

The Fukushima nuclear accident: Lessons learned and possible implications

**“Power Options for Developing Countries”
Negombo, Sri Lanka, 3-4 September 2011**

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Note: The views expressed here are of my own and do not necessarily reflect those of the JAEC nor the government.

CONTENTS

- What is Atomic Energy Commission?
- What Happened (or is happening)?
- Impact on Public and Environment
- Challenges Ahead
- Lessons Learned (so far) and Possible Implications



SUMMARY

- The 3/11 Fukushima nuclear accident triggered by the East Japan Great Earthquake and Tsunami has become one of the worst nuclear accident (3 core meltdown) not only in Japan but also in the world, and not yet under control.
- Securing safety and welfare of local public and restoring Fukushima is the first priority. It will take more than decades to finish decommissioning and decontamination.
- In the short term, securing safety of existing nuclear plants is top priority. In the longer term, future of nuclear energy should be discussed with all stakeholders, based on the assumption that safety, security and non-proliferation conditions are met.
- It is Japan's responsibility to disclose and share the information as much as possible with the public and the rest of the world. It is also our responsibility to make Fukushima a symbol of "re-creation".



The Atomic Energy Basic Law (1955)

- Article 1 (Purpose of the Act)
 - The purpose of the Act is to *contribute to the improvement of both welfare of human society and the living standard of the people* through research, development and utilization of atomic energy, *while limiting to peaceful purposes and making it a principle to assure their safety*, making transparent the results, and promoting international cooperation, with a view to securing energy resources for the future, promoting science and industries



Administrative Organizations for Nuclear Energy Policy

Cabinet Office



Atomic Energy Commission (AEC)

- **Formulates the Framework of Nuclear Energy Policy**
- **Outlines the government budget for implementing nuclear energy policy**
- **Review the administrative judgments of other governmental agencies under 'the Law for the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors'** etc.

Nuclear Safety Commission (NSC)

- Development of the intellectual infrastructure for ensuring nuclear safety
- Ensuring safety of nuclear facilities
- Nuclear disaster countermeasures
- Promoting dialog on nuclear safety with the general public etc.

Report

Basic policies & Principles

Related Governmental Organizations

Ministry of Foreign Affairs (MOFA)

- Diplomatic policies for peaceful use of Science and Nuclear energy
- Negotiation and cooperation with the foreign government, participation to the international organization for peaceful use of nuclear energy
- Preparation and enforcement for conclusion of nuclear international engagement etc.

Ministry of Education, Sports, Culture, Science and Technology (MEXT)

- Nuclear policies on science and technology
- Nuclear development for the purpose of improving the level of science and technology
- Regulation on use of nuclear reactors for experiment and research, nuclear fuel resource and materials
- Prevention of radioactive hazards etc.

Ministry of Economy, Trade and Industry (METI)

- Agency for Natural Resources and Energy
 - Nuclear policies for energy use
 - Development of nuclear engineering for energy use
- Nuclear and Industrial Safety Agency (NISA)
 - Regulation on project of nuclear refinement, processing, storage, reprocessing and disposal, and on nuclear power generation facilities etc.

Other related ministries

- Ministry of Internal Affairs and Communications
- Ministry of Health, Labor and Welfare
- Ministry of Agriculture, Forestry and Fisheries
- Ministry of Land, Infrastructure and Transport
- Ministry of the Environment etc

Japan Atomic Energy Commission (JAEC)

The Role of Japan Atomic Energy Commission

The Japan Atomic Energy Commission is set up in the Cabinet Office and has five commissioners. Its mission is *to conduct planning, deliberations, and decision-making regarding basic policy for research, development, and utilization of nuclear energy, including the formulation of the Framework for Nuclear Energy Policy except matters related to nuclear safety*. When the JAEC deems it necessary as a part of its assigned mandate, *JAEC can recommend and demand reports of the head of relevant administrative organization through the Prime Minister*.

Members: 5 (appointed by the Prime Minister with the consent of the House of Representatives and House of Councilors)



Chairman
Dr. Shunsuke KONDO



Vice Chairman
Dr. Tatsujiro SUZUKI



Commissioner
Ms. Etsuko AKIBA



Commissioner
Dr. Mie OBA



Commissioner
Mr. Akira OMOTO

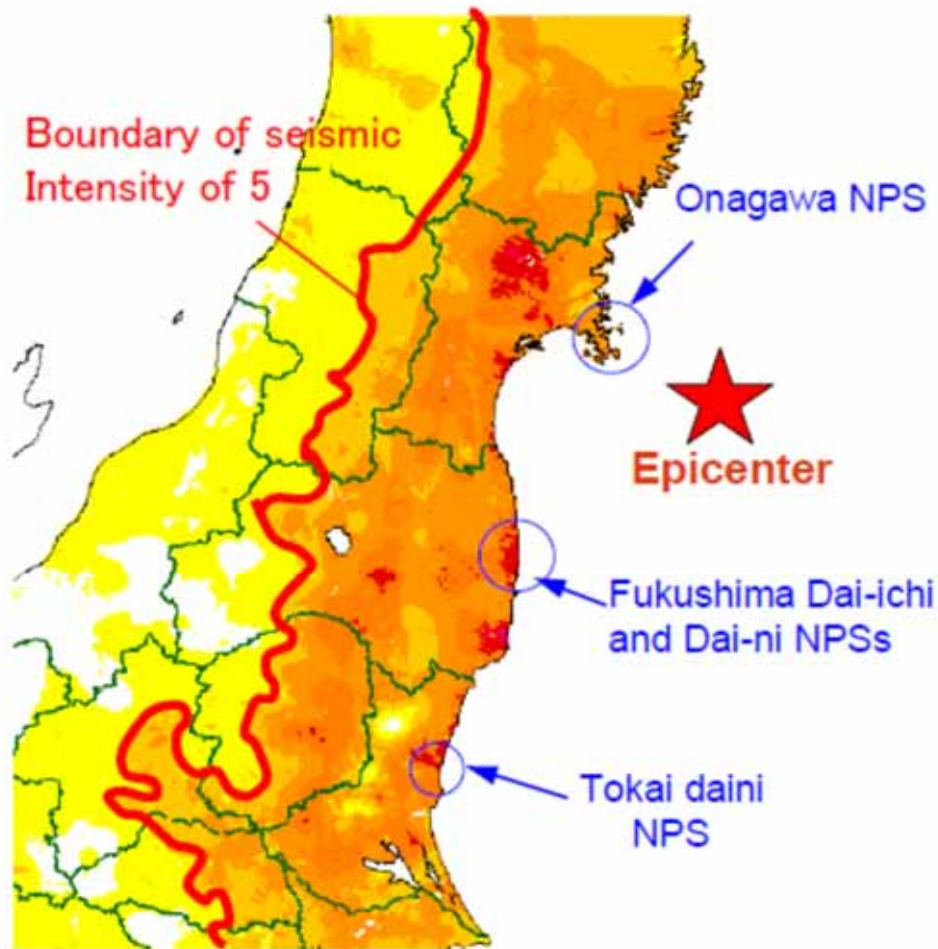
What Happened (or is happening)?



“We are gravely concerned about this accident which can fundamentally undermine public trust in safety measures, not only in Japan but also in other countries” (JAEC, 04/05/11)



Tohoku District - off the Pacific Ocean Earthquake



Seismic Intensity 4 5- 5+ 6- 6+ 7 (JMA 1st Rep.)

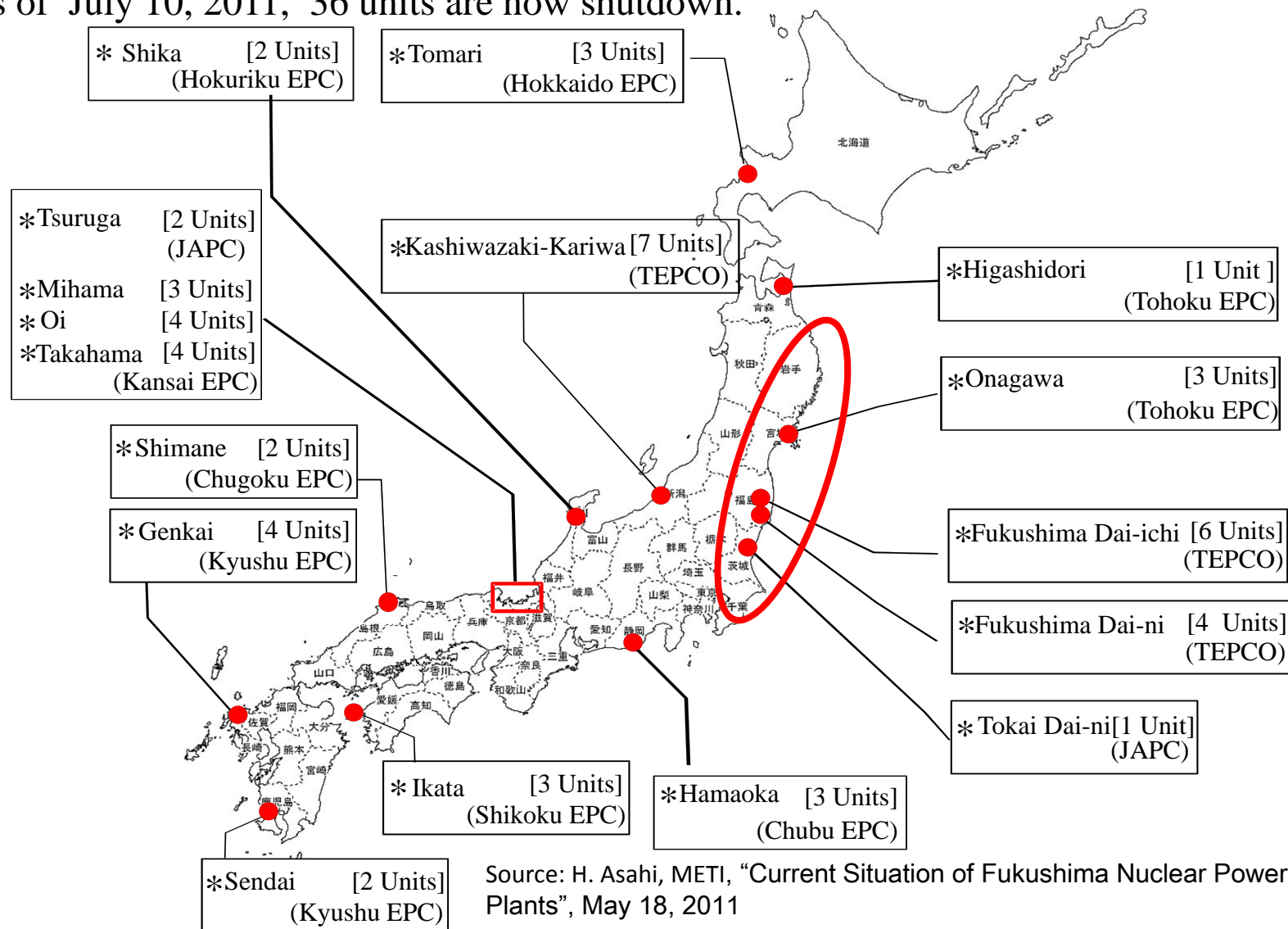
Reference: JMA Release [Online]. <http://www.jma.go.jp/jma/index.html>
Partially modified by JNES.

Map of JMA seismic intensities observed during the main shock.

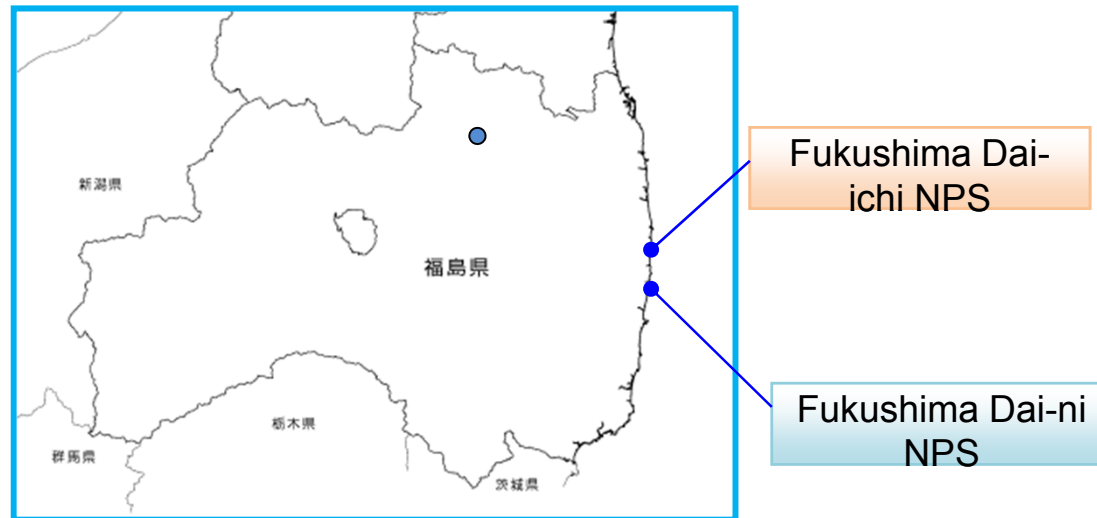
- Occurrence: 14:46 March 11, 2011
- Mw(moment magnitude): 9.0
- Epicenter: approximately 130km off the coast of Sanriku (at 38.10 degrees north latitude, 142.86 degrees east longitude and 23.7km deep)

Location of Nuclear Power Stations in Japan

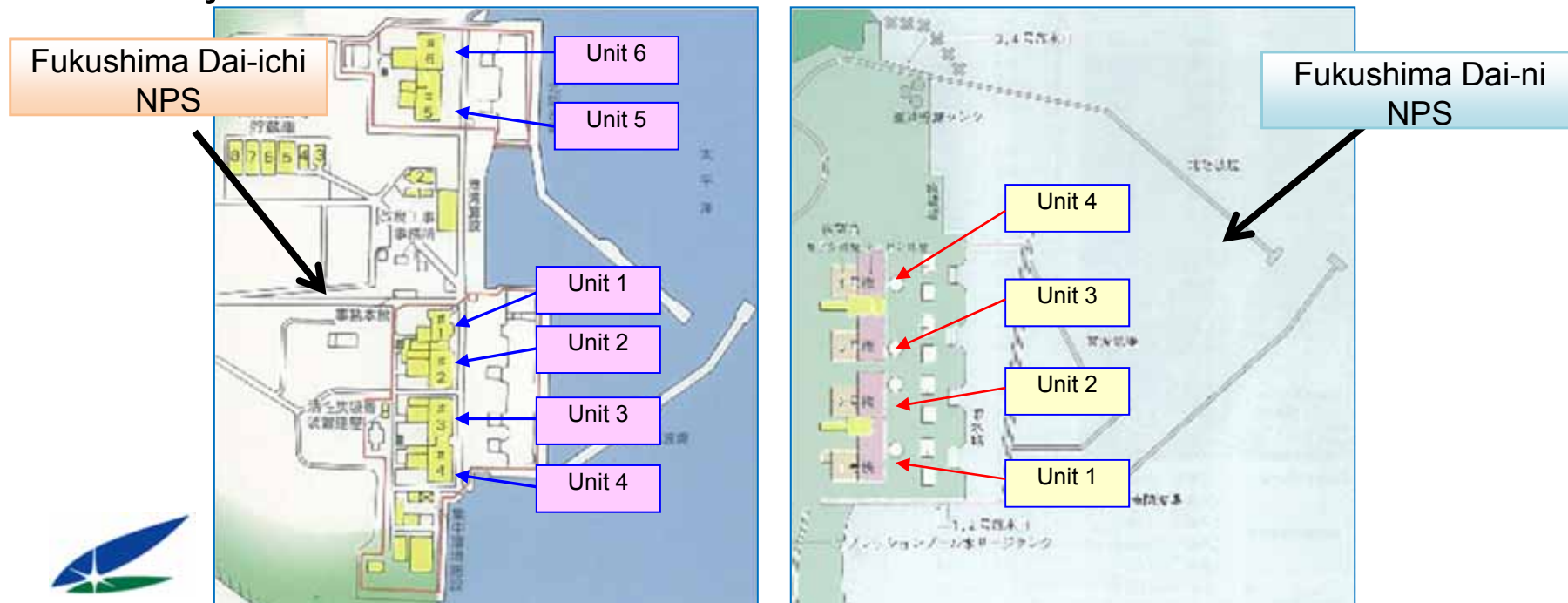
54 units (30 units of BWR and 24 units of PWR, total 49GW) in 17 sites
As of July 10, 2011, 36 units are now shutdown.



