Nuclear Safety, Emergency Planning, Safeguards and Security and Physical Protection : Japanese Experience

August 2017

JAIF International Cooperation Center (JICC)

Akio Toba

Content

1. Nuclear Safety

- Lessons learned from Fukushima Daiichi NPP accident

2. Emergency Planning

- Lessons learned from Fukushima Daiichi NPP accident

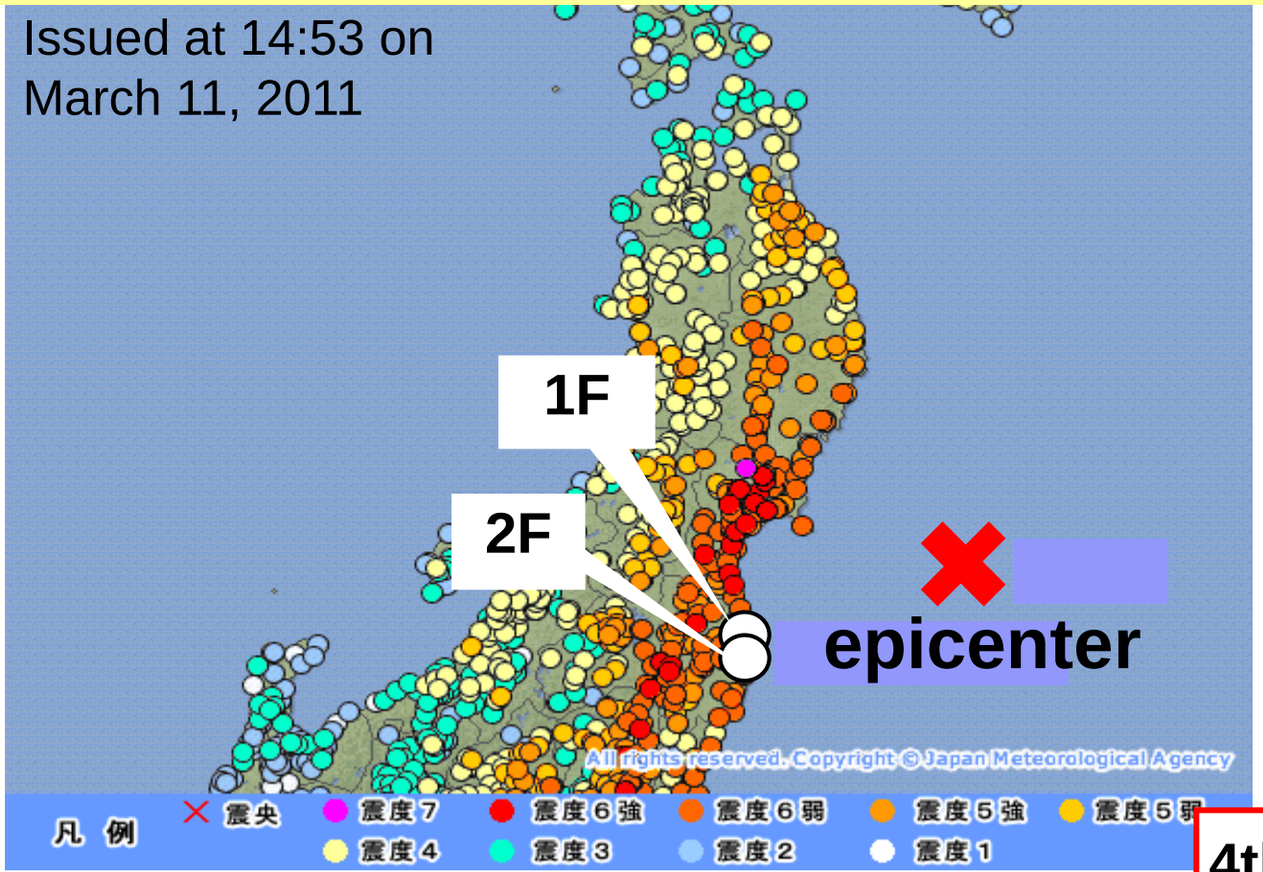
3. Safeguards and Security and Physical Protection

4. Current Status of NPPs in Japan

5. Summary

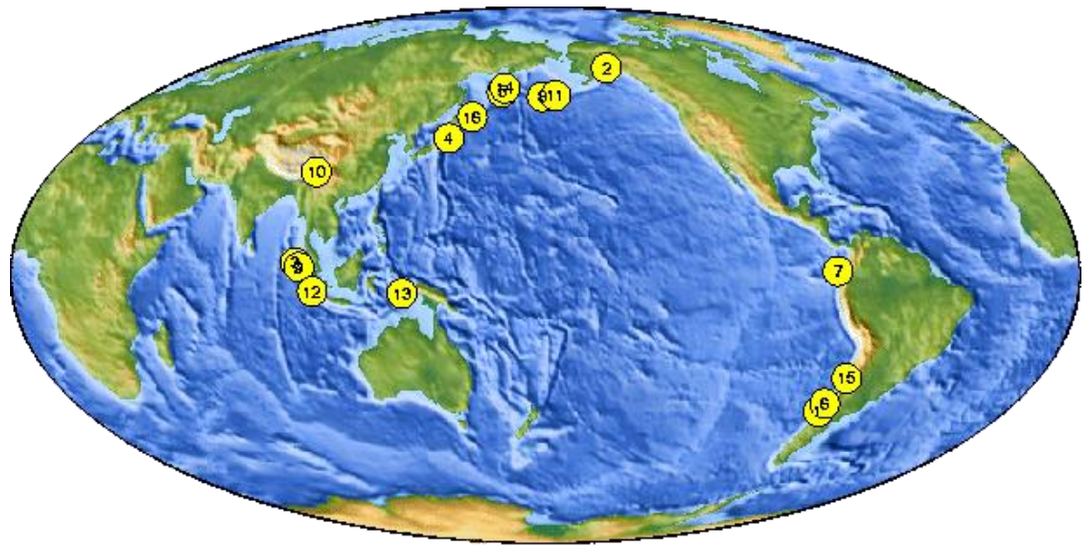
Great East Japan Earthquake

- **Time:** 2:46 pm on Fri, March 11, 2011.
- **Place:** Offshore Sanriku coast (northern latitude of 38 degrees, east longitude of 142.9), 24km in depth, Magnitude 9.0
- **Intensity:** **Level 7** at Kurihara in Miyagi Miyagi prefecture
  Upper 6 at Naraha, Tomioka, Okuma, and Futaba in Fukushima pref.
  Lower 6 at Ishinomaki and Onagawa in Miyagi pref., Tokai in Ibaraki pref.



Seismic Intensity Distribution

Largest Earthquakes in the World Since 1900



4th-largest magnitude on record in the world

From Tokyo Electric Power Company

Observed Seismic Data

Comparison between Basic Earthquake Ground Motion and observed acceleration.

Observation Point (The lowest basement of reactor buildings)		Observed data (*interim)			Maximum Response Acceleration against Basic Earthquake Ground Motion (Gal)		
		Maximum Response Acceleration (Gal)					
		Horizontal (N-S)	Horizontal (E-W)	Vertical	Horizontal (N-S)	Horizontal (E-W)	Vertical
1F	Unit 1	460※2	447※2	258※2	487	489	412
	Unit 2	348※2	550※2	302※2	441	438	420
	Unit 3	322※2	507※2	231※2	449	441	429
	Unit 4	281※2	319※2	200※2	447	445	422
	Unit 5	311※2	548※2	256※2	452	452	427
	Unit 6	298※2	444※2	244	445	448	415
2F	Unit 1	254	230※2	305	434	434	512
	Unit 2	243	196※2	232※2	428	429	504
	Unit 3	277※2	216※2	208※2	428	430	504
	Unit 4	210※2	205※2	288※2	415	415	504

*1: The data above is interim and is subject to change.
*2: The recording time was about 130-150 seconds

From Tokyo Electric Power Company

Tsunami Attack on Fukushima Daiichi NPS (1F)

From Tokyo Electric Power Company

Flooding at 1F

＜Near Unit 4 exhaust stack：O.P.+10m＞

Date/time: 2011/3/11 15:42

Date/time:_2011/3/11 15:42

Date/time:_2011/3/11 15:43

Date/time:_2011/3/11 15:43

Date/time:_2011/3/11 15:43

Date/time:_2011/3/11 15:44

From Tokyo Electric Power Company

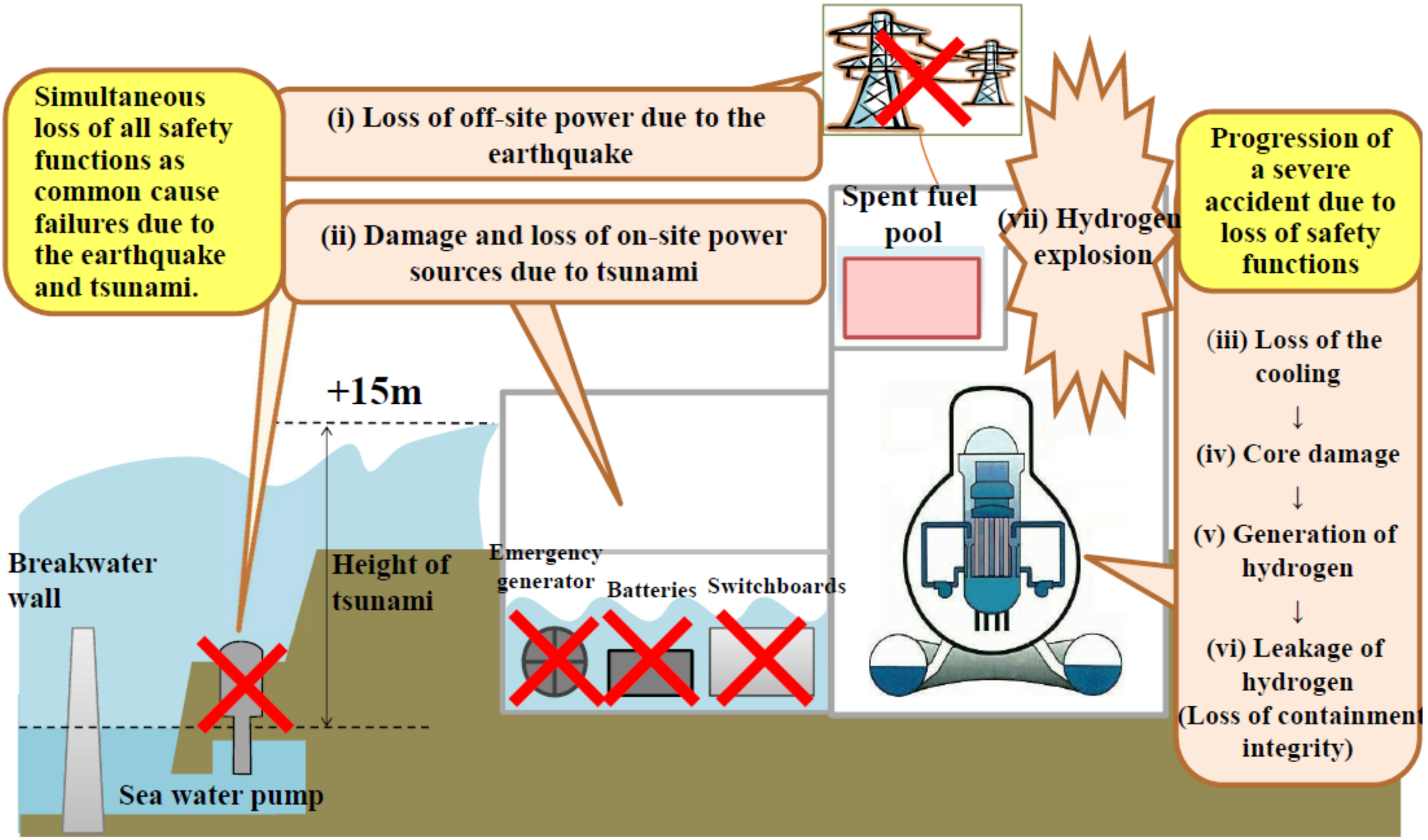
Damage at Yard (Seawater Pump) Area

Unit 3 Sea Pump Area

Unit 5,6 Intake Screen Area

From Tokyo Electric Power Company

How the Severe Accident happened?

