Sea Area Monitoring

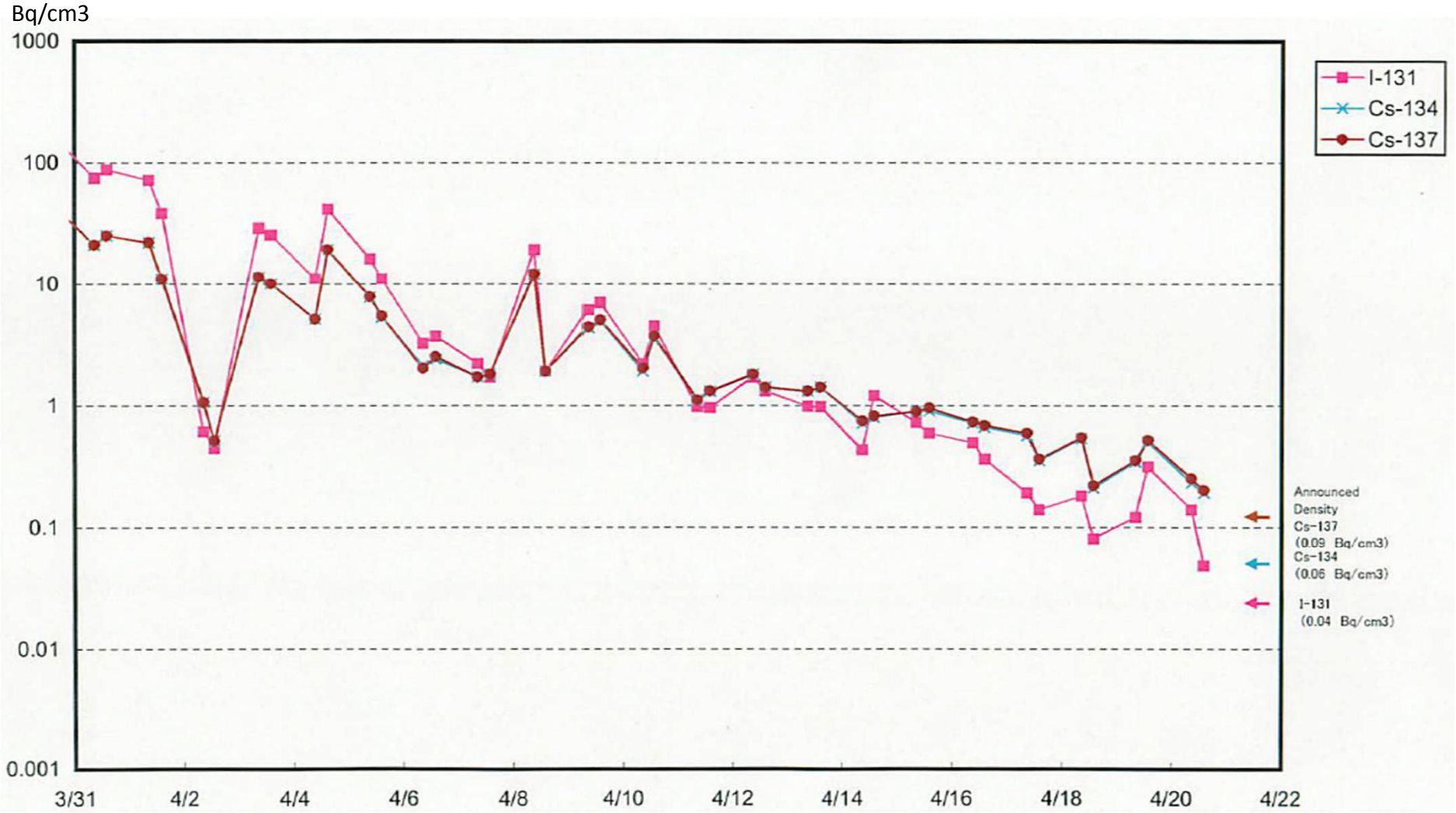


- MEXT have conducted seawater sampling surveys at 12 points, from surface water (1m from the sea surface) and sub-surface (10m above the sea bottom) around 30km off-shore Fukushima Pref.
- TEPCO have conducted seawater sampling surveys at 4 points, off the shore and 6 points, 15 km off the shore of 1F.
- Since April 17, TEPCO have also conducted sampling surveys at 4 points, 3 km off the shore and two points, 8 km off the shore of 1F.