Location of NPSs within Fukushima



LAYOUTS OF Fukushima Dai-ichi NPS AND Fukushima Dai-ni NPS



Summary of Fukushima Daiichi Nuclear Power Plants

Generation Facilities of Fukushima Dai-ichi NPS

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Electric Output (MWe)	460	784	784	784	784	1100
Commercial Operation	1971/3	1974/7	1976/3	1978/10	1978/4	1979/10
Reactor Model	BWR3	BWR4			BWR5	
PCV Model	Mark-1					Mark-2
Number of Fuel Assembly in the Core	400	548	548	548	548	764

Generation Facilities of Fukushima Dai-ni NPS

	Unit 1	Unit 2	Unit 3	Unit 4
Electric Output (MWe)	1100	1100	1100	1100
Commercial Operation	1982/4	1984/2	1985/6	1987/8
Reactor Model	BWR5			
PCV Model	Mark-2	Mark-2 Advance		
Number of Fuel Assembly in the Core	764	764	764	764

Loss of all power sources due to the Earthquake and Tsunami



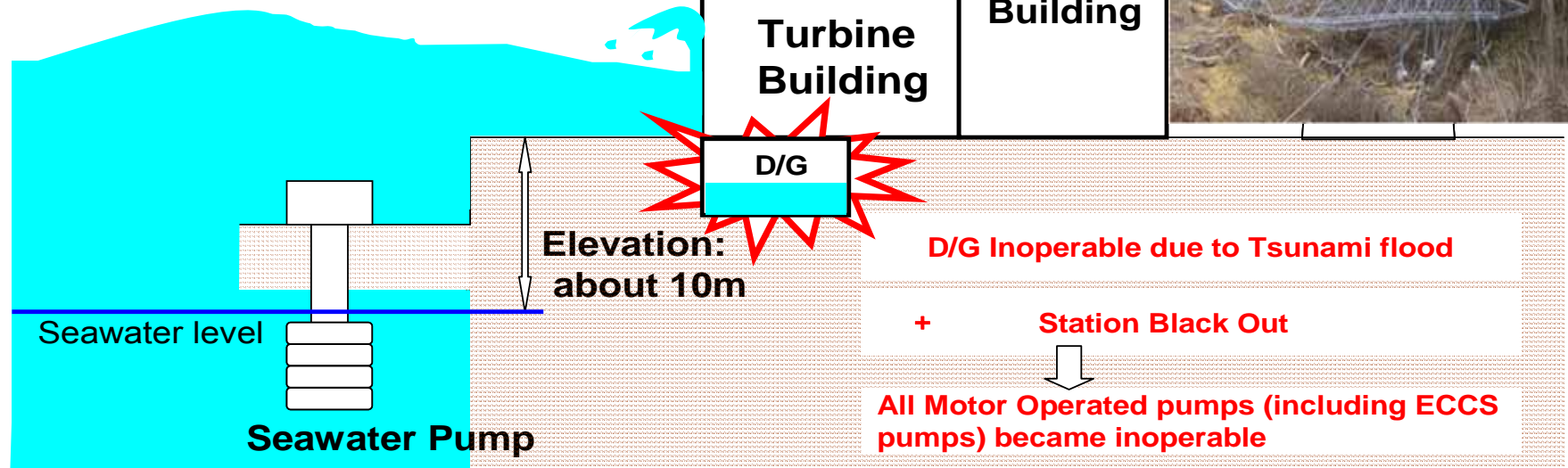
Note:

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

Loss of offsite power due to the earthquake

Grid Line

Tsunami (estimated more than 10m)



Source: Nuclear and Industry Safety Agency(NISA), April 4, 2011, at IAEA

<http://www.nisa.meti.go.jp/english/files/en20110406-1-1.pdf>



Earthquake

Design basis earthquake and observed acceleration (Basement of Reactor/B)

Nr.	MWe	3.11 Observed (max. gal)			Design (Ss) (max. gal)		
		N-S	E-W	Vertical	N-S	E-W	Vertical
1Fuku1	460	460	447	258	487	489	412
1Fuku2	784	348	550	302	441	438	420
1Fuku3	784	322	507	231	449	441	429
1Fuku4	784	281	319	200	447	445	422
1Fuku5	784	311	548	256	452	452	427
1Fuku6	1100	298	444	244	445	448	415

Note 1: **Damage by the earthquake:** Not fully inspected but maybe not significant considering the KK earthquake (2007) where no damage to safety functions even though the observed acceleration exceeded design basis by factor 2-3
(Acceleration will not necessarily be damages indicators)

Note 2: **Scram set points** by acceleration (Basement of Reactor Building)
Horizontal=135-150 gal, Vertical=100 gal

Note 3: Design means new design basis (2009)



Source: A. Omoto, "Fukushima Accident: Overview," ICAPP 2011, May 3, 2011
https://www.sfen.fr/content/download/30655/1616957/file/1-ICAPP_Omoto2.pdf

Fukushima Dai-ichi NPS

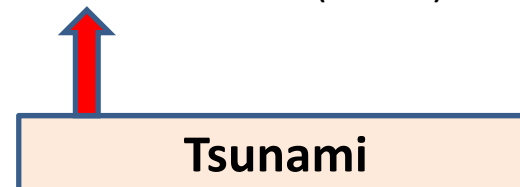
(AC Power supply)

[External power supply] ➡ [Emergency diesel generators]

X	Yonomori -line No.1
X	Yonomori- line No.2
X	Okuma- line No.1
X	Okuma-line No.2
X	Okuma-line No.4
X	TEPCO nuclear line



X	<input type="checkbox"/>	(Unit 1)
X	<input type="checkbox"/>	(Unit 1)
X	<input type="checkbox"/>	(Unit 2)
X	<input type="checkbox"/>	(Unit 2)
X	<input type="checkbox"/>	(Unit 3)
X	<input type="checkbox"/>	(Unit 3)
X	<input type="checkbox"/>	(Unit 4)
X	<input type="checkbox"/>	(Unit 5)
X	<input type="checkbox"/>	(Unit 5)
X	<input type="checkbox"/>	(Unit 6)
X	<input type="checkbox"/>	(Unit 6)
O	<input type="checkbox"/>	(Unit 6)



Fukushima Dai-ichi NPS Unit 1

(Status of the reactor core)

- 14:46 March 11: Loss of external power supply, Start-up of emergency diesel generators
 - 14:52 March 11: Start-up of isolation condenser
 - 15:37 March 11: Loss of all AC power
 - 05:46 March 12: Start of fresh water injection from a fire extinguishing line
- Water injection seemed to have stopped for 14 hours and 9 minutes.
- around 17:00 March 11: The fuel was exposed, and the core melt started afterwards.



Fukushima Dai-ichi NPS Unit 2

(Status of the reactor core)

- 14:47 March 11: Lose of external power supply, Start-up of emergency diesel generators
- 14:50 March 11: Start-up of RCIC (reactor core isolation cooling system)
- 15:41 March 11: Lose of all AC power

- 13:25 March 14: Stop of RCIC

- 19:54 March 14: Start of seawater injection from a fire extinguishing line

Water injection seemed to have stopped for 6 hours and 29 minutes.

- around 18:00 March 14 : The fuel was exposed, and the core melt started afterwards.



Fukushima Dai-ichi NPS Unit 3

(Status of the reactor core)

- 14:47 March 11: Loss of external power supply, Start-up of emergency diesel generators
 - 15:05 March 11: Start-up of RCIC
 - 15:41 March 11: Lose of all AC power
 - 11:36 March 12: Stop of RCIC
 - 12:35 March 12: Start-up of HPCI (high pressure core injection system)
 - 02:42 March 13: Stop of HPCI
 - 09:25 March 13: Start of fresh water injection from a fire extinguishing line
- Water injection seemed to have stopped for 6 hours and 43 minutes.
- around 08:00 march 13: The fuel was exposed, and the core melt started afterwards.



Hydrogen explosion and the sound of an impact

- Unit 1 15:36 March 12: Hydrogen explosion in the reactor building
- Unit 3 11:01 March 14: Hydrogen explosion in the reactor building
- Unit 2 around 06:00 March 15: Noise of explosion around the suppression chamber of the PCV (There is a possibility that hydrogen explosion occurred in the torus room of the PCV.)
- Unit 4 around 06:00 March 15: Explosion in the reactor building
(An inflow of hydrogen from Unit 3 may be possible, as the exhaust pipe for venting the PCV joins the exhaust pipe from unit 4 before the exhaust.)



Explosion at Unit 4 and spent fuel pool

Standby Gas Treatment System exhaust pipe

Fig. IV-5-11 Standby Gas Treatment System exhaust pipe



Due to the analysis result of nuclides in the water extracted from the spent fuel pool using a concrete pump truck, it is assumed that no extensive damage in the fuel rods occurred.

Condition of the spent fuel pool (Unit 4)



Fig. IV-5-12 Condition of the spent fuel pool (Unit 4)

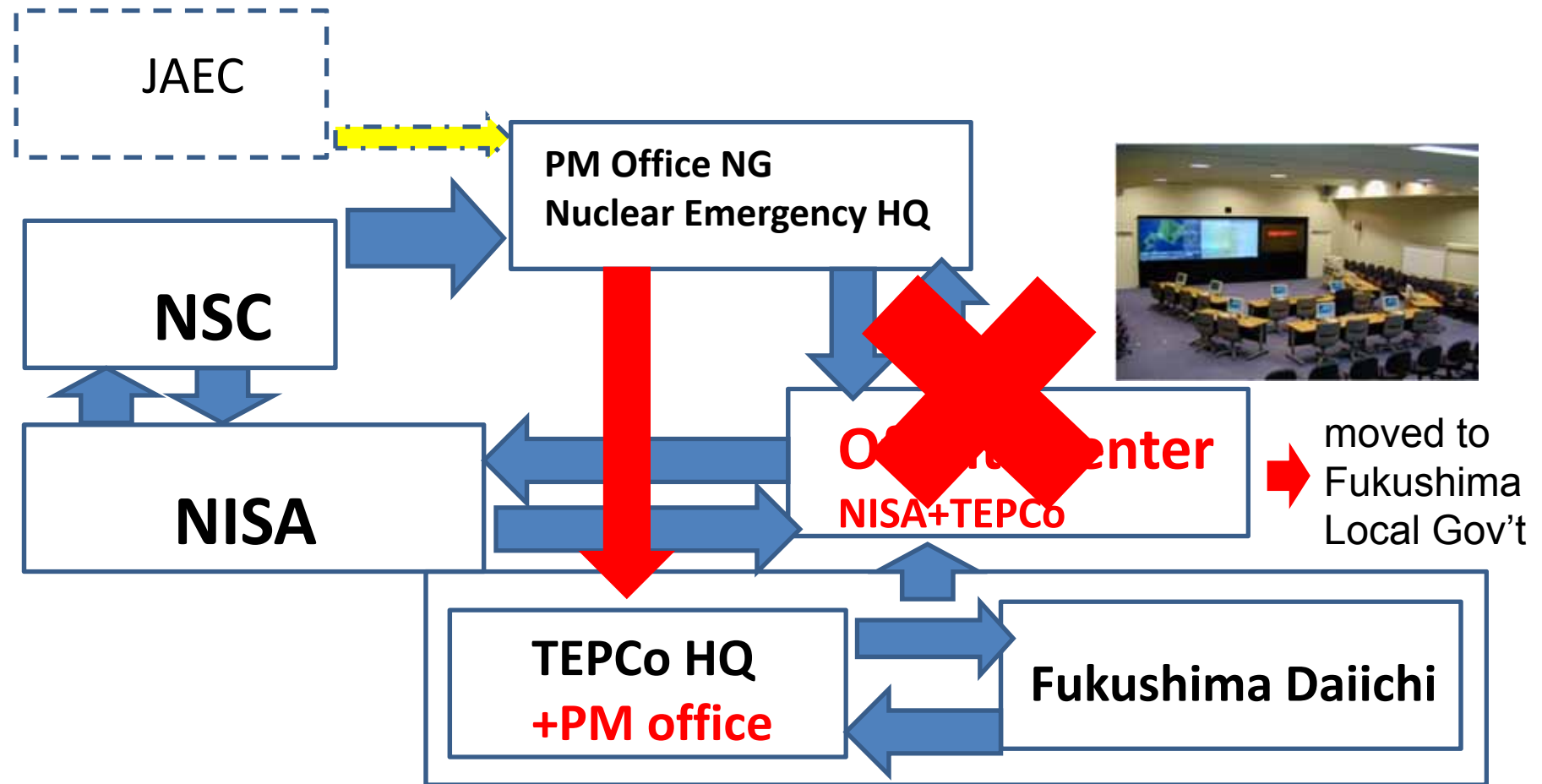
(Source: TEPCO)

Radiation Exposure to the Workers on site

- As of May 23, total of 7,800 technicians and engineers worked on site (collectively). No radiation-induced illness has not been reported.
- According to the gov't report, average exposure level is 7.7 mSv.
- It is reported that 115 workers were exposed to higher than 100 mSv. 9 workers received more than 250 mSv (as of June 21, 2011.)
 - But, due to lack of availability of WBC (only 4 units), not all workers were tested for internal dose. Besides, TEPCo cannot identify and track the records of 198 workers out of 3726 workers who worked on site during March. (Nikkei, July 21, 2011)



Nuclear Emergency: Institutional Arrangement under the Law*



*Act on Special Measures Concerning Nuclear Emergency Preparedness (ASMCNE)



Safety Regulation on Sever Accident

- The Regulatory Guide for Reviewing Safety Design *does not take total AC power loss as a design basis event.*
 - *No particular considerations are necessary against a long-term total AC power loss*
 - the assumption of a total AC power loss is not necessary if the emergency AC power system is reliable enough
 - Loss of all seawater cooling system functions is not taken as a design basis event.
- Flammability Control System (FCS) is not aimed at preventing hydrogen combustion *inside the reactor building*
- In Japan, a civil standard on seismic PSA is also established, *while study of PSA related to other external events such as flooding has only started.*
- (Based on NSC decision in 1992).. licensees have taken *voluntary actions (not included in regulatory requirements)*, such as measures to prevent accidents from becoming severe accidents



Despite repeated warnings from scientists on earthquake and tsunami...