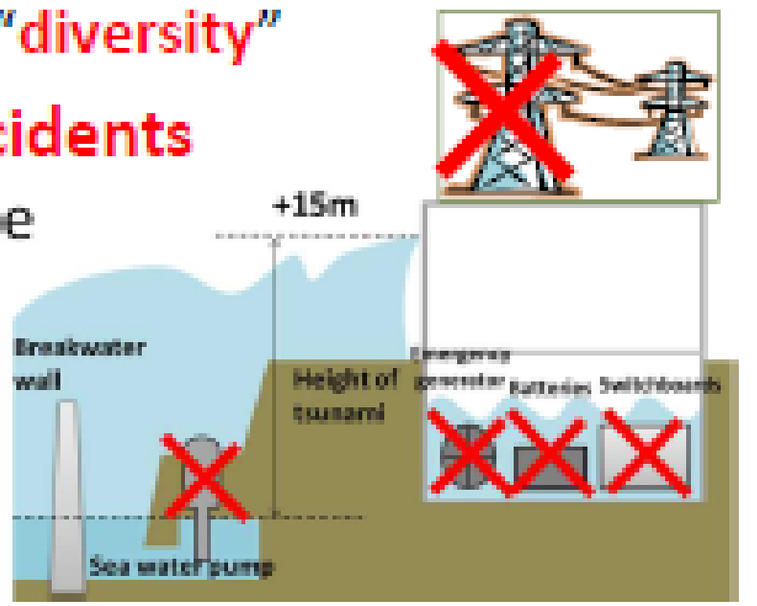


New Requirements Based on Lessons Learned

- Large scale **common cause failures** due to extreme natural hazards led to long lasting **SBO / LUHS**, resulting in **severe accidents**.

SBO: Station Blackout
LUHS: Loss-of Ultimate Heat Sink

- Enhanced measures against **natural hazards**
  - ✓ Not only earthquakes and tsunamis but also **volcanic activities, tornadoes, forest fires, etc.**
- Enhanced **reliability of safety functions** such as power supply
  - ✓ Use of **mobile equipment**, strengthened **"diversity"**
- **Mandatory** measures against **severe accidents**
  - ✓ **Prevention** and **mitigation** of core damage
  - ✓ Suppression of radioactive materials dispersion
- **Back-fitted** to existing plants



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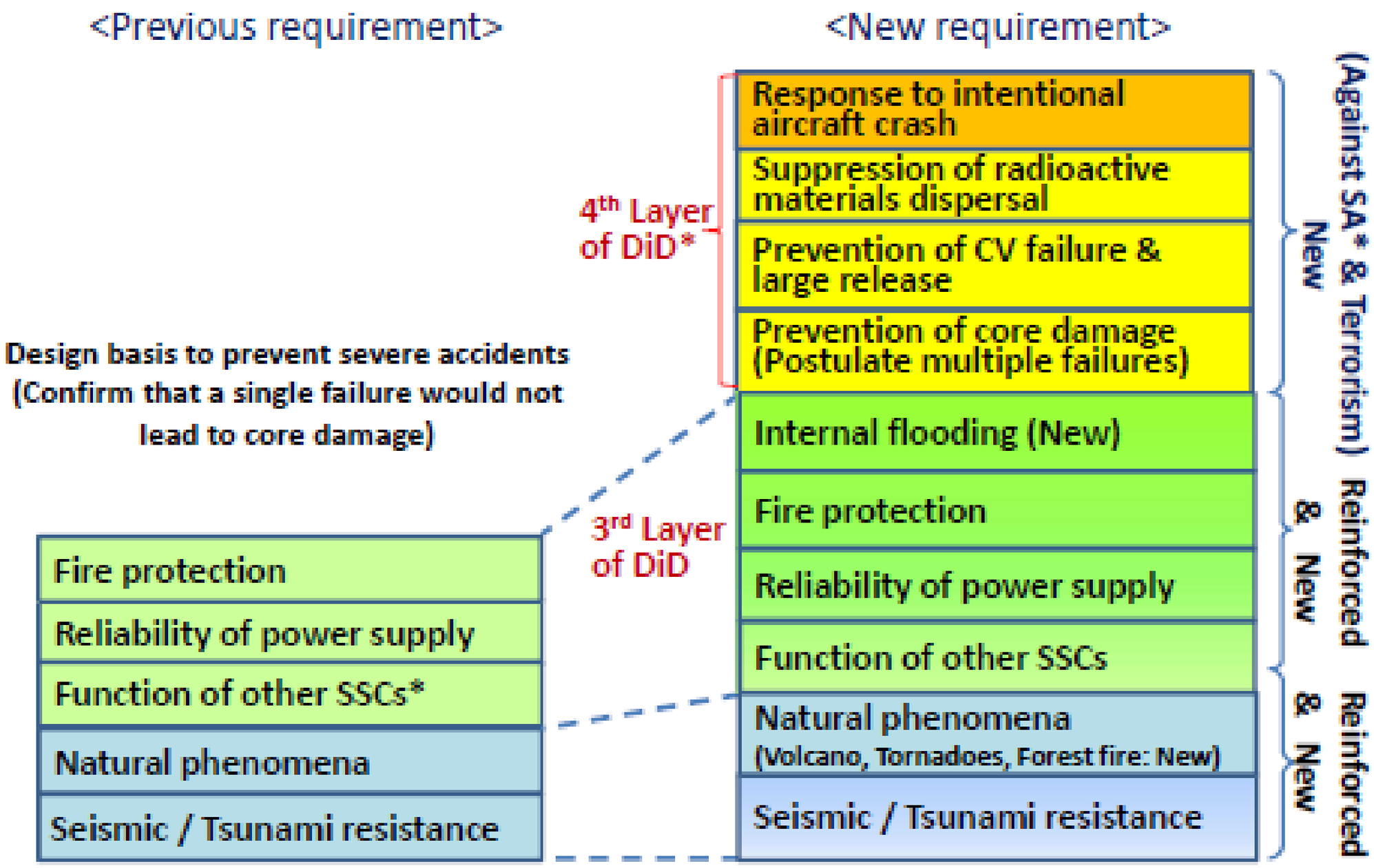
From NRA

Comparison between Previous and New Requirements



DiD* : Defense in Depth
SSCs*: Structure, Systems and Components
SA* : Severe Accident

NRA, Japan
Nuclear Regulation Authority

Continuous and Voluntary Improvement of Safety

Before the Accident: "Safety Myth": Severe accidents will not happen.

In reality, the Accident Happened.

Lesson learnt: Continuous and Voluntary Safety Improvement are necessary.
(Pursuing the world's highest safety level)

Plant Manufactures

Utilities
<Voluntary/Continuous Safety Improvement>

Risk Assessment

Considering/ Conducting Measures

Needs for Solutions

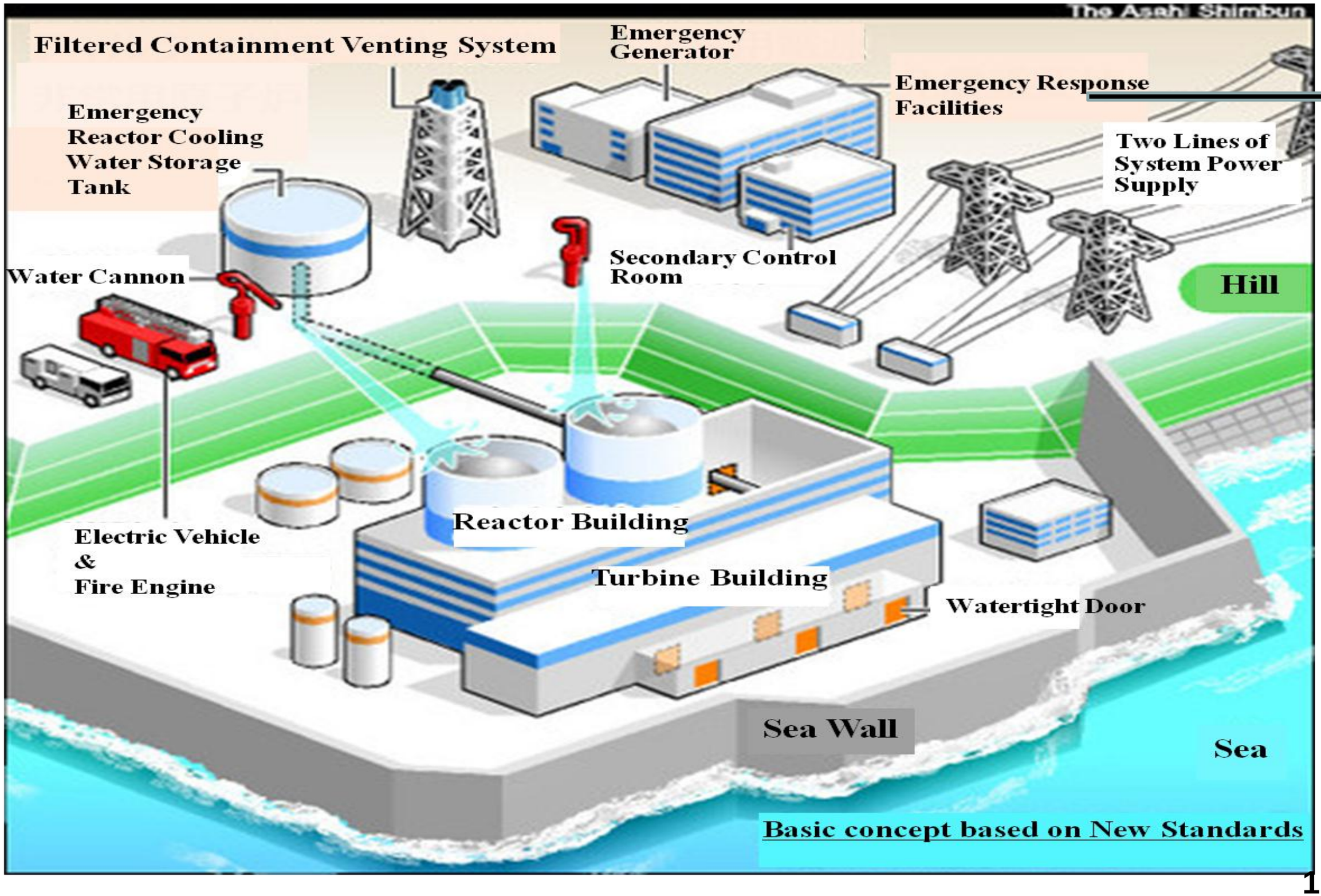
Solutions, Information, etc.