8-4. Sea Area Monitoring (2/5)

②Radioactivity concentration of Seawater at South Discharge Channel of 1F

- Overall Radioactivity concentration trending down since March 31st.
- Radioactivity concentration I-131 peaked out at approx.87 Bq/L on March 31st.



8-4. Sea Area Monitoring (3/5)

③Radioactivity concentration of Seawater at 3 km, 8km and 15km off the shore of 1

Results of Nuclide Analysis of Seawater <Offshore>

Reference

(Data summarized on April 23)

Place of Sampling	15 km offshore of MinamiSouma City		15 km offshore of Ukedo-gawa		15 km offshore of Fukushima Daiichi		15 km offshore of Fukushima Daini		15 km offshore of Iwasawa Shore		15 km offshore of Hirono-machi		② Density limit by the announcement of Reactor Regulation (Bq/cm3) (the density limit in the water outside of surrounding monitored areas in the section 6 of the appendix 2)
Time and Date of Sample Collection	2011/4/22 11:24		2011/4/22 10:22		2011/4/22 9:45		2011/4/22 9:10		2011/4/22 8:36		2011/4/22 8:07		
Detected Nuclides (Half-life)	①Density of Sample (Bq/cm^3)	Scaling Factor (①/②)	①Density of Sample (Bq/cm^3)	Scaling Factor (①/②)	①Density of Sample (Bq/cm^3)	Scaling Factor (①/②)	①Density of Sample (Bq/cm^3)	Scaling Factor (①/②)	①Density of Sample (Bq/cm^3)	Scaling Factor (①/②)	①Density of Sample (Bq/cm^3)	Scaling Factor (①/②)	
I-131 (about 8 days)	ND	-	5.0E-03	0.13	1.0E-02	0.25	1.5E-02	0.38	3.7E-03	0.09	ND	-	4E-02
Cs-134 (about 2 years)	ND	-	1.1E-02	0.18	2.0E-02	0.33	3.3E-02	0.55	5.2E-03	0.09	ND	-	6E-02
Cs-137 (about 30 years)	ND	-	1.1E-02	0.12	2.4E-02	0.27	2.7E-02	0.30	ND	-	ND	-	9E-02

※ O.OE−O means $O.O \times 10^{-O}$.

※ Data of other nuclides are under evaluation.

Place of Sampling	3 km offshore of Haramachi-ku		3 km offshore of Odaka-ku		3 km offshore of Iwasawa Shore		3 km offshore of North of Iwaki City		8 km offshore of Odaka-ku		8 km offshore of Iwasawa Shore		② Density limit by the announcement of Reactor Regulation (Bq/cm3) (the density limit in the water outside of surrounding monitored areas in the section 6 of the appendix 2)
Time and Date of Sample Collection	2011/4/22 10:32		2011/4/22 10:10		2011/4/22 7:45		2011/4/22 7:10		2011/4/22 9:40		2011/4/22 8:00		
Detected Nuclides (Half-life)	①Density of Sample (Bq/cm^3)	Scaling Factor (①/②)	①Density of Sample (Bq/cm^3)	Scaling Factor (①/②)	①Density of Sample (Bq/cm^3)	Scaling Factor (①/②)	①Density of Sample (Bq/cm^3)	Scaling Factor (①/②)	①Density of Sample (Bq/cm^3)	Scaling Factor (①/②)	①Density of Sample (Bq/cm^3)	Scaling Factor (①/②)	
I-131 (about 8 days)	ND	-	ND	-	5.6E-02	1.4	5.4E-02	1.4	ND	-	1.9E-02	0.48	4E-02
Cs-134 (about 2 years)	ND	-	ND	-	1.2E-01	2.0	1.2E-01	2.0	ND	-	4.4E-02	0.73	6E-02
Cs-137 (about 30 years)	ND	-	ND	-	1.2E-01	1.3	1.3E-01	1.4	2.4E-02	0.27	5.0E-02	0.56	9E-02

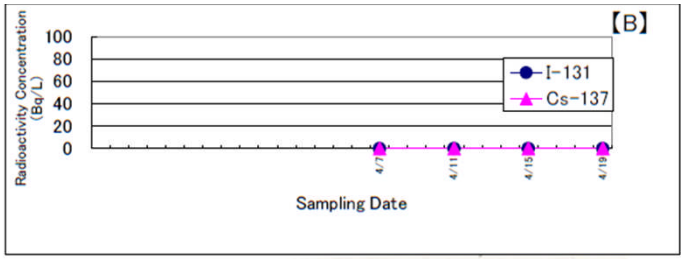
※ O.OE−O means $O.O \times 10^{-O}$.