- “For nuclear power plants, *disaster caused by earthquake can be especially dangerous because it could cause multiple failures at the same time* unlike normal accident”
 - Prof. Katsuhiko Ishibashi, from “Nuclear power disaster with large earthquake”, *Kagaku (Science)*, Oct., 1997
- “I cannot accept this report *because it does not mention ‘Jogan-earthquake-tsunami’ at all which hit Tohoku area in 869 with huge impacts*” - Dr. Yukinobu Okamura, at NISA expert meeting in June 2009.

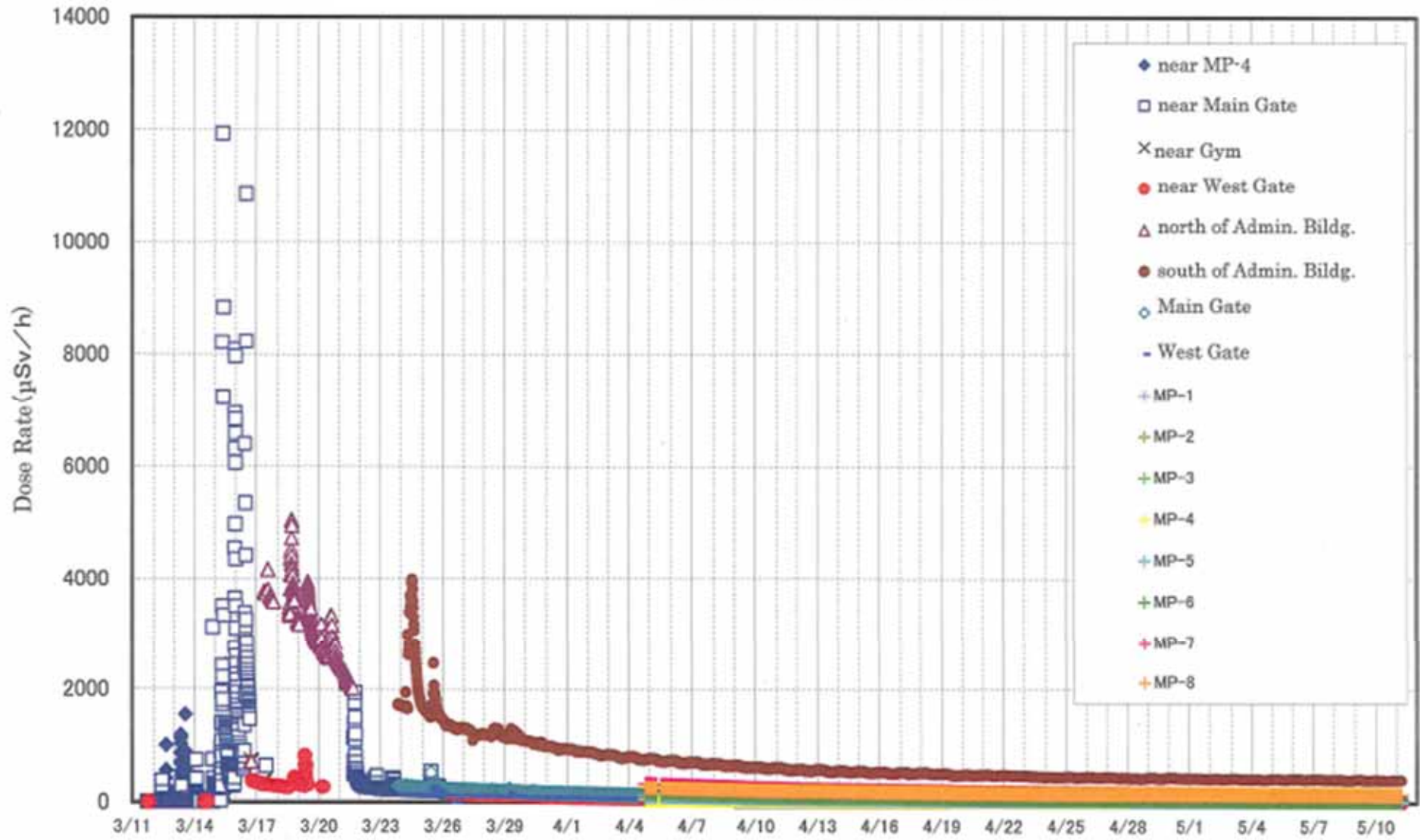


Impact on Public and Environment

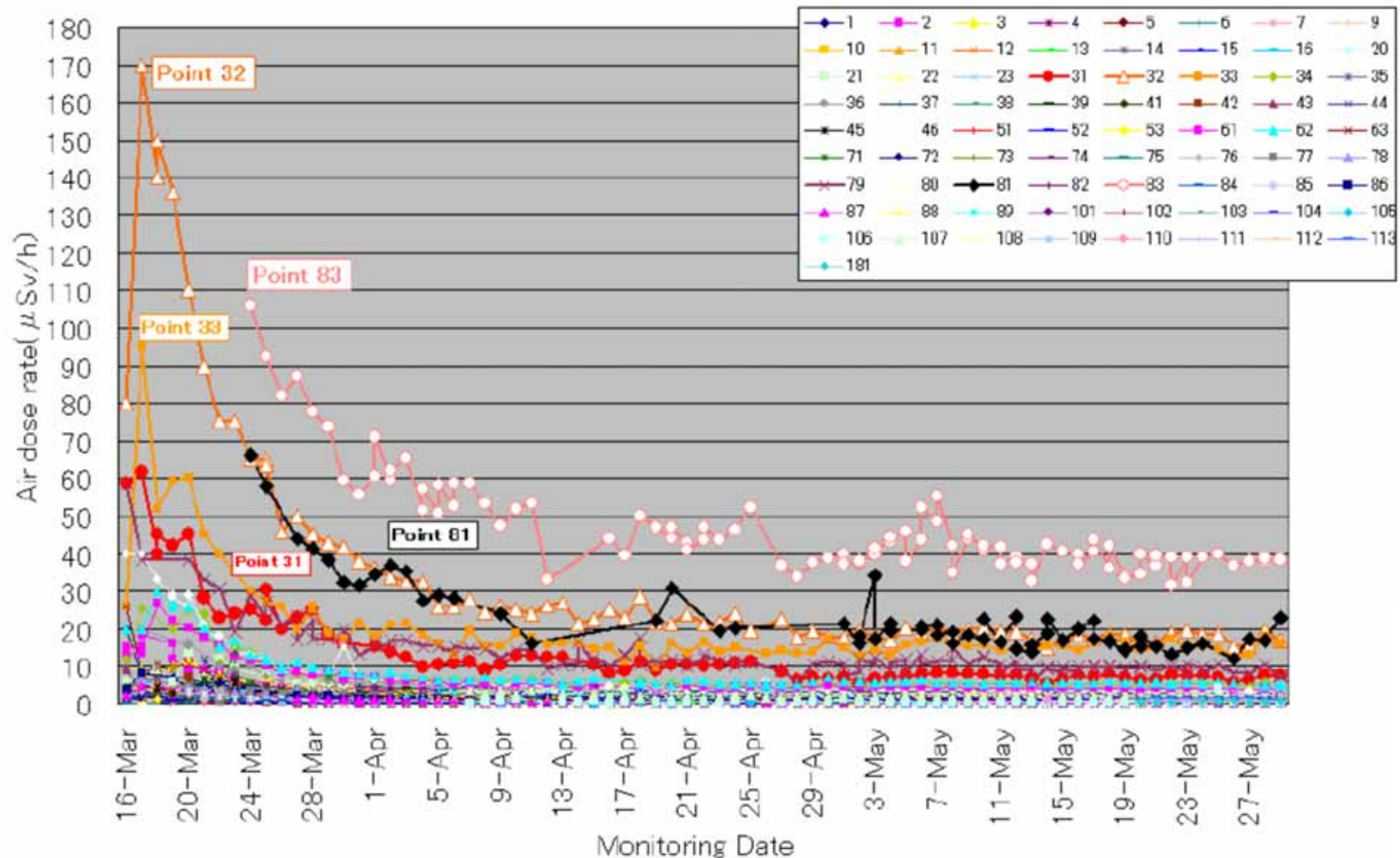
“..the monitoring of environmental radiation doses should be continued and dose assessments should be implemented for residents. *The government should **develop an organizational framework to promptly and effectively carry out such emergency measures...it should develop the legal framework required for each measure, and immediately start on such steps** as implementing demonstration tests on effective technology.*” – JAEC (05/10/11)



Trend of on-site Radiation Level

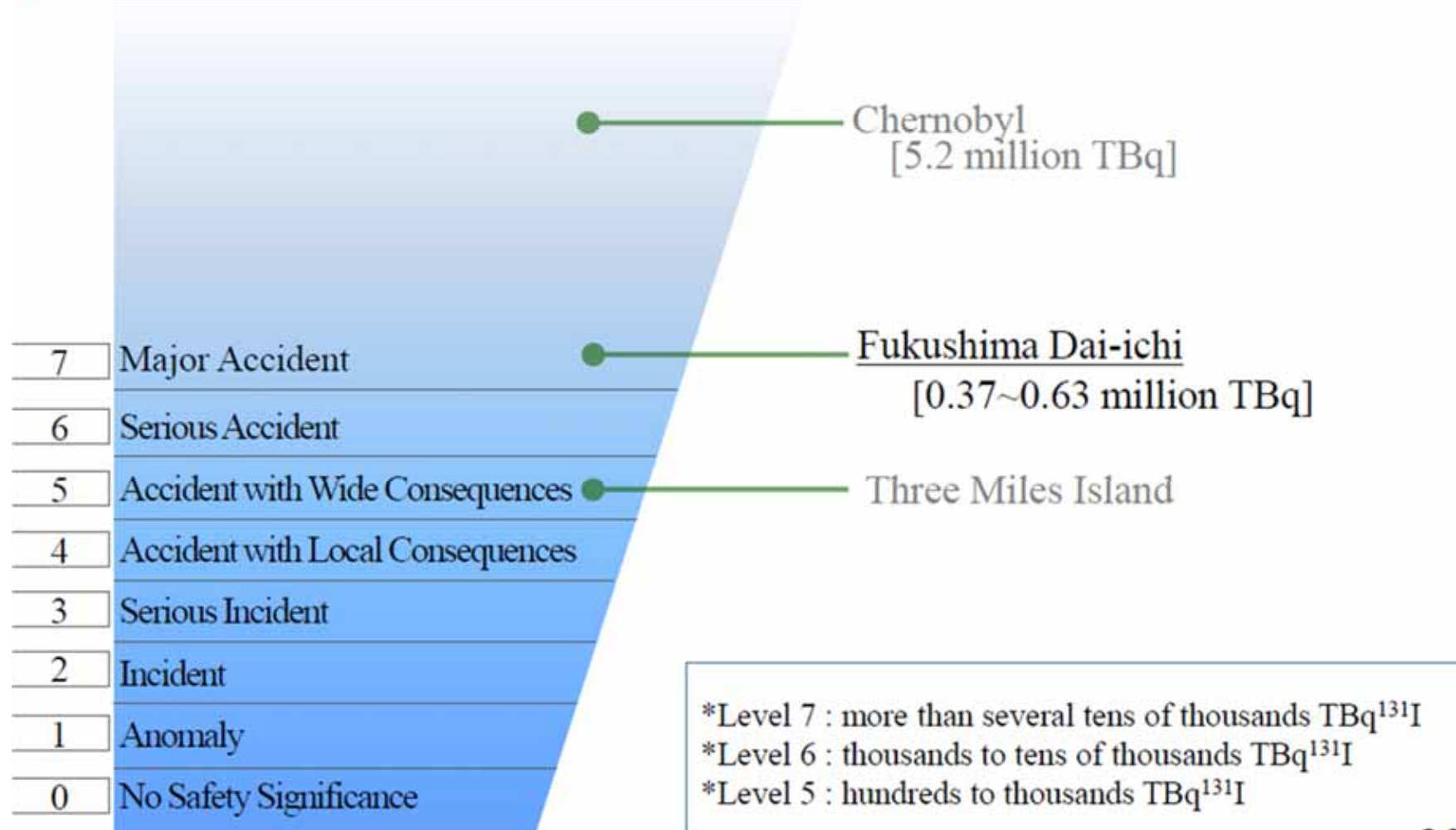


Time dependence of air dose rate at reading point out of 20km zone of Fukushima Dai-ichi NPS