Nuclear Risk Research Center
<R&D>

From METI of Japan

Measures to enhance safety -3

--- lessons learned from Fukushima accident ---



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Summary of the Off-site Emergency Response Chronology

	March 11(Fri)	March 12(Sat)	March 13(Sun)	March 14(Mon)	March 15(Tue)	March 16(Wen)	March 17(Thu)
Disaster Event	*(14:46)Great East Japan Earthquake *(14:49)Alert for huge tsunami *Tsunami arrival						
NPP Site	*(14:47)Reactor SCRAM *(15:37)All blackout at 1F	*(15:36)#1 hydrogen Explosion ⑤ *(7:11)PM Mr.kan arrived by Helicopter		*(11:01)#3 hydrogen Explosion	*(~6:00)#4 hydrogen Explosion	①	
National Government (Nuclear Emergency Response HQ)	④ *(15:14)Nuclear Emergency Response HQ established *(19:03)Declaration of a nuclear emergency for 1F *(21:23)An evacuation order of 3km radius of 1F Sheltering order of 3-10km radius of 1F	*(5:44)An evacuation order of 10km radius of 1F *(7:45)Declaration of a nuclear emergency for 2F *(7:45)An evacuation order of 3km radius of 2F *Preparation of 57 buses for evacuation Sheltering order of 3-10km radius of 2F ⑧ *(17:39)An evacuation order of 10km radius of 2F *(18:25)An evacuation order of 20km radius of 1F			*Off-site center moved from Okuma to Fukushima city *(11:00) Sheltering order of 20-30km radius of 1F		
③ Fukushima Prefecture (Local Nuclear Emergency Response HQ)	*(20:50)An evacuation order of 2km radius of 1F *(15:12)Request for dispatch of emergency fire brigade *(16:47)Request for dispatch of Self Defense Force *Strengthening of periphery monitoring by monitoring posts *Start of radiation exposure screening					*Request of emergency monitoring of farm products & drinking water	
Local Towns	*Confirmation of residents' safety, rescue, search, evacuation guidance & establishment of shelters						
Fire Fighting	*Start of rescue activities						
Medical	*DMAT(Disaster Medical Assistance Team) activities start						
Police	*Start of evacuation guidance & rescue activities * (23:23)Completion of evacuation of 3km radius of 1F					*Water spray to #3 SFP by Fire Engines	
Self Defense Force	*(19:30)Order of Nuclear Disaster Dispatch					*Water spray to #3 SFP by Helicopters & Fire Engines	

* Base on the table arranged by Fukushima Prefecture

Problems related to Off-site Emergency Response

* The roles and responsibilities for the operating organization and for local and national authorities were not fully clear and necessary information wasn't shared properly

* Off-site Center , where the Nuclear Emergency Response Local Headquarters is established, lost its functionality

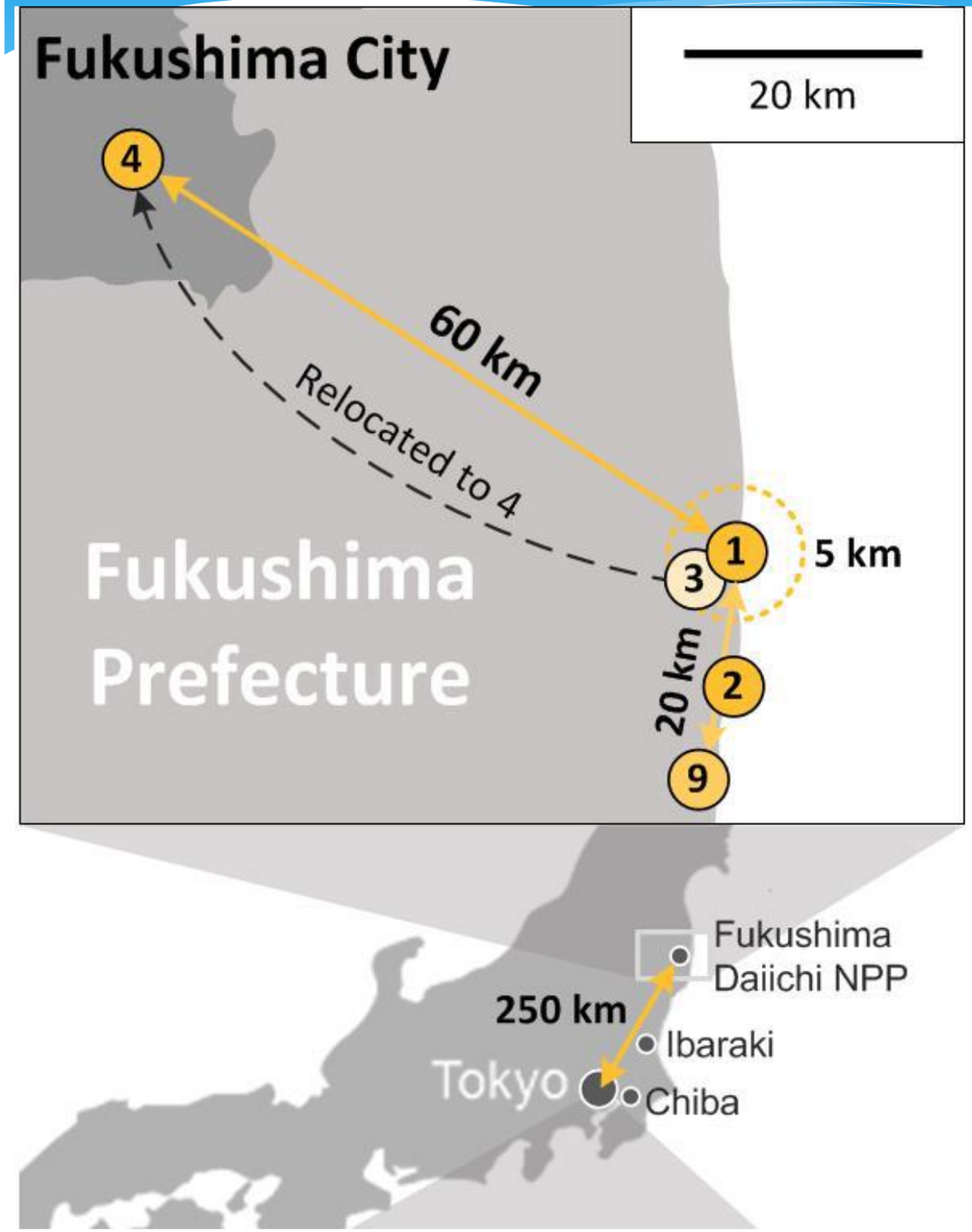
* SPEEDI was not fully utilized especially for evacuation order
  - SPEEDI couldn't work as planned because of ERSS failure
  - The result of SPEEDI calculation was not used for the evacuation

* A lot of lives were lost during the evacuation process
  - No case of direct effect of radiation but many cases of so to called "nuclear disaster related causalities"
  - Typical case is at Futaba hospital and its nursery for elderly

* Stable Iodine tablet was not systematically administrated for the residents

①Responses to the accident by the government and other bodies
- Local Nuclear Emergency Response Headquarters -

* The Nuclear Emergency Response Manual of the government is drawn up based on the ground that the Off-site Center actually functions, where the Nuclear Emergency Response Local Headquarters is established. However, the response measures stipulated in the Manual could not be taken.
  - The measures to ensure the continued functionality of the Off-site Center even at a severe accident should have been in place
  - The measures should also have been taken to facilitate response in case of failure of the Off-site Center.



1. FUKUSHIMA DAIICHI NUCLEAR POWER PLANT

- On-site ERC – Emergency Response Centre at the NPP

2. FUKUSHIMA DAINI NUCLEAR POWER PLANT

- On-site ERC – Emergency Response Centre at the NPP

3. OFF-SITE CENTRE

- Local NERHQ – Local Nuclear Emergency Response Headquarters
- JCNER – Joint Council for Nuclear Emergency Response
- Local Prefectural NERHQ – Local Prefectural Nuclear Emergency Response Headquarters

4. FUKUSHIMA PREFECTURAL GOVERNMENT OFFICE

- Fukushima Prefecture Headquarters for Disaster Control

9. J-VILLAGE

KEY ENTITIES IN VARIOUS LOCATIONS IN JAPAN

Tokyo

- JNES – Japan Nuclear Energy Safety Organization
- MEXT – Ministry of Education, Culture, Sports, Science and Technology
- MHLW – Ministry of Health, Labour and Welfare
- MAFF – Ministry of Agriculture, Forestry and Fisheries
- MOE – Ministry of the Environment
- MOD (SDF) – Ministry of Defense (Self-Defense Forces)
- JMA – Japan Meteorological Agency