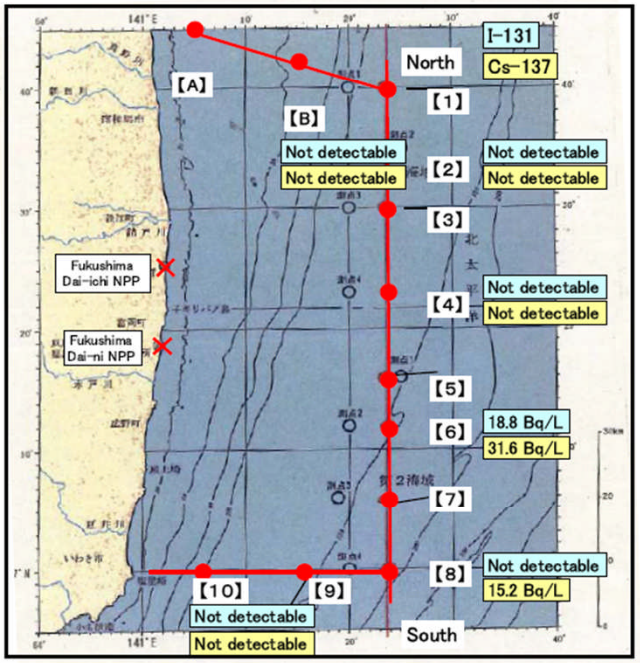
※ Data of other nuclides are under evaluation.

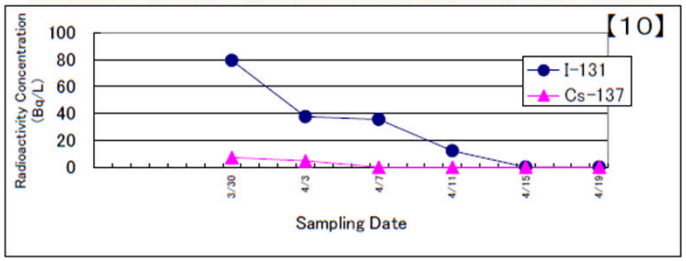
8-4. Sea Area Monitoring (4/5)

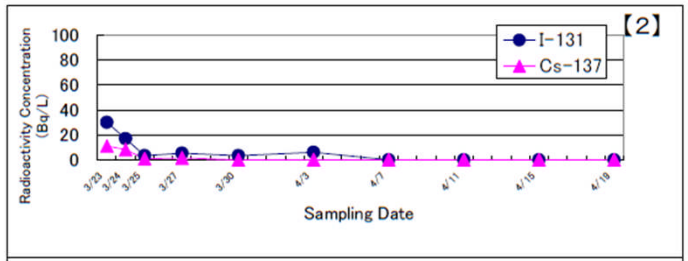
④-1 Radioactivity concentration in the Sea (outer layer)

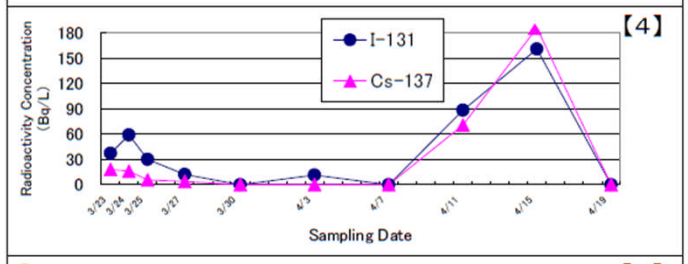
- Radioactivity concentration I-131 at location #4 peaked out at approx.161Bq/L on April 15th