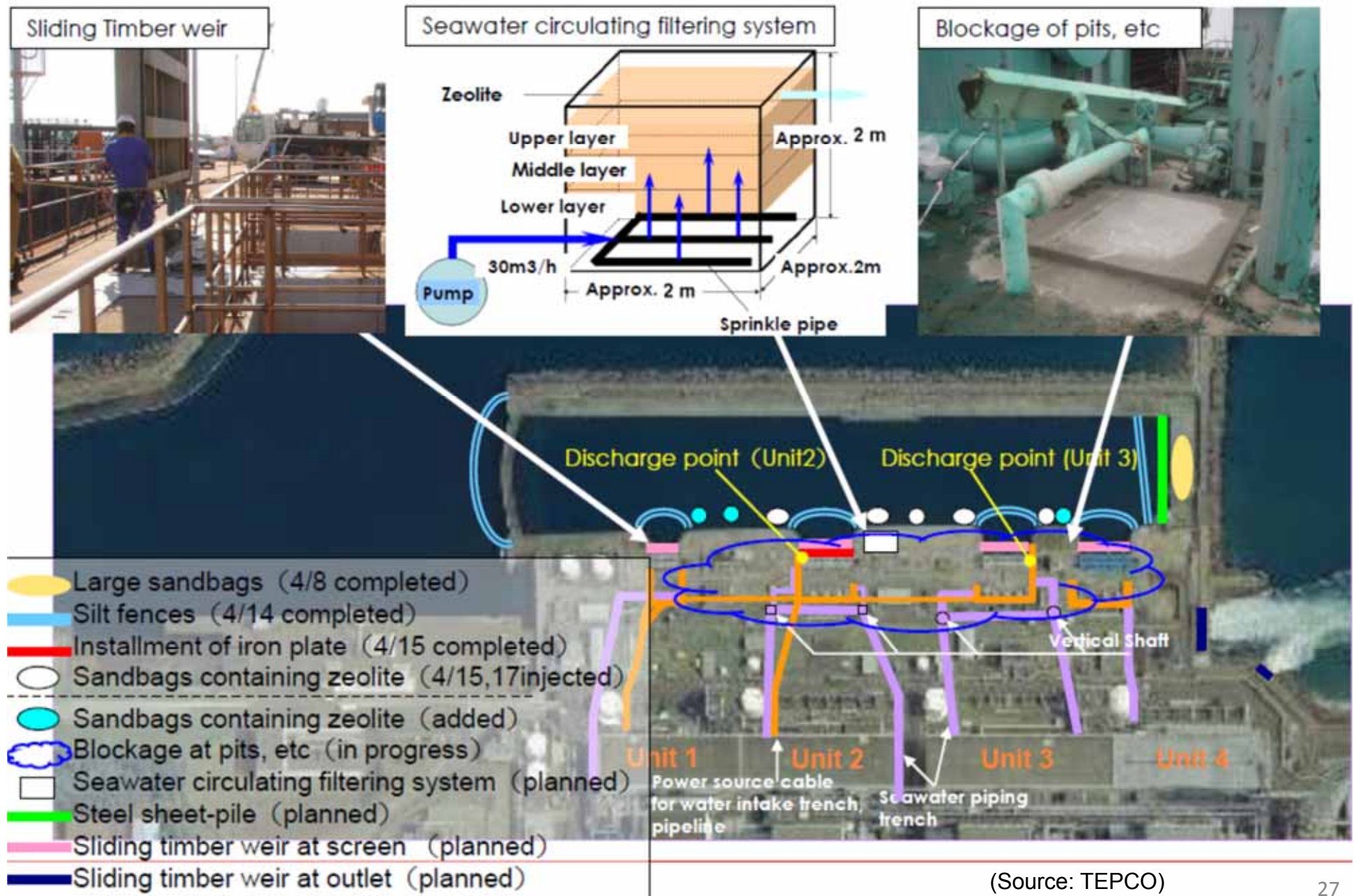


INES Rating on the Events in Fukushima Dai-ichi NPS

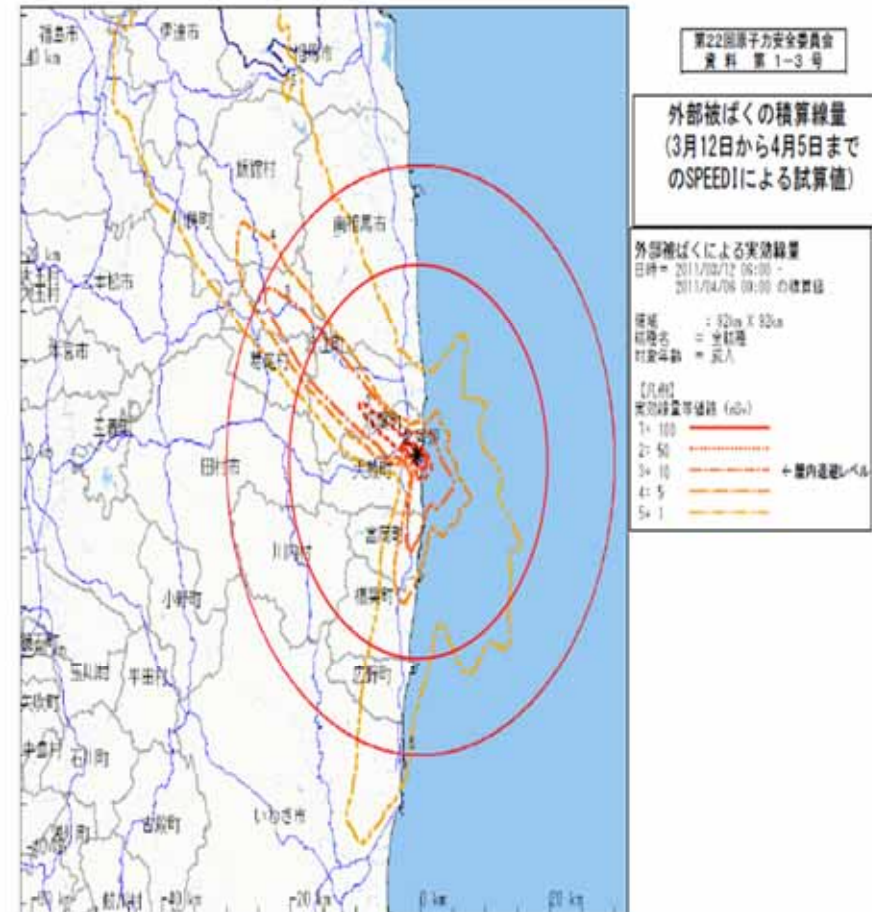
The Rating of the International Nuclear and Radiological Event Scale (INES) on Fukushima Dai-ichi Nuclear Power Station (NPS), in temporary assessed as Level 7.



Countermeasures for preventing diffusion of liquid containing radioactive materials



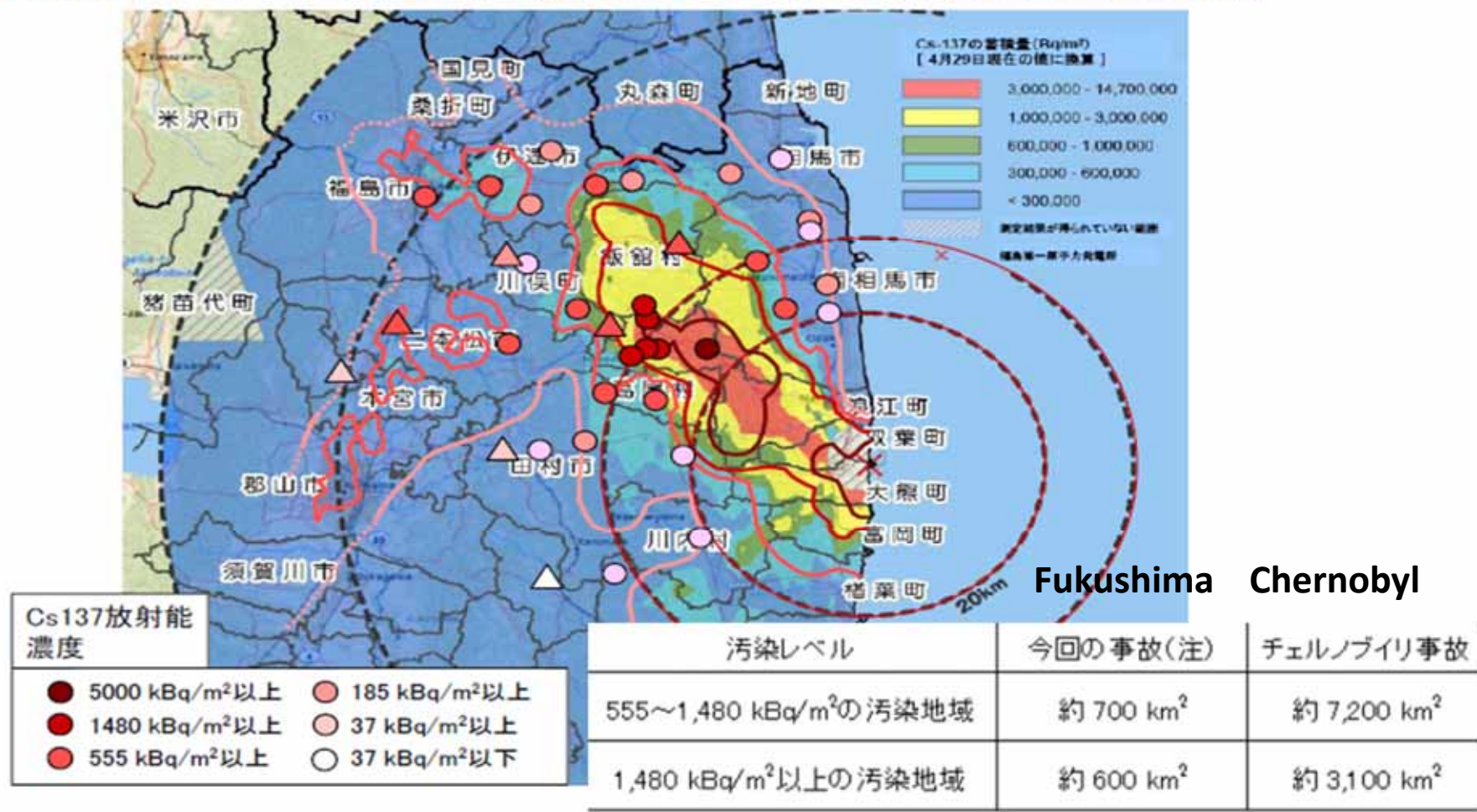
Estimated Exposure by SPEEDI (2011/03/23, 04/05)



Source: Nuclear Safety Commission, 2011/03/23, http://www.nsc.go.jp/info/110323_top_siryo.pdf
2011/04/10: <http://www.nsc.go.jp/anzen/shidai/genan2011/genan022/siryo1-3.pdf>

Contamination Map by MEXT and DOE (as of May 6, 2011)

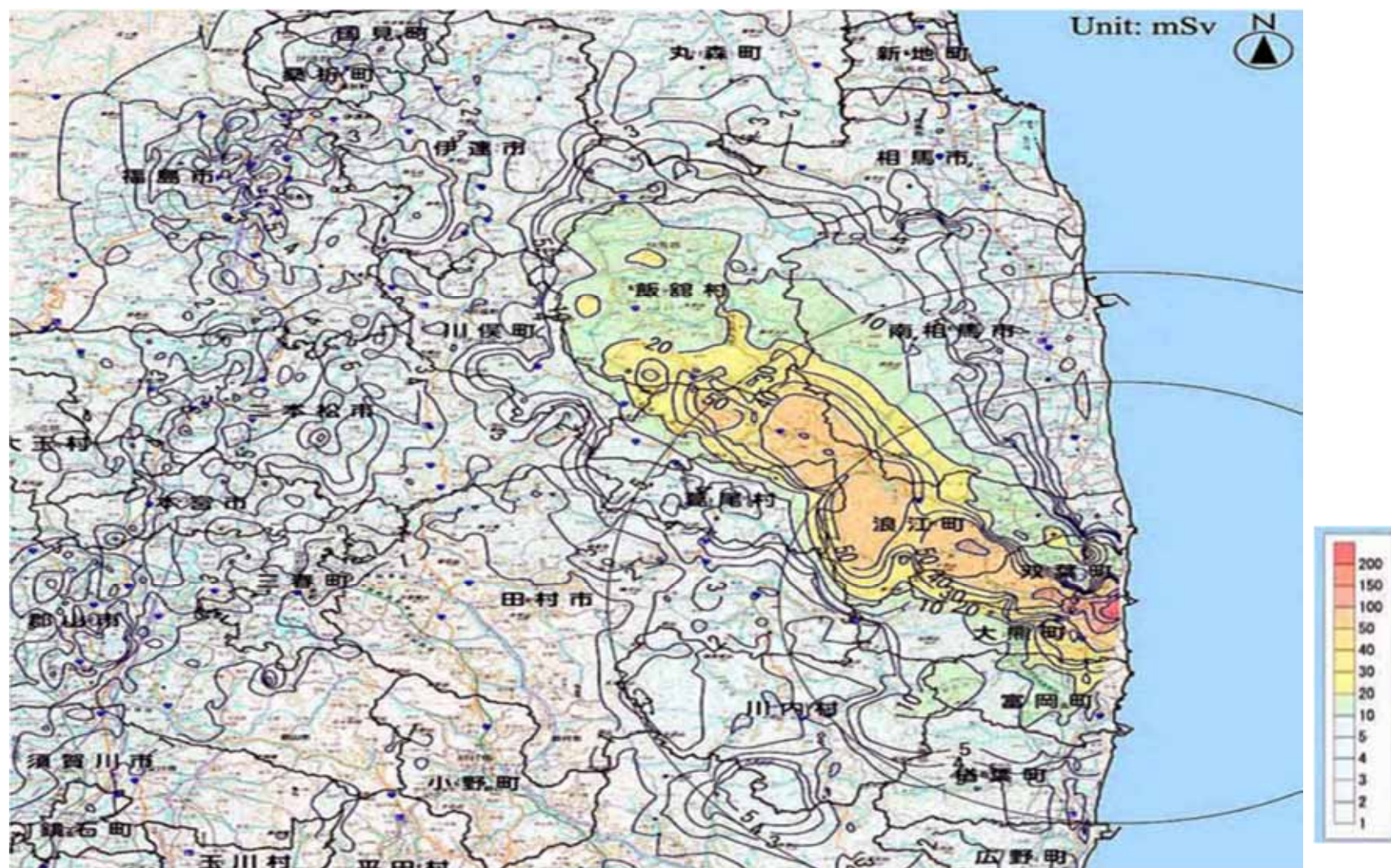
5月6日公表文科省・米国DOE航空機モニタリング結果との重ね合わせ



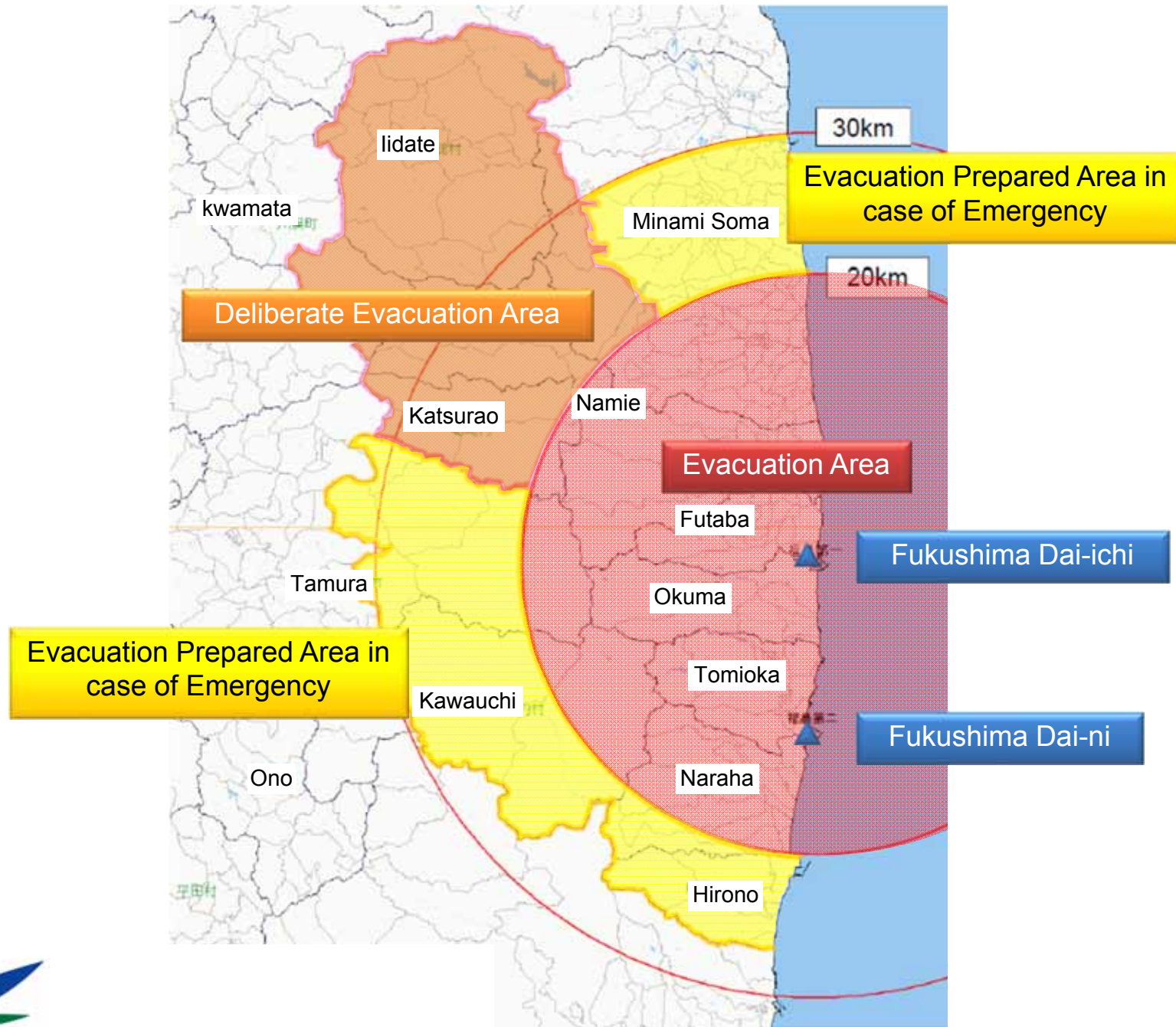
Source: T. Kawada, "Current Status of Soil Contamination and how to respond,"
Presentation at Japan Atomic Energy Commission Meeting, May 24, 2011
<http://www.aec.go.jp/jicst/NC/iinkai/teirei/siryo2011/siryo16/siryo2.pdf>