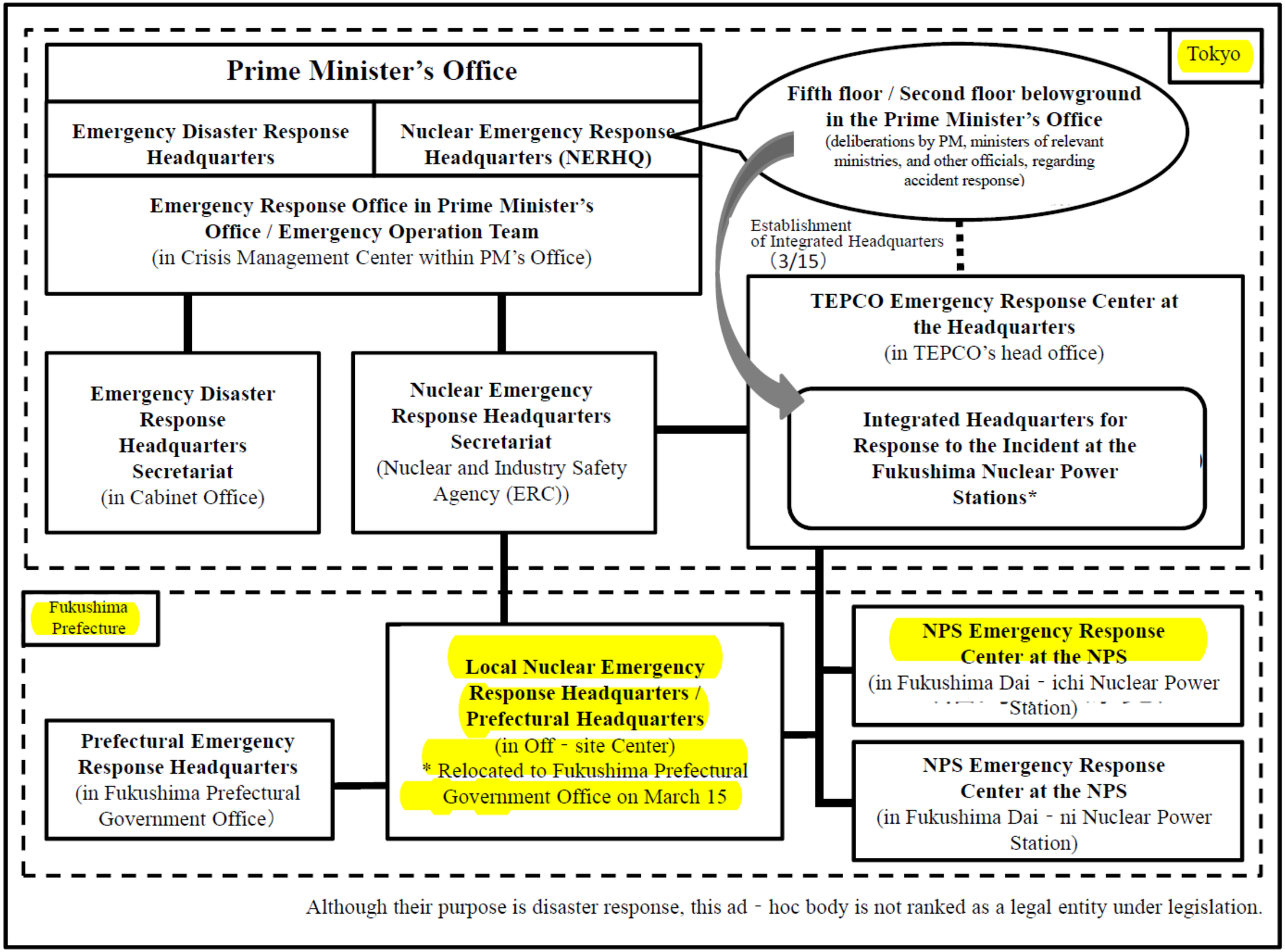
Ibaraki

- JAEA – Japan Atomic Energy Agency

②Responses to the accident by the government and other bodies
- Response within the Prime Minister's Office -

* Many of the important decisions, including evacuation measures, were undertaken in the mezzanine floor in the basement of the PM's Office or in the fifth floor of the PM's Office, away from the Crisis Management Center and the ERC which served as the government's base for the collection of information on the site.
* This resulted in a lack and bias in information, creating a situation where a decision had to be made without sufficient information.
  - The emergency responses should be based at a location close to the accident site.

Organizational chain of command for accident response at Fukushima Dai-ichi and Dai-ni Nuclear Power Stations (until March 15, 2011)



Final report of the Investigation Committee on the Accident at the Fukushima Daiichi NPS of Japanese Government

③Problems with collection of information
- Fukushima Prefecture Nuclear Emergency Response Center -

* Fukushima Prefecture established the Fukushima Prefecture Nuclear Emergency Response Center on March 11 with the Governor of Fukushima heading the Center .
* Insufficiencies in internal and external coordination by the Prefectural Emergency Response Center gave rise to problems such as significant delays in the evacuation and rescue of patients in Futaba Hospital, who had been left behind in the evacuation area.

④Analyses of other specific responses
- Delay of Declaration of a nuclear emergency -

* At about 17:42 on March 11 METI Minister with NISA DG, being accompanied by other officials reported to PM Kan on the occurrence of a nuclear emergency as defined by Article 15 of the Act.
* At the same time, they requested approval for the declaration of a nuclear emergency.
* NISA DG and the accompanying officials were unable to provide sufficient explanations to the questions by PM Kan, when questioned on the situation of the nuclear reactors at the Fukushima Dai-ichi NPS as well as on related legislation.
* As time passed, the petition proceedings were temporarily suspended because PM Kan had to leave for a meeting.
* The declaration of a nuclear emergency was issued at 19:03 on the same day.

⑤Analyses of other specific responses
- Inspection visit to the Fukushima Dai-ichi NPS -

* PM Kan implemented the inspection visit to the Fukushima Dai-ichi NPS on March 12 for reasons including the lack of adequate information.
  * This inspection visit ended without any accident and apparently did not affect venting procedures at the Fukushima Dai-ichi NPS after all.

➢ A question remains as to whether a less problematic step should have been taken by, for instance, dispatching another person to check the situation, instead of having the PM, who is the supreme commander, staying absent from the PM's Office for long time in the event of such a large-scale disaster and accident,

taking a risky inspection tour to, and visiting,

the accident site where the site staff were

being pre-occupied with emergency response.

⑥Measures to prevent the expansion of damage - Monitoring readiness -

* In this accident, the monitoring activities based in the Local NERHQ within the Off-site Center were insufficient. Therefore, on March 16, 2011, the division of roles of the related organizations was coordinated.

➢ It is difficult to assess that a decision was made with adequate coordination beforehand, amidst a situation that requires an urgent response, among the related organizations, with regard to the range of data assessment.

⑦－１　SPEEDI utilization policy
- Problems with the systems and the entities that make use of them -

* The System for Prediction of Environmental Emergency Dose Information (SPEEDI) is a system that can predict radiation dose rates in the surrounding environment when a nuclear accident occurs, based on the emissions source information from the Emergency Response Support System (ERSS).
* The ERSS failed to function when the accident occurred.
* The policies of utilizing SPEEDI under such circumstances should have been reviewed and shared beforehand.
* No clarification had been made as to the entities that would make use of SPEEDI in the event that an off-site center failed to function.

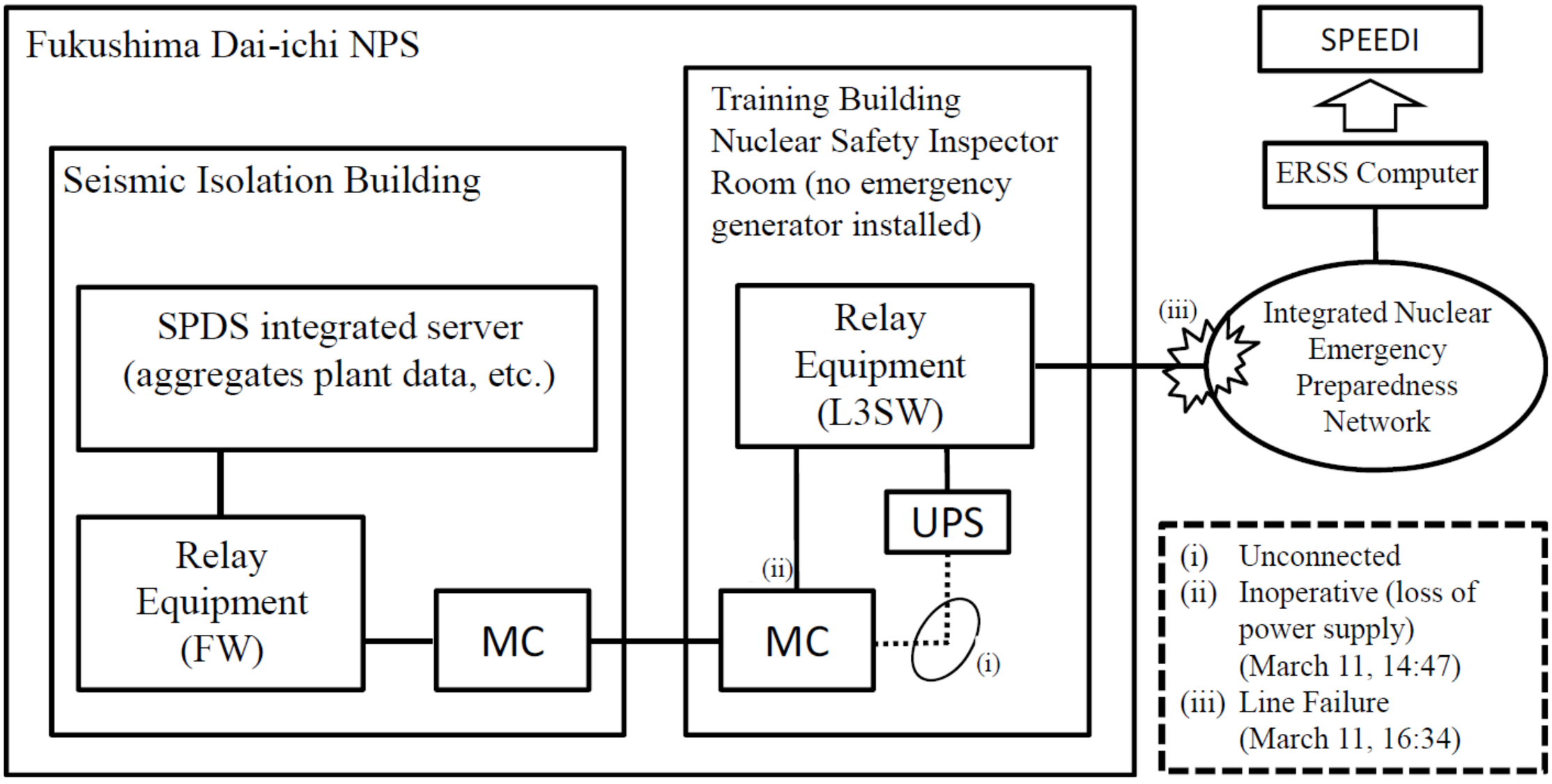


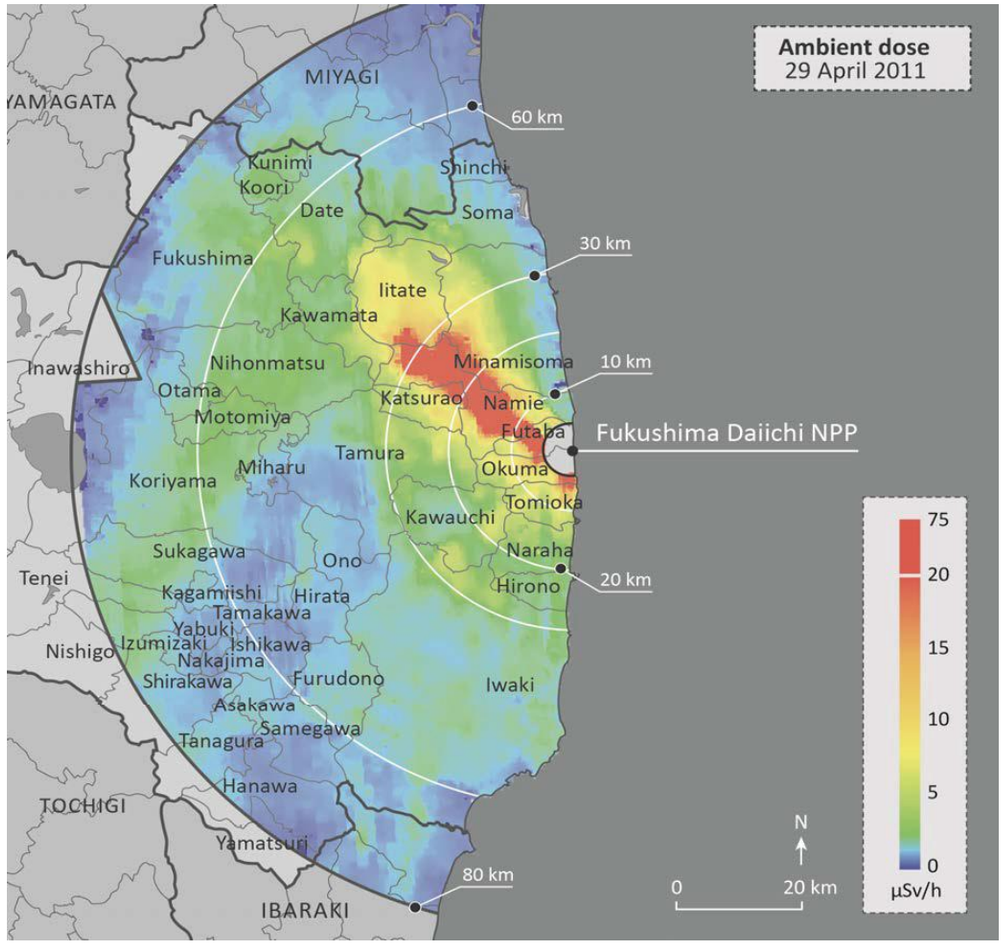
Fig. IV-1 Transfer of SPDS Data to ERSS

Final report of the Investigation Committee on the Accident at the Fukushima Daiichi NPS of Japanese Government