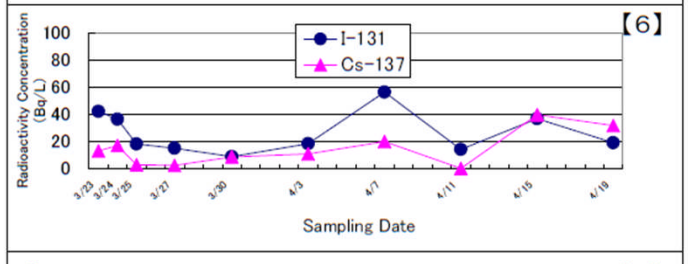


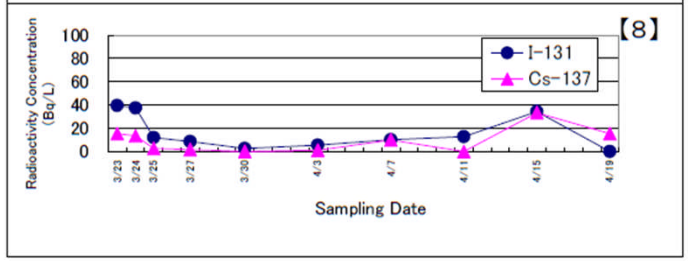










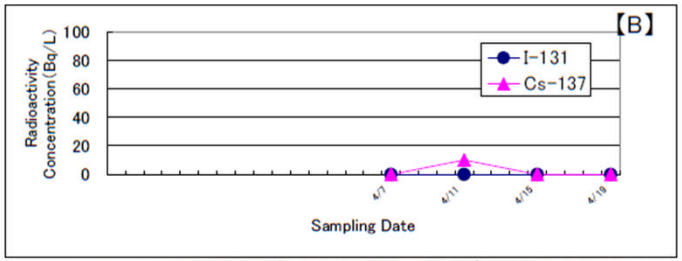


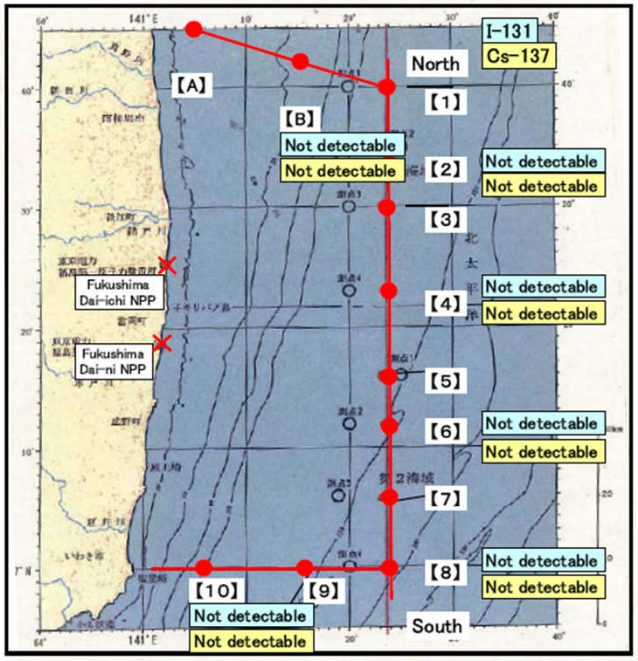
Note: "Not Detectable" is illustrated as OBq/L.

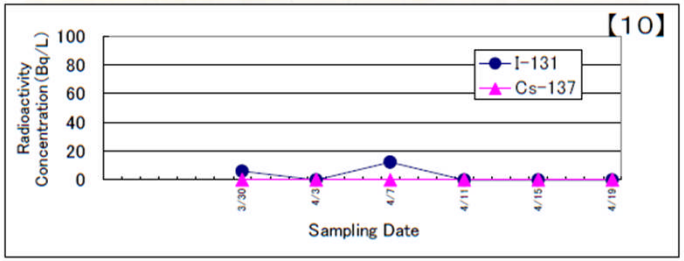
8-4. Sea Area Monitoring (5/5)

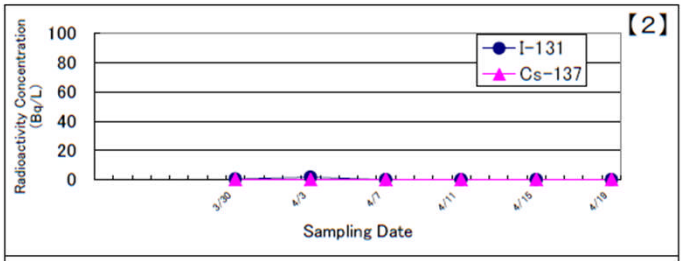
④-1 Radioactivity concentration in the Sea (lower layer)