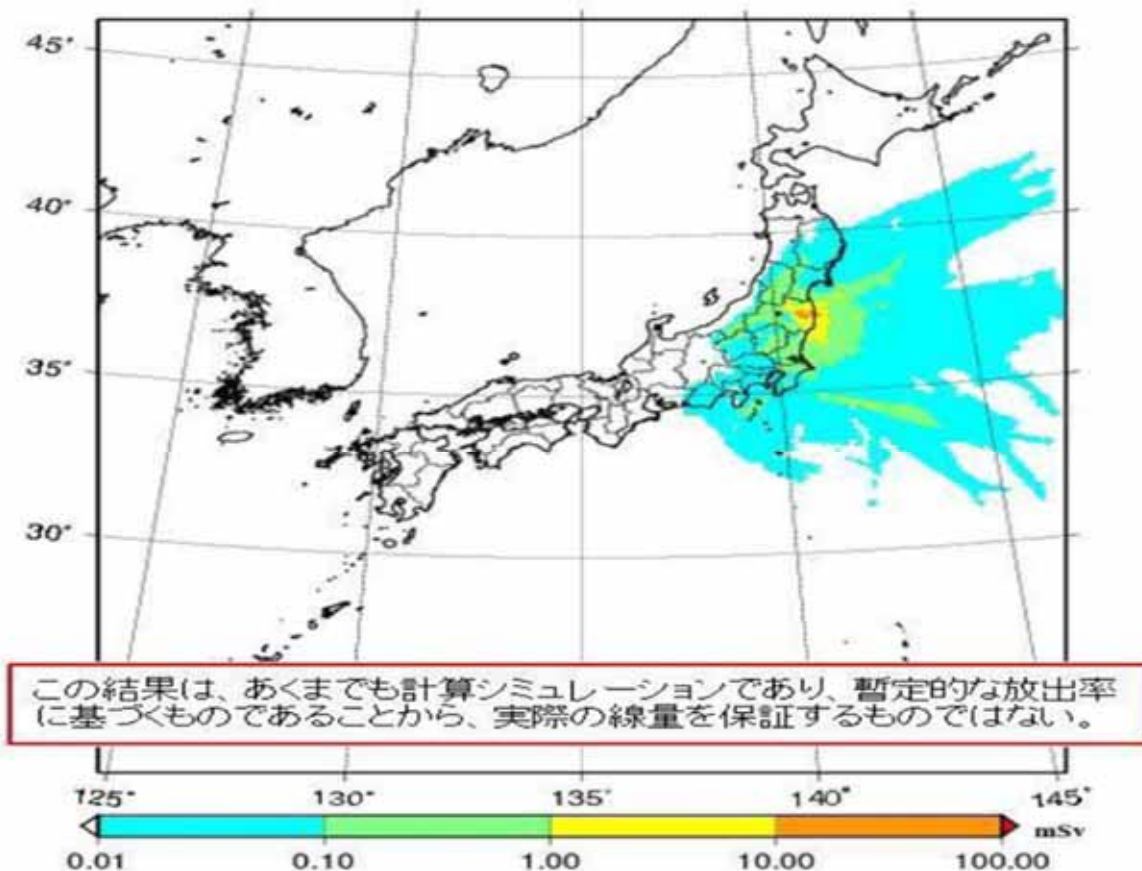
Cumulative exposure map (2011/08/19)



Evacuation Areas



Estimated cumulative exposure level by simulation (06/28/11)



Source: M. Chino, presented at JAEC, June 28, 2011.

<http://www.aec.go.jp/jicst/NC/iinkai/teirei/siryo2011/siryo23/siryo1-2.pdf>



Residents

Situation

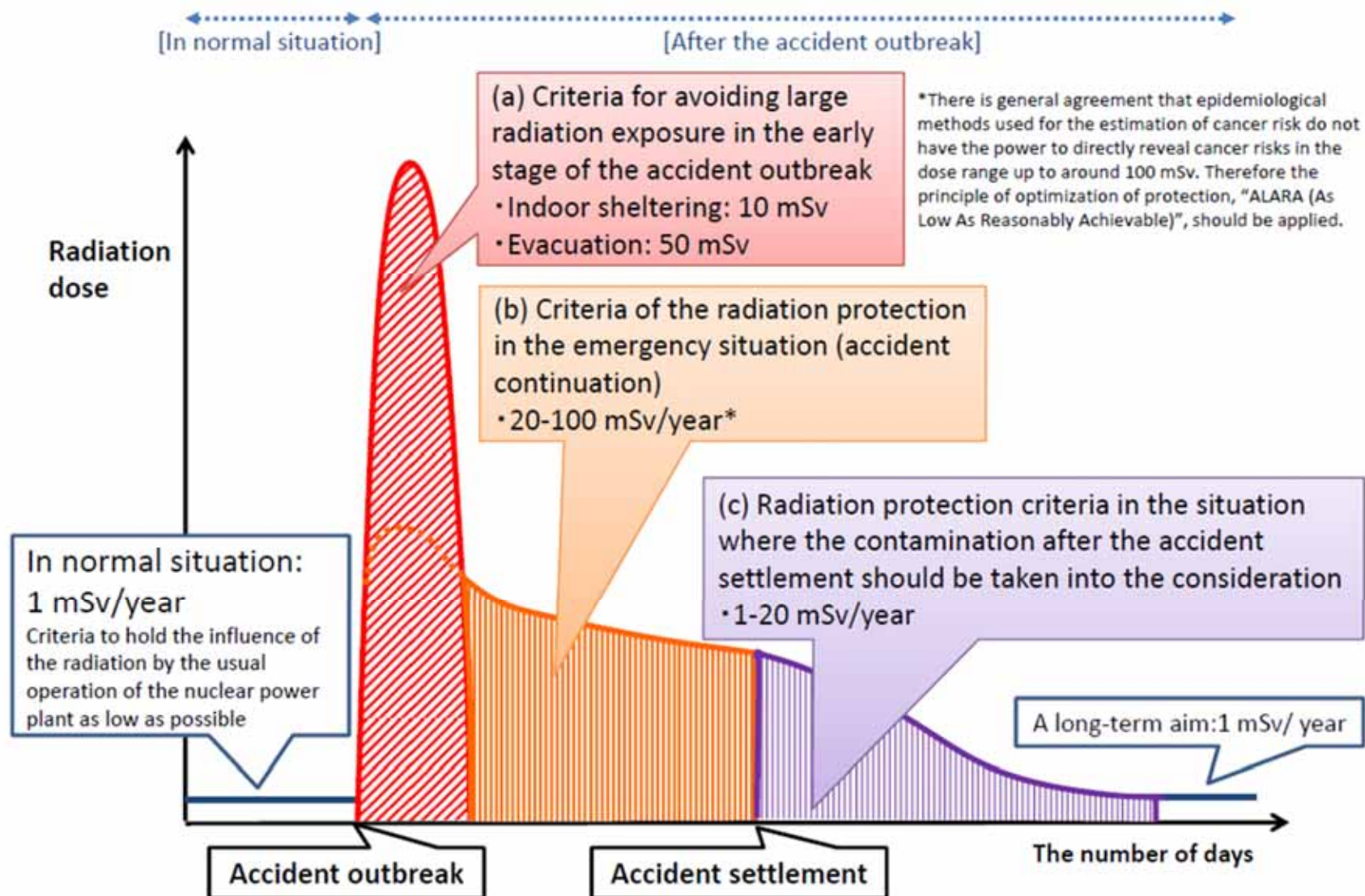
Actions	Results
Screening Survey	Most of the 195,354 people checked as of May31 were under the 100,000cpm limit.
Survey for thyroid exposure	Among the 1,080 children from 0 to 15 years old surveyed, there were no children who exceeded the screening criteria of 0.2 μ Sv/h

Future

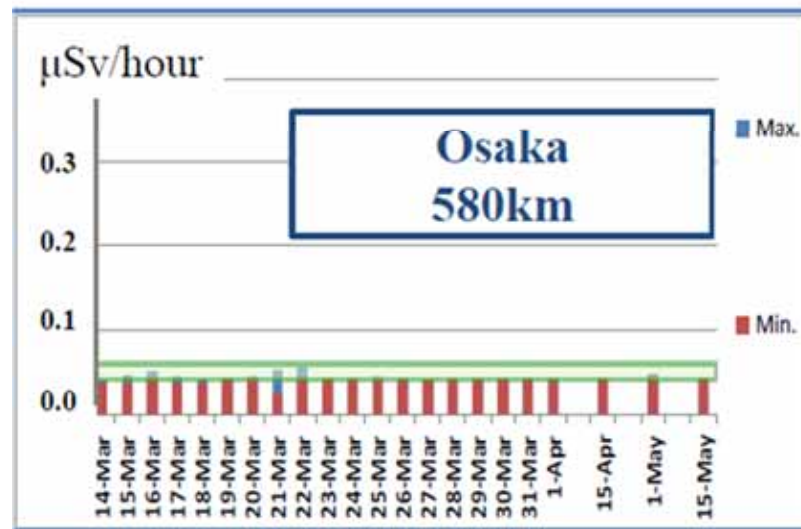
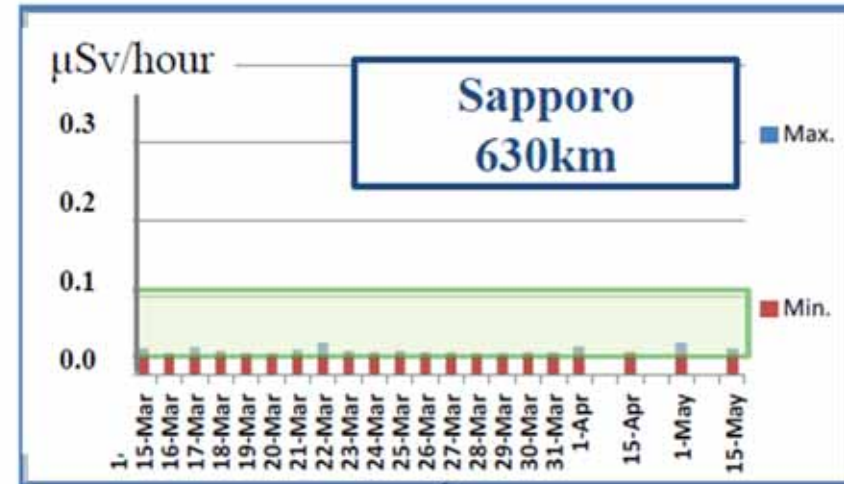
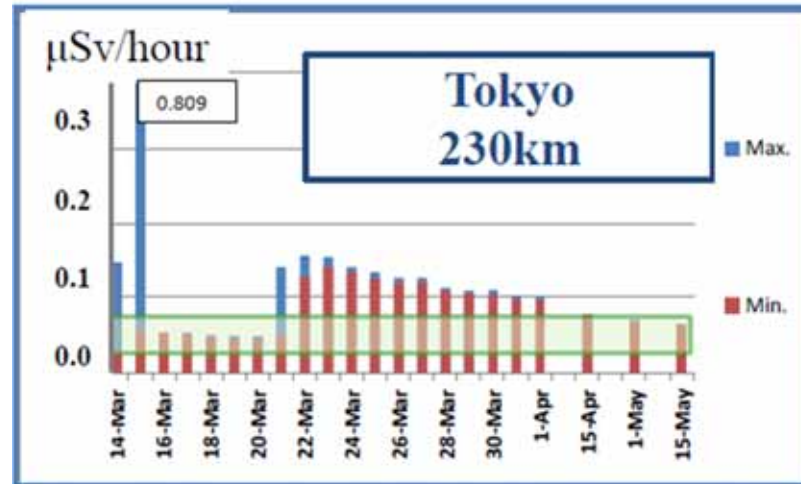
- Fukushima Prefecture will estimate and evaluate the radiation dose for 2 million residents in cooperation with related government offices and the National Institute of Radiological Sciences (NIRS).



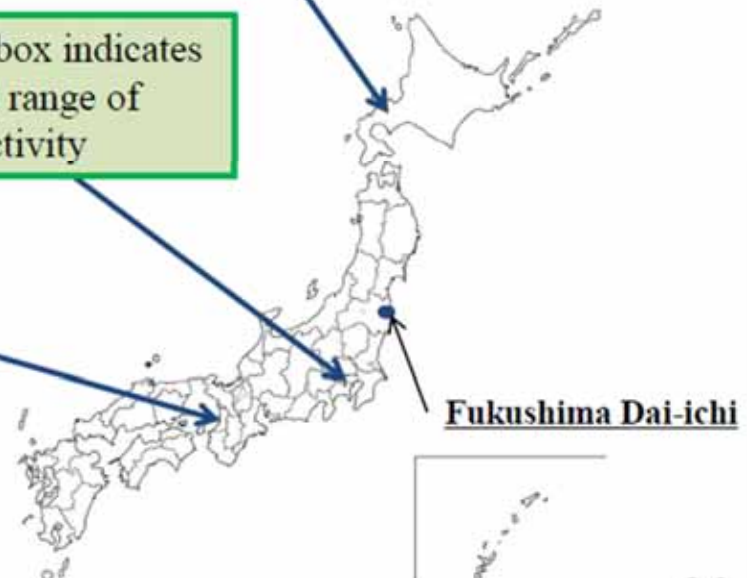
The idea of the criteria of the radiation dose for the radiation protection



Atmospheric Readings in Tokyo, Osaka and Sapporo



Green box indicates normal range of radioactivity



Safety of Food

Japan inspects radioactivity in food every day, and restricts distribution of food that fails to meet provisional regulation values taking into consideration the spread of contamination.