⑦－２　SPEEDI utilization policy
- SPEEDI and evacuation orders -

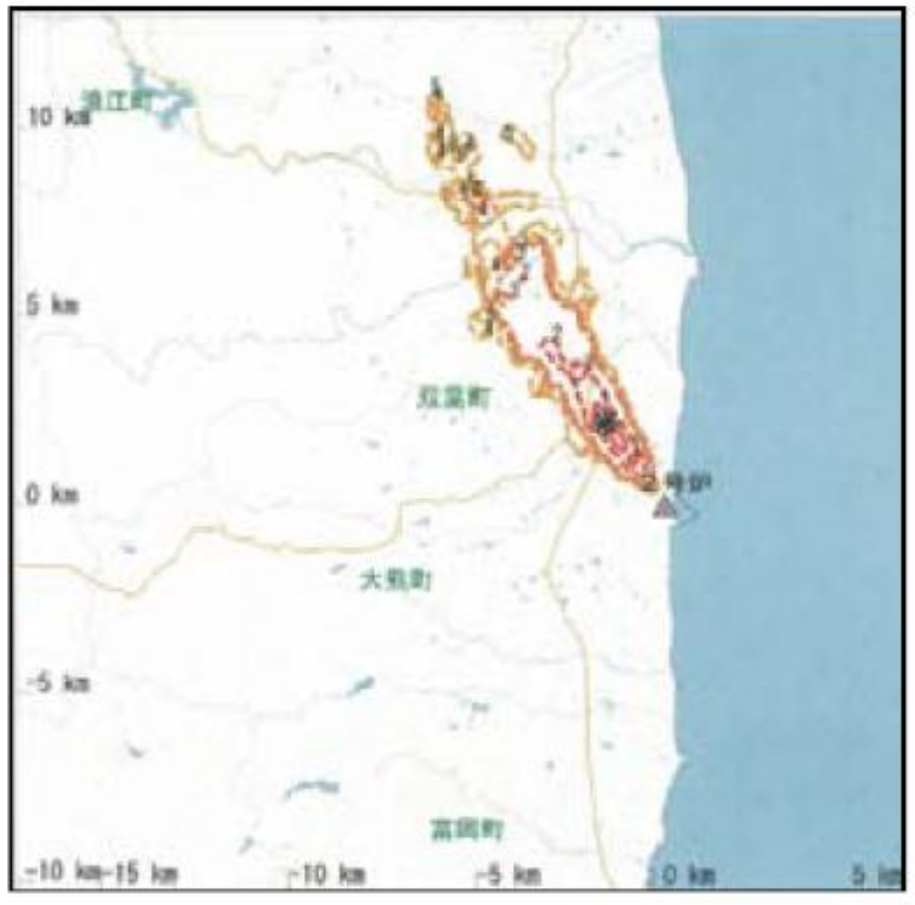
* The major reason why SPEEDI was not effectively utilized is considered to lie in the fact that any of the relevant organizations did not have the idea of using it for evacuation activities when emissions source information could not be obtained from the ERSS.
* However, prediction results through SPEEDI that assumed the unit emissions had been actually obtained.
* If that information were distributed, the respective local governments and residents could have been able to select a more appropriate timing or direction to evacuate.

The Comparison between Actual Dose Rate and SPEEDY Result



IAEA Pub1710-TV3

Fixed-time calculation results at 23:00 March 15 (Dispersion prediction for 23:00 March 15-00:00 March 16)



Final report of the Investigation Committee on the Accident at the Fukushima Daiichi NPS of Japanese Government

⑧ Evacuation orders for residents - Evacuation orders to areas beyond 10km radius from the Fukushima Dai-ni NPS -

* At 17:39 on March 12, an evacuation order was issued for the evacuation to areas beyond 10 km radius from the Fukushima Dai-ni NPS.

* The judgment was not based upon the information on the specific conditions at each unit of the Fukushima Dai-ni NPS.

* The plant conditions at the Fukushima Dai-ni NPS were then comparatively stable. Problems remained with the decision-making process of the evacuation order in question.

⑨ Evacuation orders for residents - Evacuation of hospital patients, etc. -

* With regard to the Futaba Hospital, where many bedridden patients had been accommodated, the evacuation response could only be assessed as inappropriate.
* The rescue of warded patients had been greatly delayed; and the transportation destination for those who had been rescued was a gymnasium of a high school in remote location.
* There is a need for the Self-Defense Forces to make sure to secure a communication system with external parties.
* Those who are responsible for the rescue of human lives should gain a renewed awareness of the weight of that responsibility, and undertake their duties with a strong sense of that responsibility.

⑩ Response to radiation exposure
- Orders from the government concerning the intake of iodine tablets -

* On March 13, 2011, the Medical Squad of the Local NERHQ commenced preparations to issue an order , concerning the screening level.
* During that process, the NSC delivered a FAX transmission to the ERC with the comment that stable iodine tablets should be administered to those whose radiation contamination exceeded the screening level.
* A liaison officer dispatched from the NSC to the ERC received this transmission, but this comment was not shared and not reviewed among the ERC Medical Squad, and was not communicated to the Local NERHQ, either.
* This was considered to be the result of a lack of awareness, on the part of the NSC liaison officer, of the importance and necessity of incorporating the NSC comments into orders to be issued by the Head of the NERHQ.

NRA's view on Nuclear Emergency Preparedness

- In nuclear facilities satisfied the New Regulatory Requirements, the possibility of a severe accident - seen in Fukushima Daiichi NPS - is extremely low.
- Apart from safety regulations, it is necessary to establish Nuclear Emergency Preparedness measures against unexpected nuclear events.

Chronology of Revision of National Nuclear Disaster Prevention Guide

	Law/Plan/Guide etc.,	Outline
Jun 27, 2012	NRA Establishment Law	NRA shall make Nuclear Disaster Prevention Guide
Sep 6, 2012	Revision of Basic Plan of Disaster Prevention	Prescribe practice of drill and Strengthening of residents protection against combined disaster and severe accident
Sep 14, 2012	Ministerial ordinance	Change of requirement for "Off-site Center"
Oct 19, 2012	Revision of Nuclear Disaster Prevention Manual	Strengthening of secretariat of PM office, and clarify the structure and role on off-site response
Oct 31, 2012	Nuclear Disaster Prevention Guide	Widen PAZ to 30 km radius and introduce criteria for decision making at time of emergency
Feb 27, 2013	Revision of Guide	Materialize judgement & criteria for preventive measure implementation like taking Iodine tablets
Jun 5, 2013	Revision of Guide	Materialize way of Emergency Monitoring and Iodine tablets distribution and taking
Jun 21, 2013	Partial Revision of Law	Local governments shall list up name of needed support and sufferers
Sep 2, 2016	Partial Revision of Manual	Prepare structure of Monitoring implementation and instruction for Iodine tablets taking
Sep 5, 2013	Revision of Guide	Change of criteria for the emergency state classification
Sep 12, 2013	Revision of Ministerial ordinance	

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Basic Stance of Japan

Japan's Efforts toward the International Peace and Stability

As the only country to have ever suffered atomic bombings in war, Japan has consistently engaged in disarmament and nonproliferation efforts, playing a leading role in international initiatives to realize "a world free of nuclear weapons."

"Japan's Efforts on Nuclear Disarmament and Non-Proliferation"
https://www.jaea.go.jp/04/iscn/activity/2016-11-29/index_en.html

Efforts to Strengthen Nuclear Security

Japan will proactively participate in the IAEA International Conference on Nuclear Security and will express its commitments for nuclear security.

Contribution to International Capacity Building on Nuclear Security

◆Integrated Support Center for Nuclear Nonproliferation and Nuclear Security (ISCN) accepts experts from Asian countries and hold training courses and symposiums.

Minimization of Nuclear Materials

◆Remove all HEU and separated plutonium fuels from the Fast Critical Assembly (FCA)
◆Remove all HEU fuels from the Kyoto University Critical Assembly (KUCA) by the conversion of KUCA from HEU to LEU fuels

Related Initiatives

◆G7 Presidency and Global Partnership against the Spread of Weapons and Materials of Mass Destruction
◆Global Initiative to Combat Nuclear Terrorism (GICNT) to be held at Tokyo in June 2017

"Japan's Efforts on Nuclear Disarmament and Non-Proliferation"
https://www.jaea.go.jp/04/iscn/activity/2016-11-29/index_en.html

ISCN

Activity Summary

○Domestic and international contributions

Technical Development for Nuclear Nonproliferation and Nuclear Security

○Nuclear nonproliferation and safeguards technologies (e.g.)