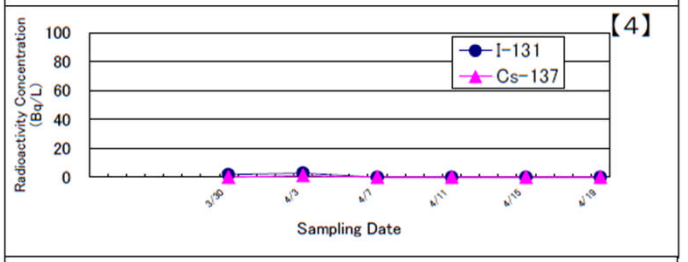
- Radioactivity concentration I-131 at location #10 peaked out at approx.12.5 Bq/L on April 7th

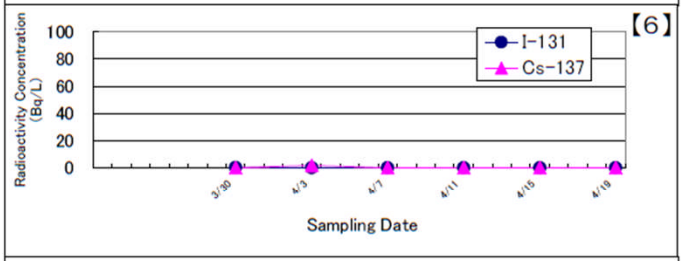


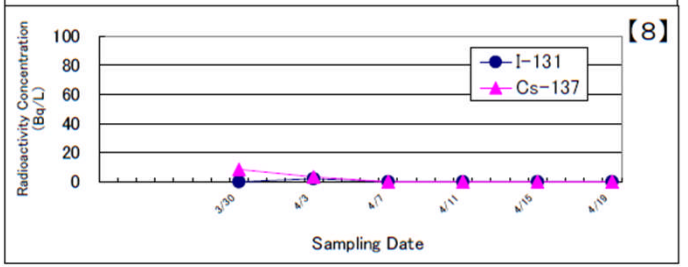












Note: "Not Detectable" is illustrated as 0Bq/L.

9. Information sharing with international communities

9. Information sharing with international communities (1/2)

1. Daily Notification

(1) ENAC Website

NISA has constantly been providing facility-related and other relevant information on the Emergency Notification and Assistance Convention Website, designed for member states to exchange information on nuclear accidents.

(2) IEC (IAEA)

NISA has constantly been providing the Incident and Emergency Centre of IAEA with press releases and other relevant information, as well as responses to questions on such communication.

(3) Foreign Media Briefing

- NISA joins relevant government agencies in daily foreign media briefings at the PM's official residence on March 14, 17 and every day afterwards.
- NISA officials give account to damages suffered at Fukushima NPSs and respond to questions.

(4) Briefings for Diplomatic Representatives in Tokyo

- NISA joined the Ministry of Foreign Affairs in briefing sessions for Diplomatic representatives in Tokyo.
- Distributed press releases (English), provided explanations and answered questions.

(5) English information on the Web

- Nuclear and Industrial Safety Agency: http://www.nisa.meti.go.jp/english/index.html
- Office of Prime Minister: http://www.kantei.go.jp/foreign/index-e.html

9. Information sharing with international communities (2/2)

2. IAEA

(1) Technical Briefing on March 21st

Following the special meeting of the IAEA Board of Governors, NISA officials briefed the member state representatives on the overview of the earthquake itself as well as the status of and ongoing measures to address the Fukushima NPS accident.

(2) Side event on the “Fukushima Daiichi Accident and Initial Safety Measures Worldwide” on April 4th

NISA and MEXT officials explained the member state representatives the Status of Fukushima Daiichi NPPs and monitoring, action taken and Future plan as well as the implementation on emergency safety measures.

3. OECD

(1) MDEP Steering Technical Committee on April27-29

(2) OECD/NEA Steering Committee on April 28-29

(3) CNRA Highlevel Senior Task Group on May 4-6

10. Remarks

- Continue to make every possible efforts to bring the situation under full control
- Will identify the cause of the accident thoroughly and review safety assurance measures
- Offer the information as much as possible and share the lessons learned from the accident with the international community