Instructions (as of 23 June 2011)

... Not to Distribute

* Fukushima Prefecture

- Raw milk
- Non-head type leafy vegetables (e.g. spinach)
- Head type leafy vegetables (e.g. cabbage)
- Flowerhead brassicas (e.g. broccoli, cauliflower)
- Turnip
- Log grown shiitake (grown outdoor)
- Bamboo shoot
- Ostrich fern
- Ume
- Juvenile (baby) fish of Japanese sand lance
- Cherry salmon (excluding farmed fish)
- Japanese dace

* Ibaraki, Tochigi, Chiba and Kanagawa Prefecture

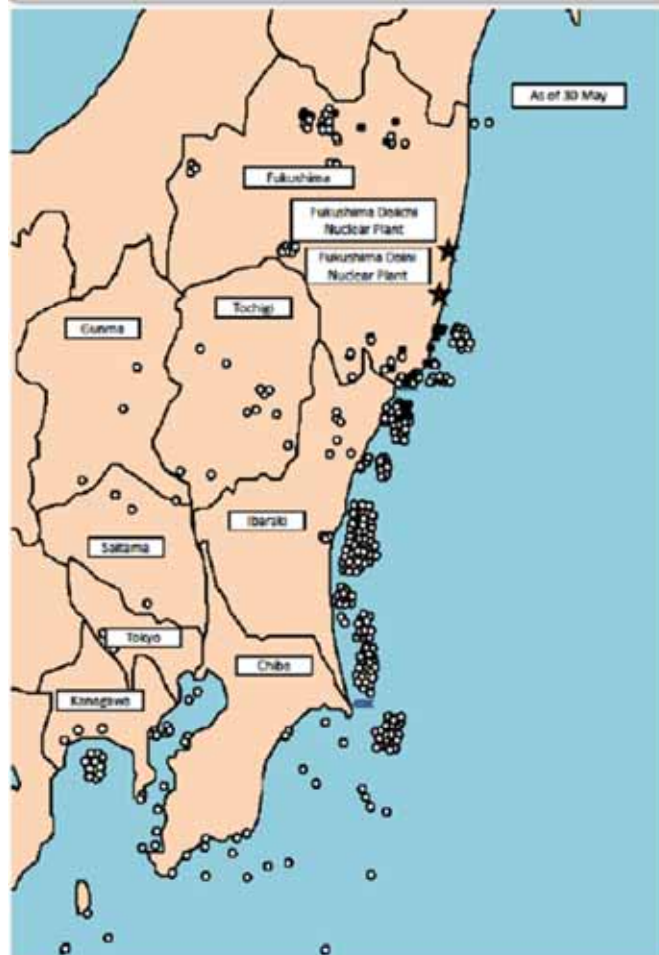
- Tea leaf

Please refer to the following URL for the details of Instructions.
<http://www.mhlw.go.jp/english/topics/2011eq/index.html>

21



Safety of Fishery Products



【As of June 7th】

- Samples over provisional regulatory value: 31
- +○ Samples tested: over 500

● Intensive inspections over a wide range of samples.

Inspections on radioactive substances in fishery products are conducted on a weekly basis at each major port under the cooperation between prefectural governments, the Fisheries Agency and fishing industries.

Variety of samples

Ranging from coastal species to migratory species, as well as from surface species to bottom water species.

Samples which exceeded the provisional regulatory value

Japanese sand lance(juvenile), Japanese anchovy(juvenile), cherry salmon, Japanese smelt, ayu-sweetfish, Mediterranean mussel, Japanese dace, Wakame seaweed, Hijikii-seaweed, Arame seaweed)
(※Exceeding values are detected only in Fukushima Prefecture, except for Japanese sand lances in northern part of Ibaraki Prefecture as well.)

● Ensuring the safety of fishery products on the market.

Weekly exploratory operations should be conducted in principle, and fishing operation should resume only after the levels of radioactive substances detected remain below the provisional regulatory value three times in a row.

(※)No fishery is currently conducted in Fukushima.



Safety of Industrial Products

- Japanese manufacturing industries spare no effort to ensure the safety of their products.
- Inspection institutions and industry associations provide testing service of the radiation levels of export products.

Example of Inspection Institutions

- Nippon Kaiji Kentei Kyokai
(International Inspection & Surveying Organization)
- SK(Shin Nihon Kentei Kyokai)
- ANCC (All Nippon Checkers Corporation)
etc.

Reference: JETRO Homepage

http://www.jetro.go.jp/world/shunsai/20110318_11.html



JAMA(Japan Automobile Manufacturers Association) Comments on Radiation Testing Related to the Fukushima Nuclear Power Plant Situation (April 18,2011)

<extracts>

The tests implemented by JAMA — which are conducted directly on various designated areas of the surface of vehicles — are showing results that fall within the range designated by the Nuclear Safety Commission of Japan as being unthreatening to human health, based on the daily readings performed by the Ministry of Education, Culture, Sports, Science and Technology in every prefecture since March25.

Reference : JAMA Homepage: <http://www.jama-english.jp/release/comment/2011/110418.html>



Challenges Ahead



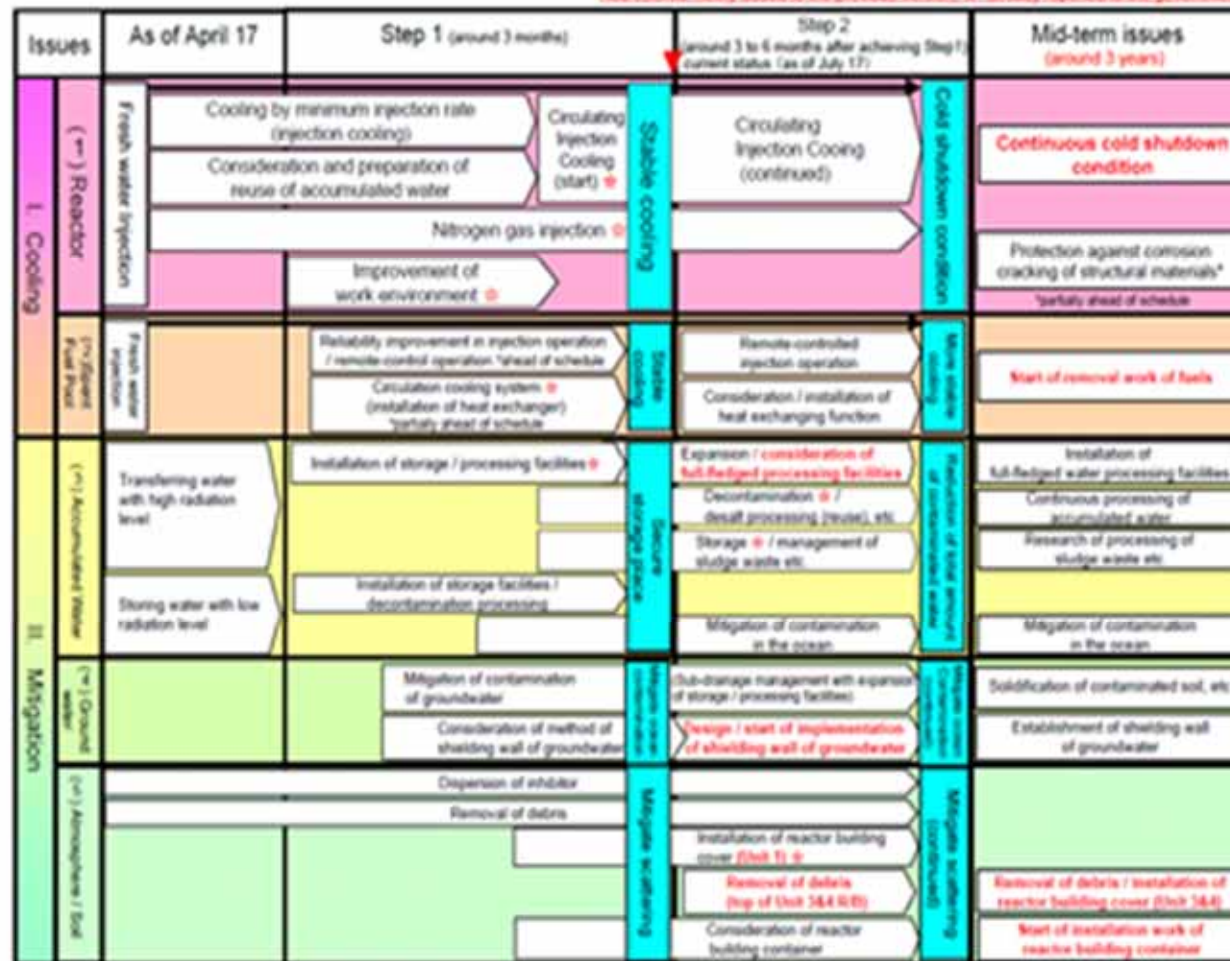
Efforts to restore the Accident (updated, 7/19/11)

Current Status of "Roadmap towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station, TEPCO" (Revised edition)

July 19, 2011
Nuclear Emergency Response Headquarters
Government (TEPCO Integrated Response Office)

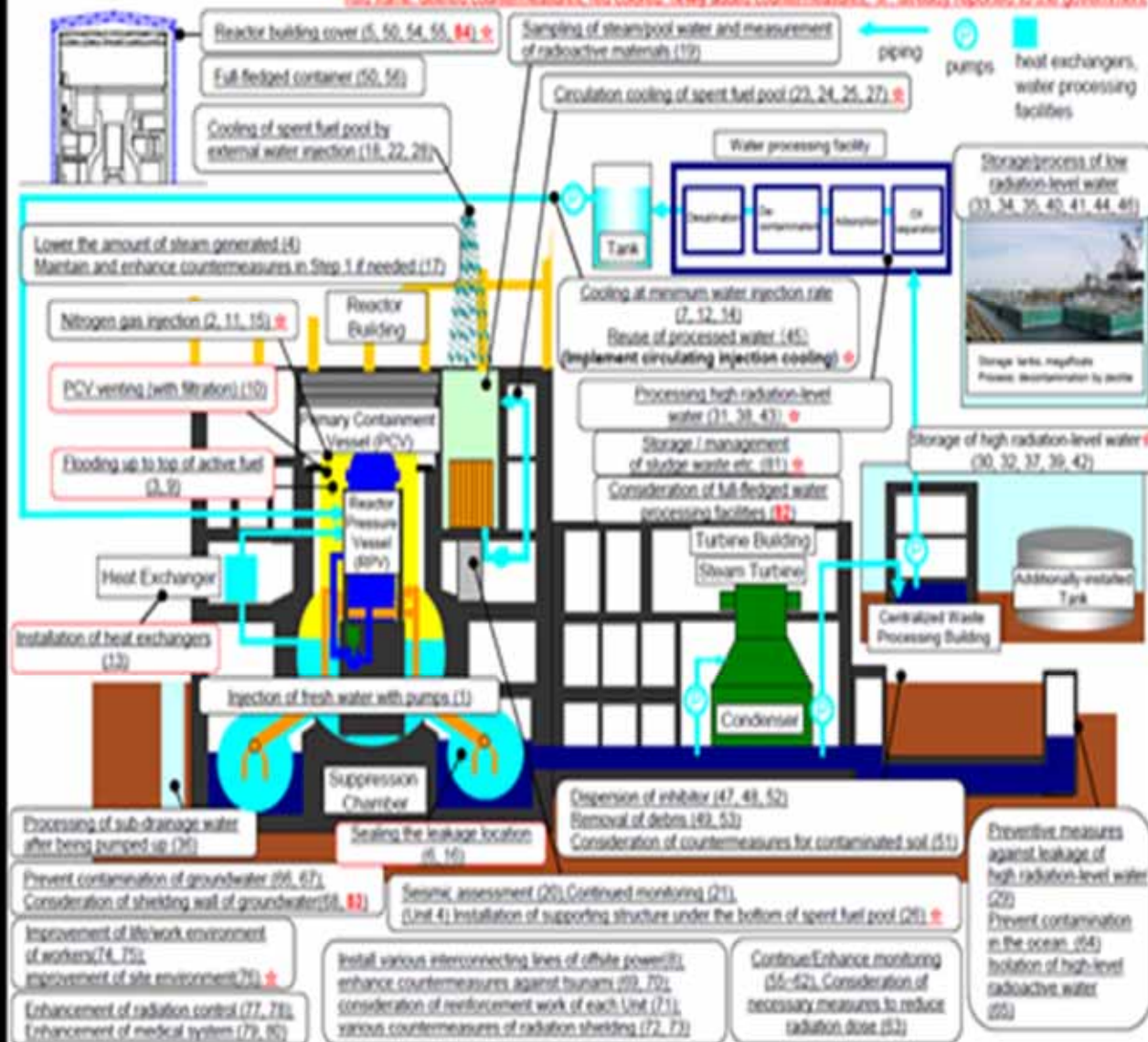
Appendix 1-3

Red colored newly added to the previous version, etc., already reported to the government



Overview of Major Countermeasures in the Power Station as of July 17

Red frame: deleted countermeasures, red colored: newly added countermeasures, St.: already reported to the government



Storage and Treatment of Contaminated Water (>100,000tons?)