- Safeguards and material accountancy techniques for melted fuel in Fukushima
- Advanced Pu monitoring technology

○Nuclear security technologies

- Nuclear forensics techniques
- Non-destructive detection techniques for nuclear material

Contributions to the CTBT International Verification Regime

- Operate CTBT radionuclide stations, an official laboratory, and a national data center.
- Develop CTBT verification techniques

CTBT: Comprehensive Nuclear-Test-Ban Treaty
EC/JRC: European Commission/Joint Research Center

Nuclear Nonproliferation Policy Research

- Conduct policy research on nuclear nonproliferation and nuclear security based on technological knowledge
- Collect, analyze, and transmit information on international trends

Support in Capacity Building, Mainly in Asia

- Established ISCN in JAEA, following the government's statement in the Nuclear Security Summit in April, 2010
- Provide training such as a course to strengthen nuclear security

Enlightenment and International Contributions

- Organize international forums and symposiums and publish ISCN newsletters
- Cooperate internationally with U.S. and EC/JRC.
- Support IAEA in technological development

https://www.jaea.go.jp/04/iscn/activity/2016-11-29/index_en.html

Support in Capacity Building, Mainly in Asia

ISCN

○Collaboration and cooperation with international organizations

- Asian region network including three COEs, APSN, FNCA
- IAEA (INSEN, NSSC)
- Partnerships with U.S. DOE/NNSA, EC/JRC

IAEA

INSEN
International Nuclear Security Education Network

NSSCs
International Network for Nuclear Security Training & Support Centers

Bilateral Partners

DOE/NNSA

EC/JRC

Regional Frameworks in Asia

COEs

ISCN (JAPAN)
Integrated Support Center for Nuclear NP & NS

INSA (ROK)
International Nuclear Security Academy

SNSTC (China)
State Nuclear Security Technology Center

CBRN COE South East Asia of EC-JRC (in Philippines)

APSN
(Asia Pacific Safeguards Network)

FNCA
(Forum for Nuclear Cooperation in Asia)

Other COEs

https://www.jaea.go.jp/04/iscn/activity/2016-11-29/index_en.html

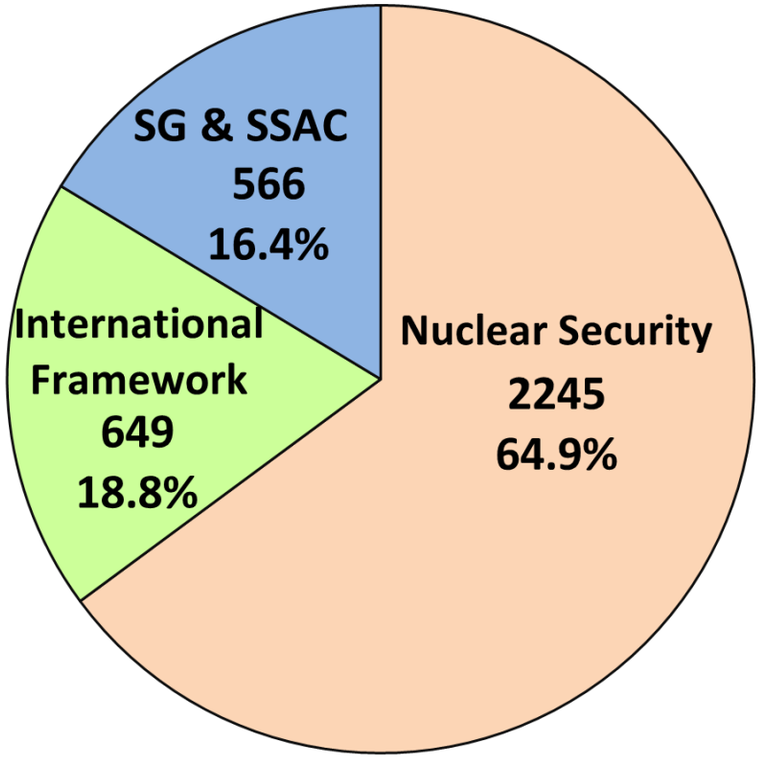
Distribution of Course Participants at ISCN/JAEA

Activity Results of 2011- July 2017

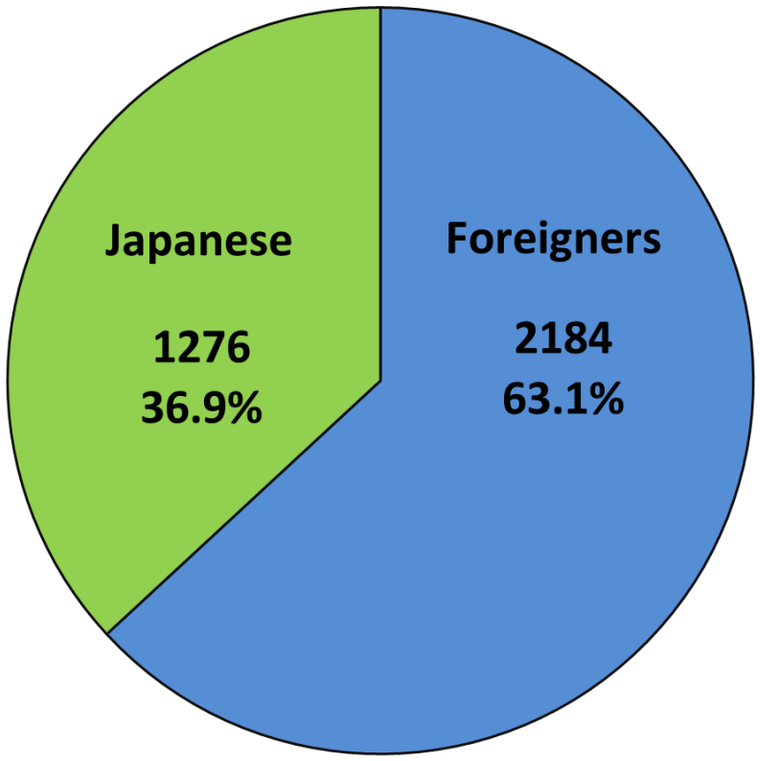
Total 3,460 participants in 127 courses

(75 countries, 3 international organizations)

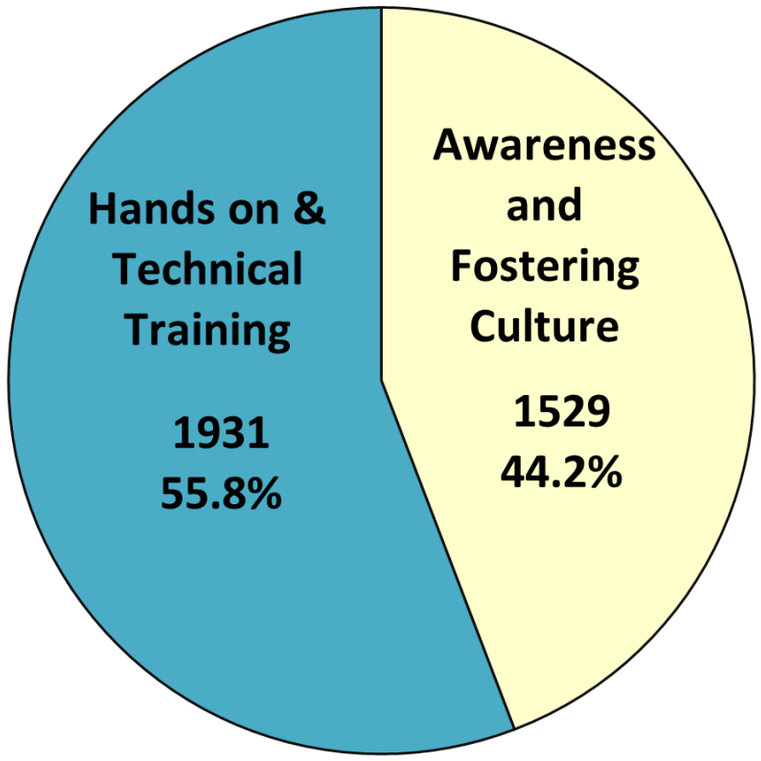
Course Topic



Nationality



Course Style



2017 ACE - JAEA Joint Seminar

3rd ACE-ISCN/JAEA Seminar
Security of Radioactive Source: Nuclear Development Programme – Capacity Building

Date: 17 April 2017, Manila, Philippines
Hosted by: DOE Philippines
Participants: 111
from 5 countries (Indonesia, Malaysia, Myanmar, Philippines, Thailand) + ACE

Goal: Reaffirm the importance of international and regional cooperation in the field of nuclear security, especially security of radioactive material.
To promote ASEAN member states' enhancement of nuclear security or security of radioactive sources through experience sharing.

Reporting ACE-JAEA Seminar during the ACE NEC-SSN Press Conference

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The Current Status of each Unit at Fukushima Daiichi NPS (1/2)

Unit 1

Hydrogen explosion
Core melt

<At the Time of the Accident>

<Now>

- The building cover has been installed to prevent dispersion of radioactive materials.
- Now the cover was dismantled in preparation for the fuel removal operation.

Unit 2

No hydrogen explosion
Core melt

<At the Time of the Accident>

<Now>

Unit 3

Hydrogen explosion
Core melt

<At the Time of the Accident>

<Now>

- Currently, toward the fuel removal from SFP, removal of rubbles is underway.
- On August 2, 2015, removal of largest rubble(FHM), weighs close to 20 tons, lying in the spent fuel pool was completed by remote control .

Unit 4

Hydrogen explosion
No core melt

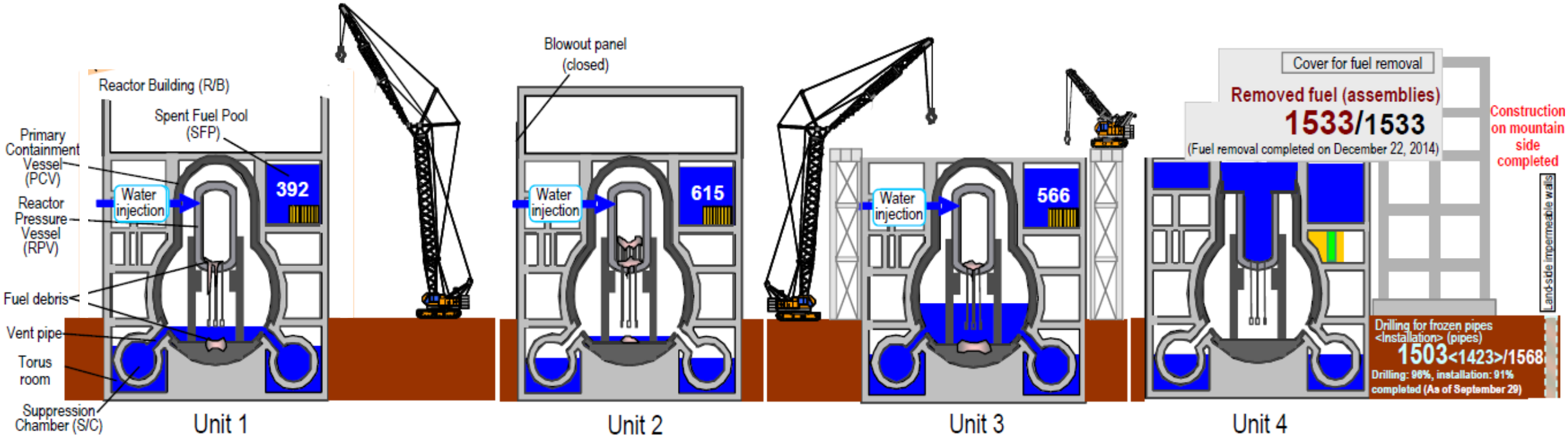
<At the Time of the Accident>

<Now>

- On December 22, 2014, all (**1533**) fuel removal from Unit 4 SFP was completed.

The Current Status of each Unit at Fukushima Daiichi NPS (2/2)

- The temperatures of the bottom of each reactor pressure vessels and spent fuel pools have been maintained in a stabilized condition



（17th August, 2017）

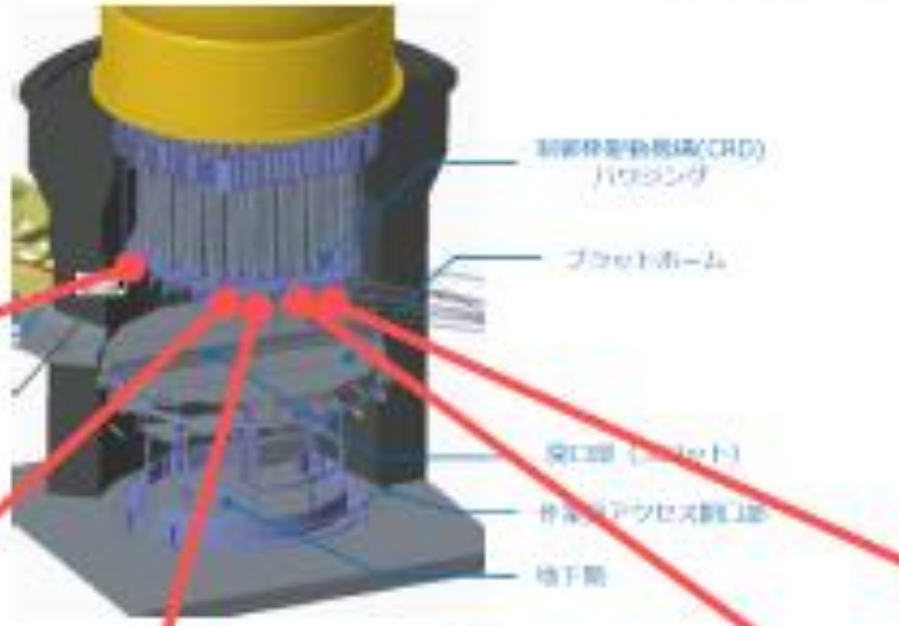
	Unit 1	Unit 2	Unit 3	Unit 4
RPV Temp	26. 8℃	32. 2℃	30. 7℃	—
SF Temp	37. 7℃	29. 9℃	29. 4℃	28. 0℃

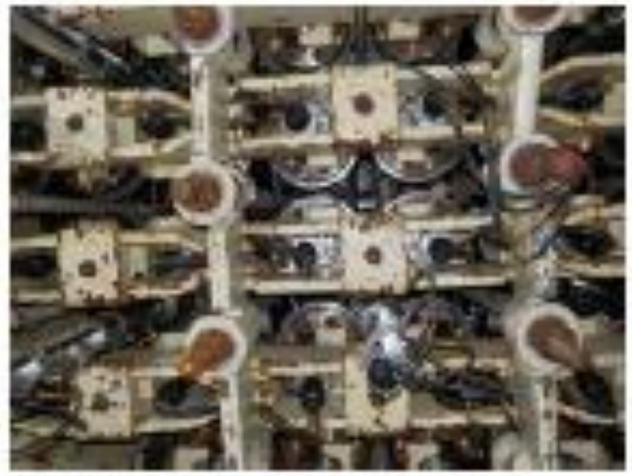
Investigation Results of Inside of Unit-3 PCV