Storage tank of contaminated water

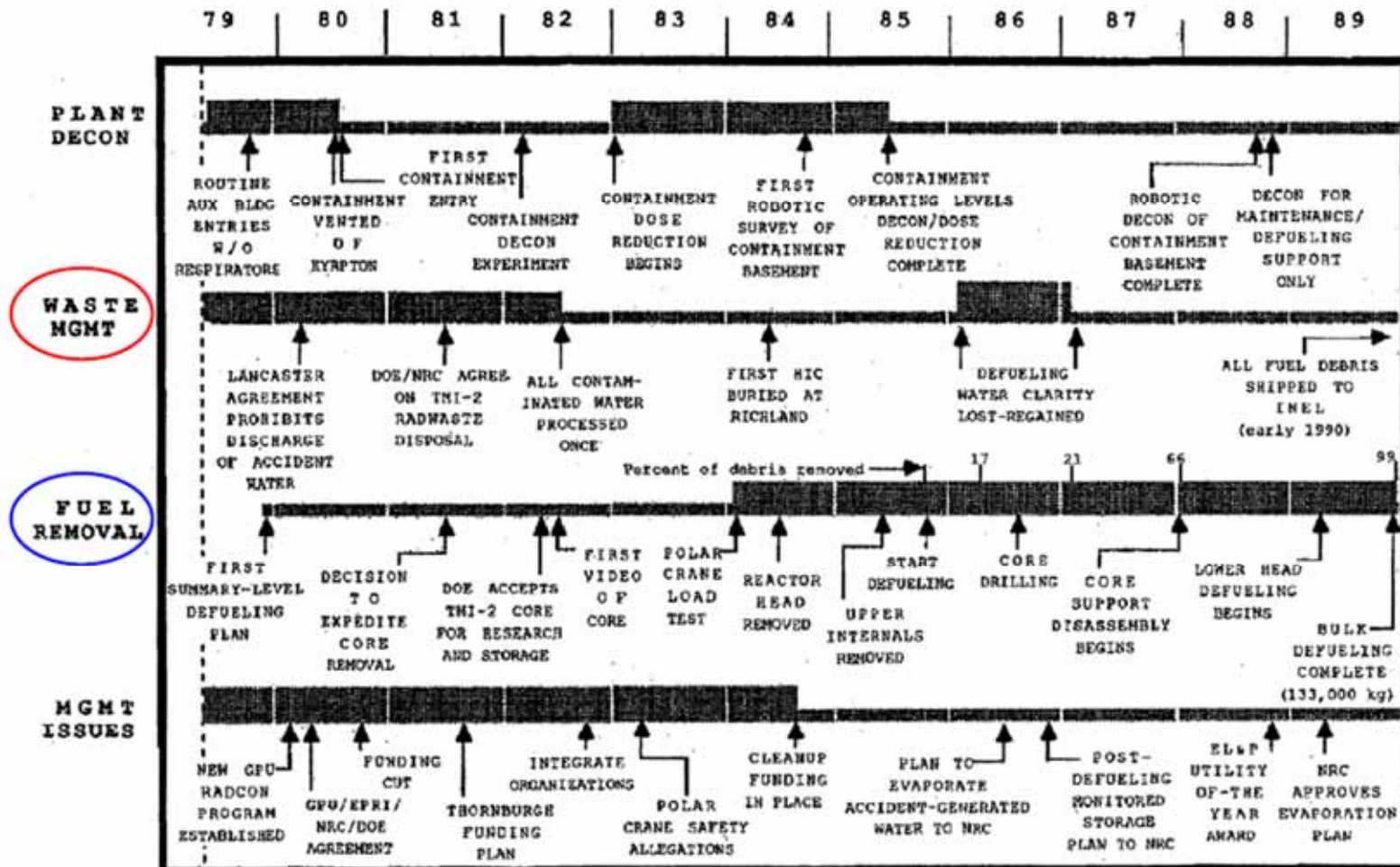


Water treatment facility under construction

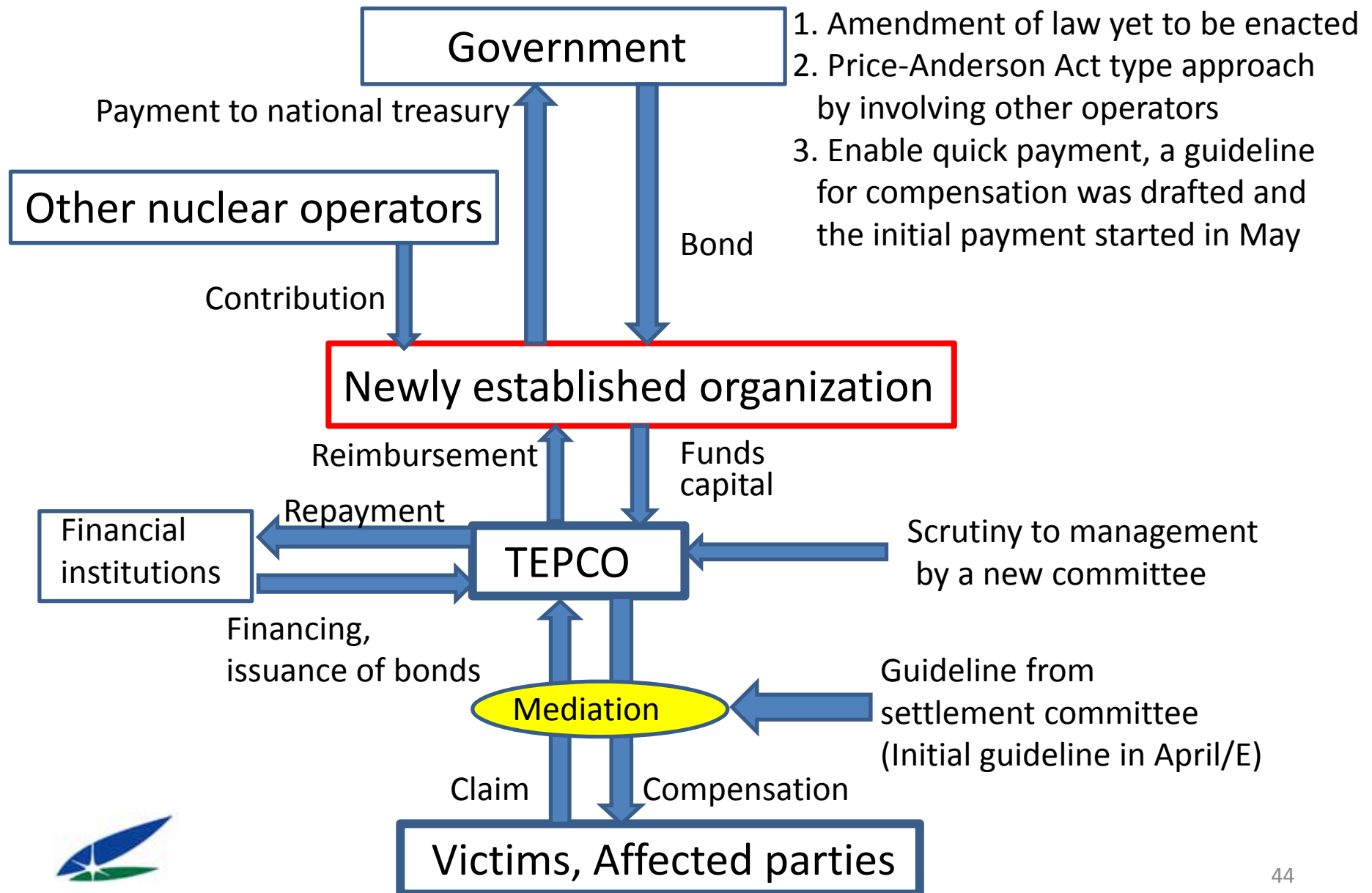
<http://www.tepco.co.jp/tepconews/pressroom/110311/index-j.html>

TMI-2 CLEANUP CHRONOLOGY

<全体時系列>



Proposed new compensation scheme



Lessons learned and Possible Implications

“If they (the regulatory authorities) judge that the measures are insufficient, **they should take strict steps, including shutdown**, in accordance with laws and regulations...**It is also Japan's responsibility to share the accident investigation results and the lessons** learned with the international community”-
JAEC (05/10/11)



Responses at other Nuclear Power Stations

1. Emergency Safety Measures

- NISA instructed all electric power companies to implement emergency safety measures. (30 March)
- Based on the report from each electric utilities, NISA has confirmed that emergency safety measures had been appropriately implemented.(6 May)

2. Additional Emergency Safety Measures

- NISA and other relevant ministries are to improve and strengthen the emergency safety measures based on lessons learned from the accidents which are stated within this report. (7 June)

3. Hamaoka NPS shutdown

- The government requested Chubu Electric Power Company to halt the operation of all units of Hamaoka NPS due to high possibility of large-scale tsunami resulting from the envisioned earthquake within mid to long term countermeasures. (6 May)



Report of Japanese Government to the IAEA Ministerial Conference on Nuclear Safety (06/07/2011)

- 5 Categories 28 list of Lessons learned
 1. Strengthen preventive measures against a severe accident
 2. Enhancement of Responsive measures against a severe accident
 3. Emergency responses to nuclear disaster accident
 4. Robustness of the safety infrastructure established at the nuclear power station
 5. Thoroughness in safety culture while summing up all the lessons.

Source: Nuclear Emergency Response Headquarters, Government of Japan,
"Report of Japanese Government to the IAEA Ministerial Conference on Nuclear Safety

-The Accident at TEPCO's Fukushima Nuclear Power Stations -", June 2011.

http://www.kantei.go.jp/foreign/kan/topics/201106/iaea_houkokusho_e.html



IAEA Director General's Concluding Remarks (06/24/11)

5 Agreed points

- to strengthen IAEA Safety Standards;
- to systematically review the safety of all nuclear power plants, including by expanding the IAEA's programme of expert peer reviews;
- to enhance the effectiveness of national nuclear regulatory bodies and ensure their independence;
- to strengthen the global emergency preparedness and response system; and
- to expand the Agency's role in receiving and disseminating information.

<http://www.iaea.org/newscenter/statements/2011/amsp2011n014.html>

Investigation Commission of Fukushima Nuclear Accident

- “Independence, transparency, and comprehensiveness: these are the three principles around which we are preparing the formulation of the Nuclear Incident Investigation Commission.”(PM Kan, Press Conference, 2011/05/10)
- Prof. Yotaro Hatamura, expert on human error, is chosen as a head of Gov’t investigation commission. (2011/05/24)
 - 1st meeting was held on June 7, 2011

http://www.kantei.go.jp/foreign/kan/statement/201105/10kaiken_e.html
<http://english.kyodonews.jp/news/2011/05/92946.html>

More nuclear plants may face shutdown

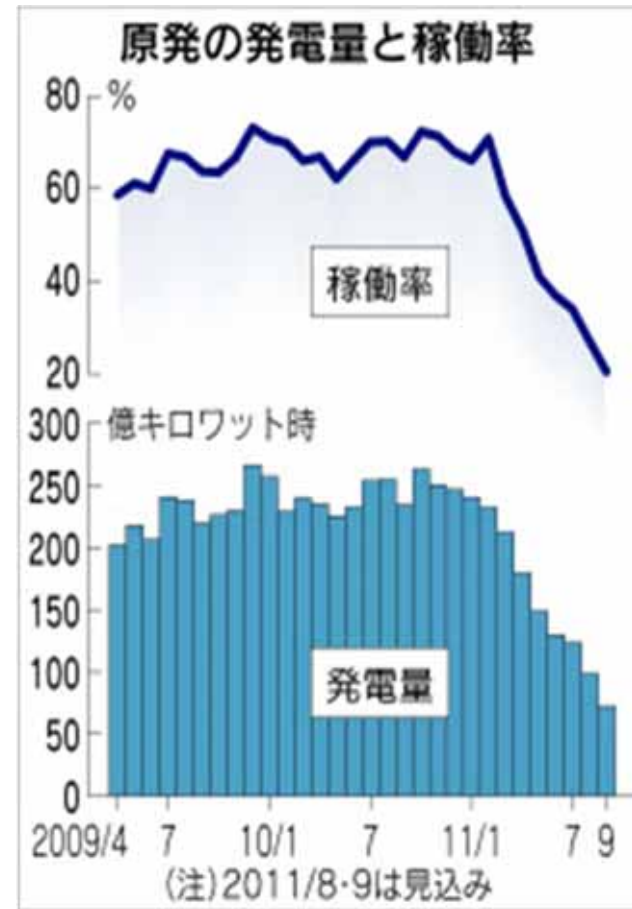
All nuclear plants may face shutdown by May 2012

- Out of all 54 units: (as of Aug. 27, 2011)
 - 14 units are shutdown due to the Earthquake
 - 26 units are shutdown due to maintenance etc.
 - 14 units are now operating, but 4 more units will be shutdown due to maintenance by early next year.
 - All nuclear plants could be shutdown by May, 2012.
- The governor of Fukui said it will not approve the re-startup of nuclear reactors without new safety requirements. (May 20, 2011, Asahi)
- The governor of Hokkaido approved to restart the operation of Tomari #3. (Aug. 17, 2011)

Declining production of nuclear power

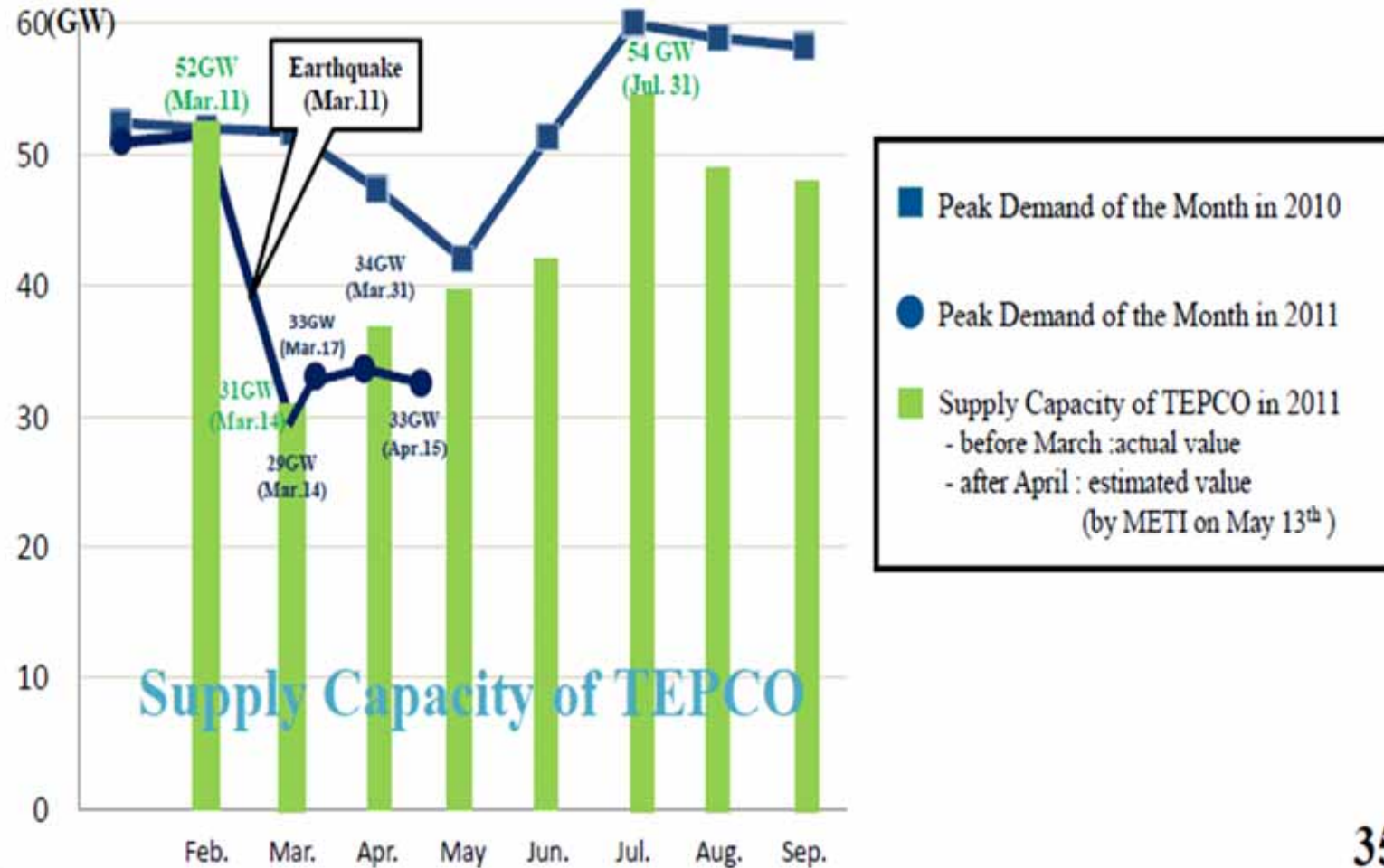
Capacity Factor

Nuclear Power Gen. (100MKwh)