2. 画像取得結果（CRDハウジング近傍）

IRID TEPCO

No.5





（参考）5号機のCRDハウジング
およびCRDハウジング支持金具

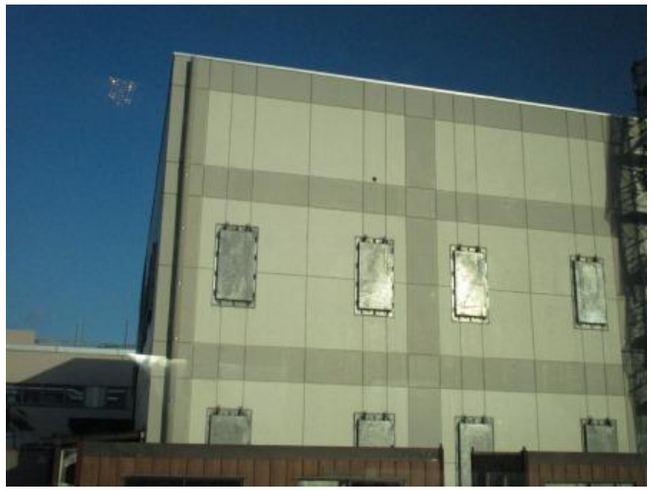
No.6

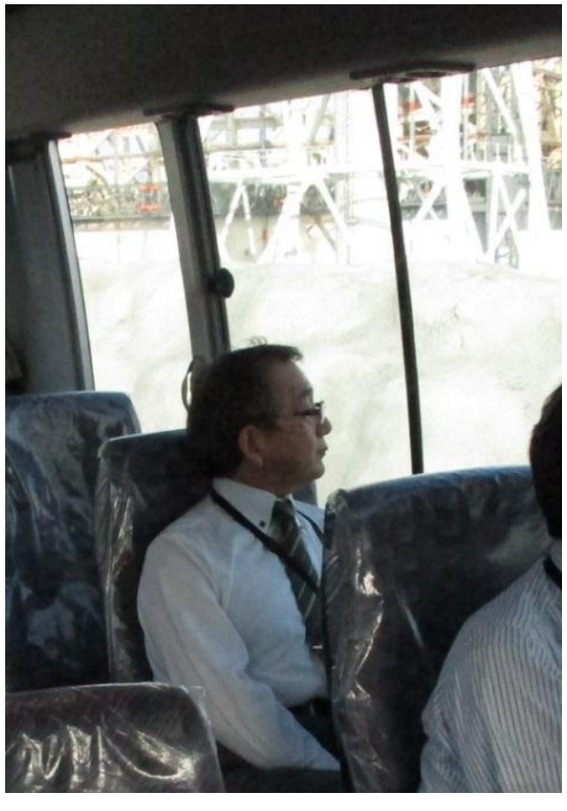
No.7

No.8

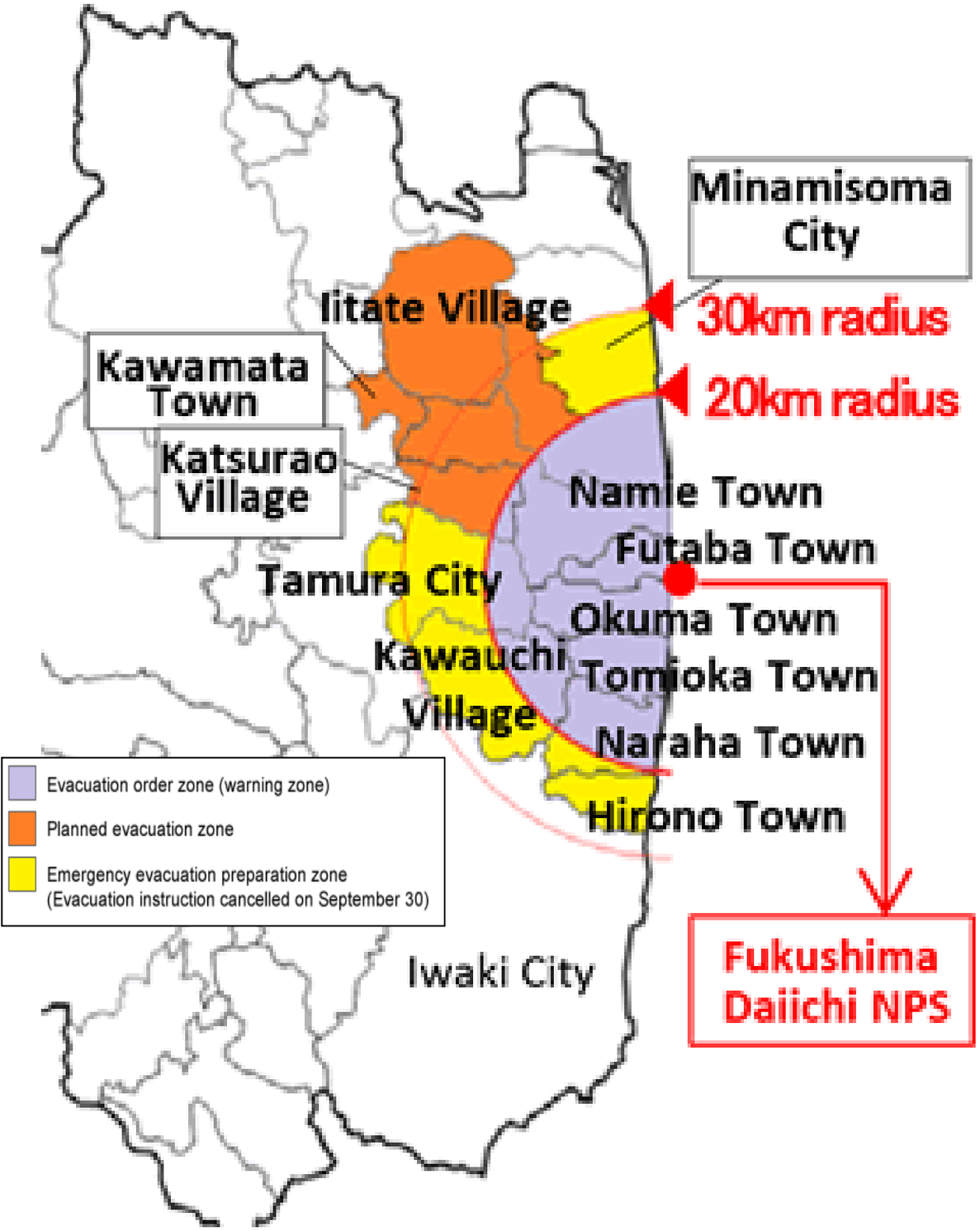
No.9

・複数個所でCRDハウジング支持金具の脱落，変形を確認した。
・CRDハウジング支持金具に溶融物が固化したと思われるものが付着していることを確認した。

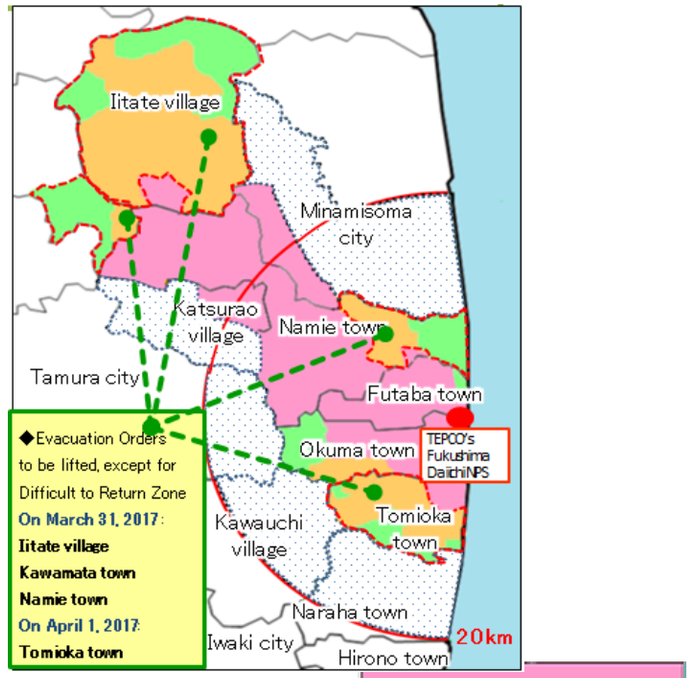


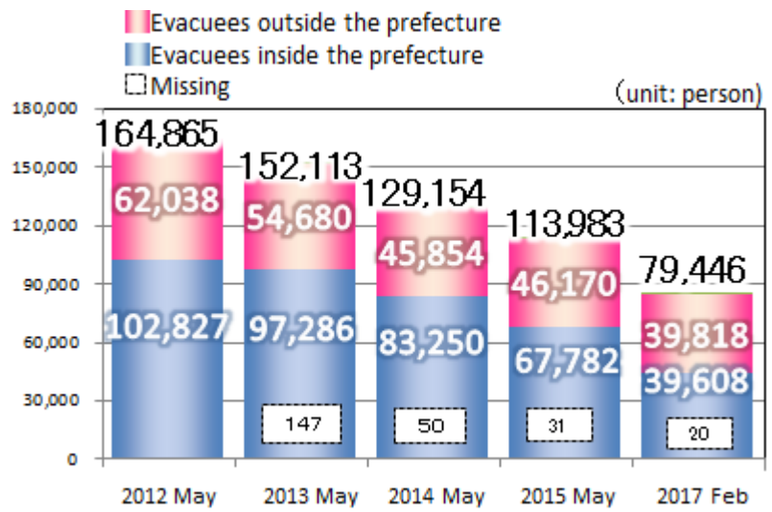


On April 22, 2011



On July 12, 2016





http://www.pref.fukushima.lg.jp/site/portal-english/en03-08.html

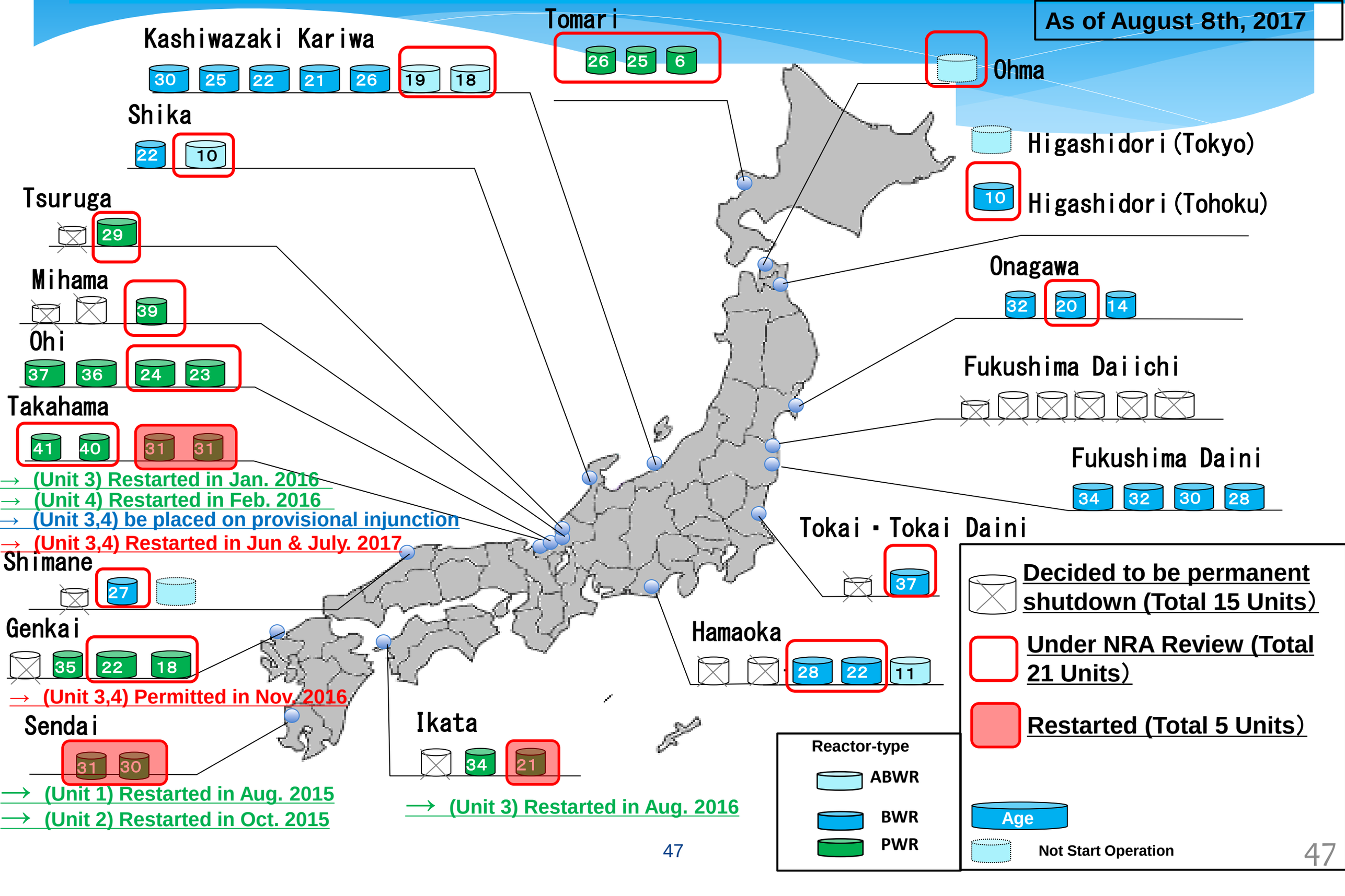
Current Nuclear Energy Policy in Japan

* The Government of Japan stated that nuclear power is an important base-load power source as a low carbon and quasi-domestic energy source, contributing to stability of energy supply-demand structure.

* The Government of Japan will proceed with the restart of NPPs, in case that the NRA confirms the conformity of nuclear power plants with the new regulatory requirements.

Nuclear Power Plants in Japan

As of August 8th, 2017



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Flow of NRA Examination

as of August 1st, 2017

Tokai-2
Higashidori-1
Hamaoka-3
Shika-2
Ohma (UC)
Tomari-1&2
Tsuruga-2
Onagawa-2
Hamaoka-4
Shimane-2
Tomari-3
Kashiwazaki-Kariwa-6&7
Ohi-3&4
Genkai-3&4
Takahama-1&2
Mihama-3
Sendai-2
Ikata-3
Sendai-1
Takahama-4
Takahama-3

2013

New Regulatory Standards came into effect

Applications by operators

Review of Reactor Installation Permit (amendment)

Permission

Review of Construction Plan

Approval

Pre-service inspection

Pass

Review of Operational Safety Programs

Approval

Ope. Safety Inspection
(4times/year)

Fuel loading

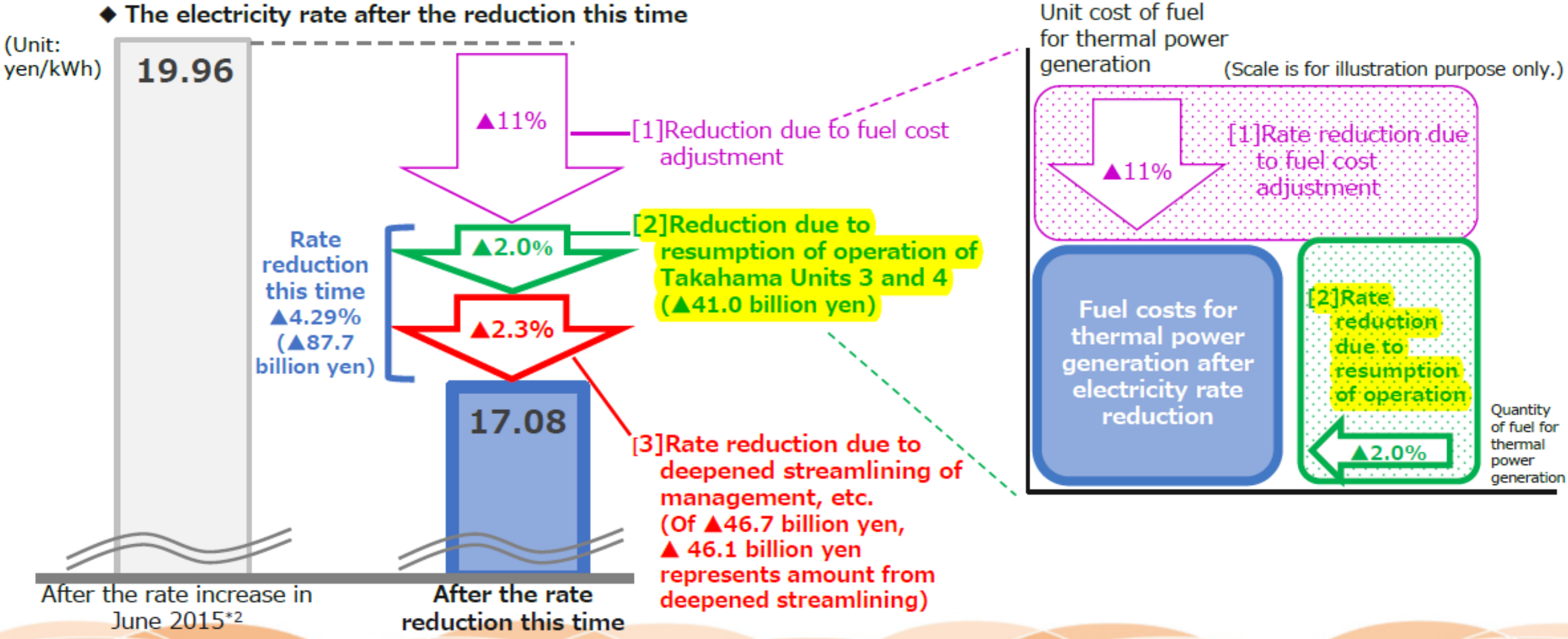
Startup

Commercial operation

Outline of Electricity Rate Reduction This Time [2]

- ✓ For fuel cost adjustment, crude oil price reduction results in the rate reduction.⇒ Refer to [1] below: approximately ▲11%
- ✓ This time, the rate is reduced by ▲4.29% on average.
  - Reflection of saving of fuel costs for thermal power generation due to resumption of operation of Takahama Units 3 and 4*1
    ⇒ Refer to [2] below: approximately ▲2.0%(▲41.0 bllion yen)
  - Further reflection of deepened streamlining of management, etc.
    ⇒ Refer to [3] below: approximately ▲2.3% (▲46.7 billion yen)

◆ **The electricity rate after the reduction this time**



*1 Saving of fuel costs for thermal power generation, etc.: Improvement of nuclear power capacity factor+9.0% × Amount affected by change in nuclear power capacity factor by 1% ▲4.6 billion yen ≈ ▲41.0 billion yen
*2 After the rate increase in June 2015:Level of electricity rate after expiration of period for mitigation (June 1 ～ September 30, 2015)

The Kansai Electric Power Co., Inc.

Restarted NPPs

Sendai-1/2

Takahama-3/4

Ikata-3

Content

1. Nuclear Safety
   - Lessons learned from Fukushima Daiichi NPP accident

2. Emergency Planning
   - Lessons learned from Fukushima Daiichi NPP accident

3. Safeguards and Security and Physical Protection

4. Current Status of NPPs in Japan

5. Summary

Summary

- Various kind of Lessons Learned (LL) have been pointed out on both nuclear safety and emergency preparedness

- Japanese government has changed nuclear regulatory requirements and National Nuclear Disaster Prevention Guide based on LL

- Japan is continuing to contribute non-proliferation and nuclear security especially capacity building in Asian countries

- Fukushima Daiichi has been stabilized and is steadily proceeding towards complete decommissioning.

- Japanese utilities have implemented various countermeasures base on LL and in accordance to new regulatory requirement and try to restart plants