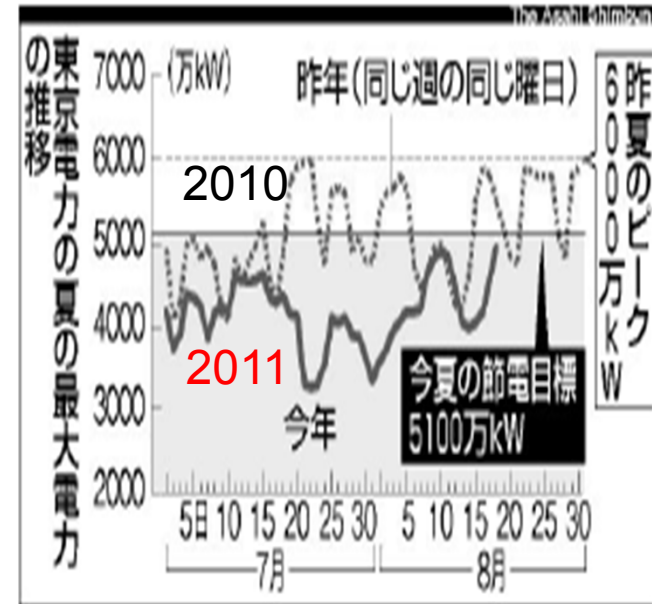
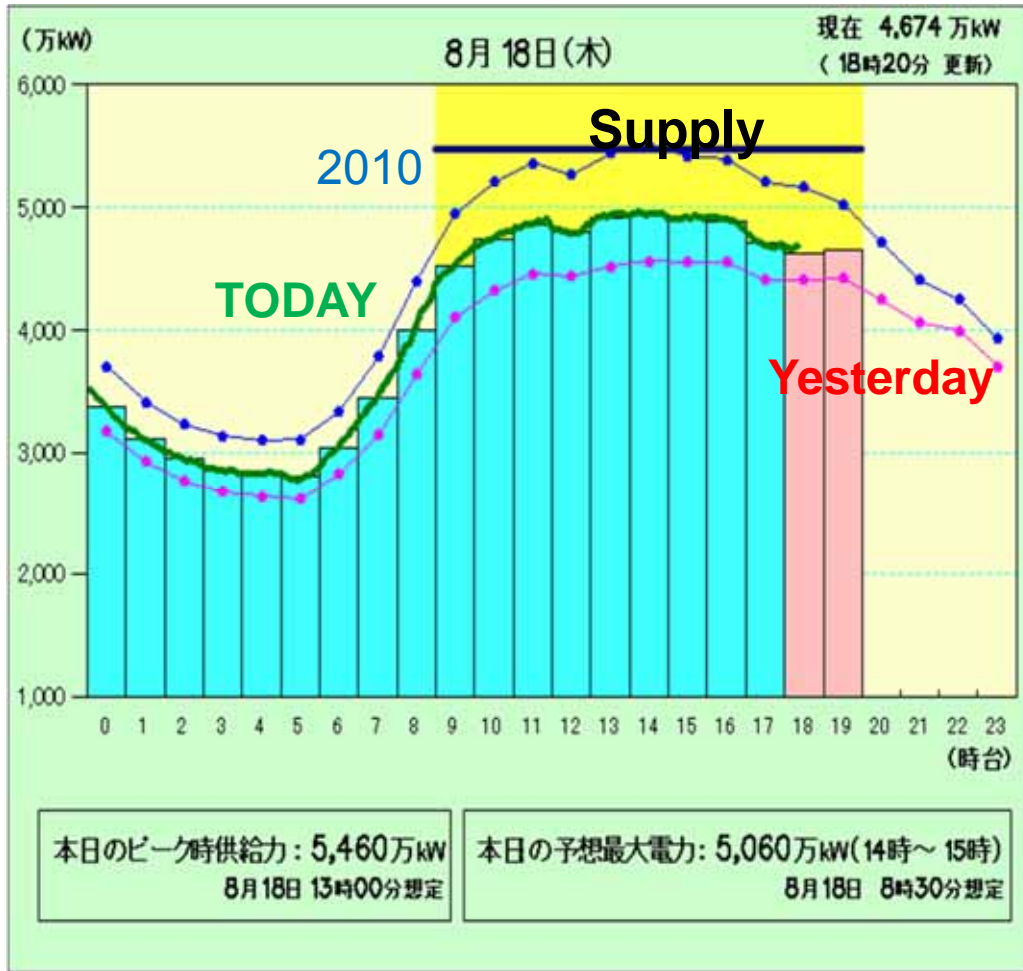
Source: Nikkei Shimbun, Aug. 23, 2011 50

TEPCO's Supply/Demand Balance



35

Tepco Summer Peak Demand/Supply Balance (2011/08/18)



東京電力の夏の最大電力の推移

<http://www.tepco.co.jp/forecast/index-j.html#graph1>

[朝日新聞、2011年8月19日
http://digital.asahi.com/articles/TKY201108180661.html?id1=2&id2=cabbaibj](http://digital.asahi.com/articles/TKY201108180661.html?id1=2&id2=cabbaibj)

Statement of PM Kan on Nuclear Power Policy on July 13, 2011

- *“..It was when I considered the scale of such risks arising from the nuclear incident that I realized that it would no longer be possible to conduct policy on the basis of ensuring safety alone...”*
- *“...with regard to Japan’s future nuclear power policy, we should aim to achieve a society that is not dependent on nuclear power. In other words, we should reduce our dependence on nuclear power in a planned and gradual manner and aim to realize a society in the future where we can do without nuclear power stations. “*

Press conference on July 13, 2011

http://www.kantei.go.jp/foreign/kan/statement/201107/13kaiken_e.html

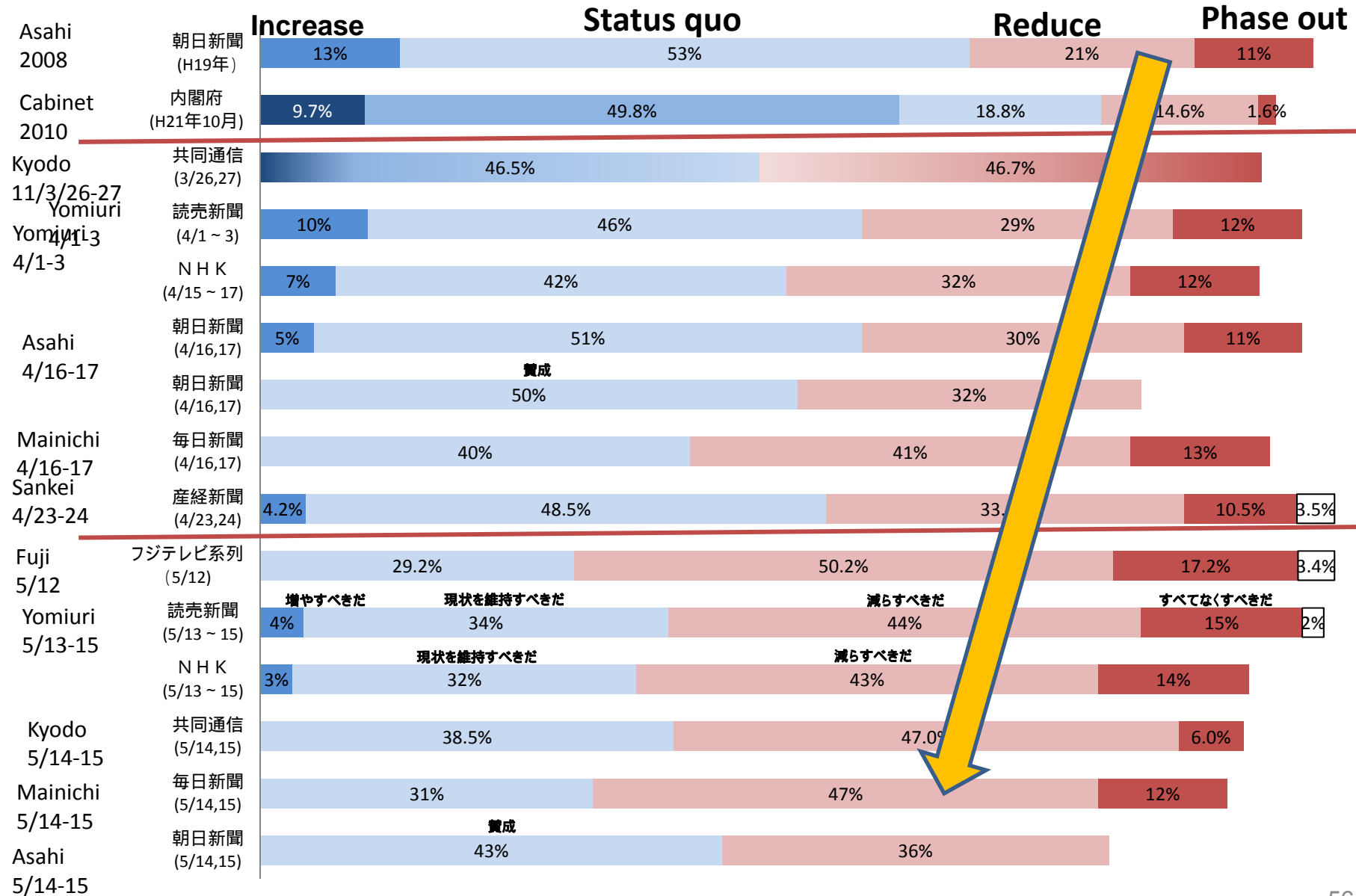
Energy Policy Debate

- “Energy Policy Wiseman Council” established by METI Minister as a private advisory organ
 - Headed by Prof. Arima, former Minister of Science and Technology
- National Strategy Office established “Energy and Environmental Policy Council” headed by Minister and METI/Environmental Ministers
 - It will draft outline of energy and nuclear energy policy (including restructuring of power industry)
- METI initiated review process for its “Energy Basic Plan” which was last published in 2010

New Energy Policy: Three Philosophies (July 29, 2011) by Energy and Environment Min. Council

- (1) Three principles toward new best energy mix (*reducing dependency on nuclear power*, strategic approach for energy security, *complete reevaluation of nuclear energy policy*)
- (2) Three principles toward new energy system (realization of distributed energy system, international contribution, multi-eyed approach)
- (3) Three principles toward national consensus (*national debate in order to overcome “pro-“ “anti-“ conflict*, strategy based on objective data, dialogue with various sectors of the public).

Public Opinion Shifting to “reduce” and “phase out”



Japanese gov't report to the IAEA says “need national discussion”

- At the same time, *it is necessary for Japan to conduct national discussions* on the proper course for nuclear power generation while *disclosing the actual costs of nuclear power generation, including the costs involved in ensuring safety.*

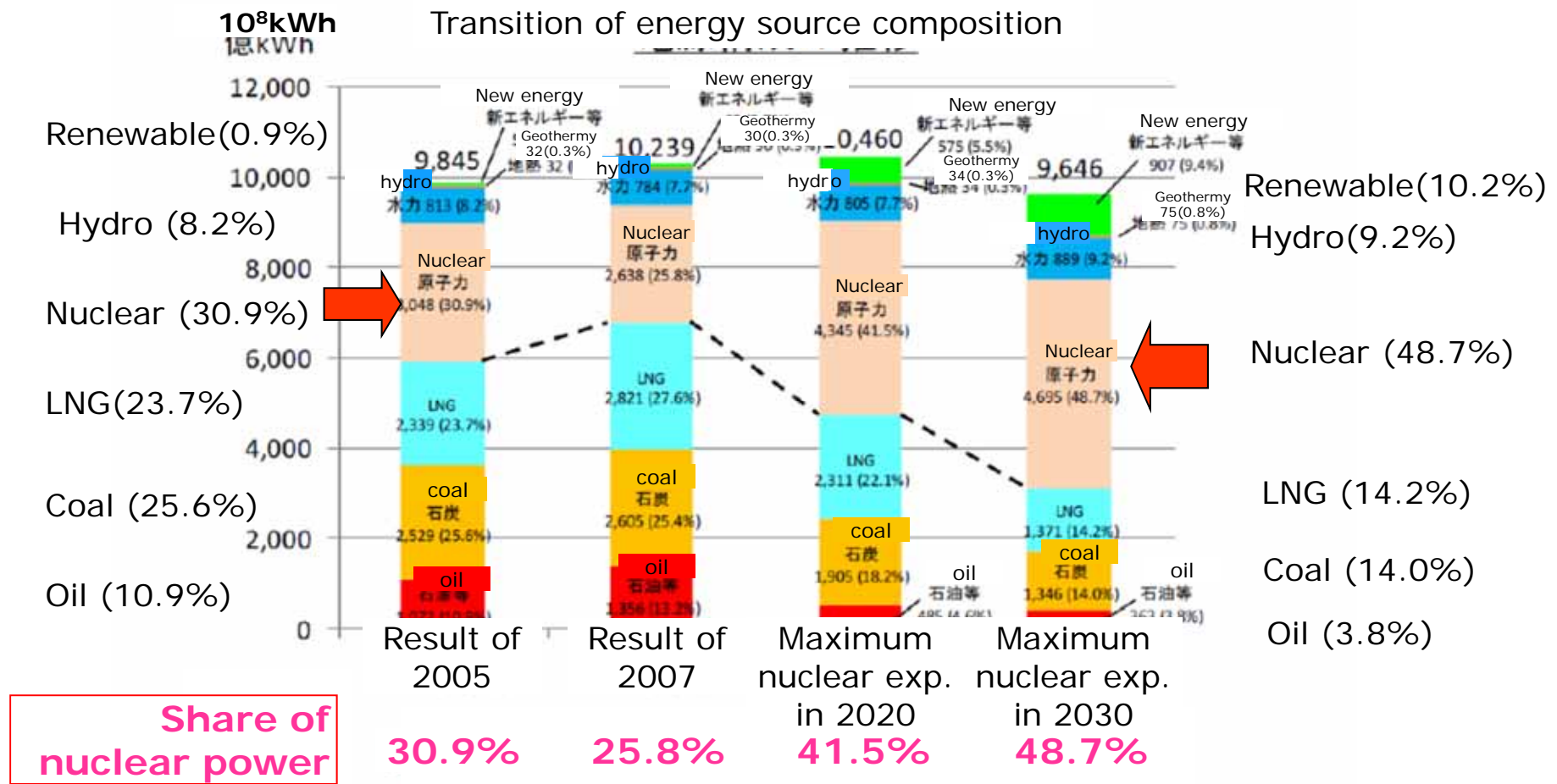
Source: Nuclear Emergency Response Headquarters, Government of Japan,

“Report of Japanese Government to the IAEA Ministerial Conference on Nuclear Safety

-The Accident at TEPCO's Fukushima Nuclear Power Stations -”, June 2011.

http://www.kantei.go.jp/foreign/kan/topics/201106/iaea_houkokusho_e.html

Goal of Power Production Mix in 2030



Source: Institute of Energy Economics, March 2010

Implications for Nuclear Security and Non-Proliferation

- Future of global nuclear power is less certain now.
 - The world could be divided into “pro-” and “anti-” nations towards nuclear power, which may make global consensus on nuclear issues more difficult.
- The Fukushima accident proved that common approaches could be effective for enhanced safety and security (esp. emergency response)
 - Especially, **spent fuel management and emergency response** have become important subjects for both security and safety.

Final Message

- *If we cannot control nuclear power, how can we control nuclear weapons? **We should overcome this man-made disaster with humble attitude towards nature and science/technologies***
- *As Hiroshima and Nagasaki have become symbol of peace, **Fukushima should become a symbol of recovery from nuclear accident***

Thank you very much for your attention!



At the 59th Pugwash Conferences on Science
And World Affairs, Berlin, July 3, 2011