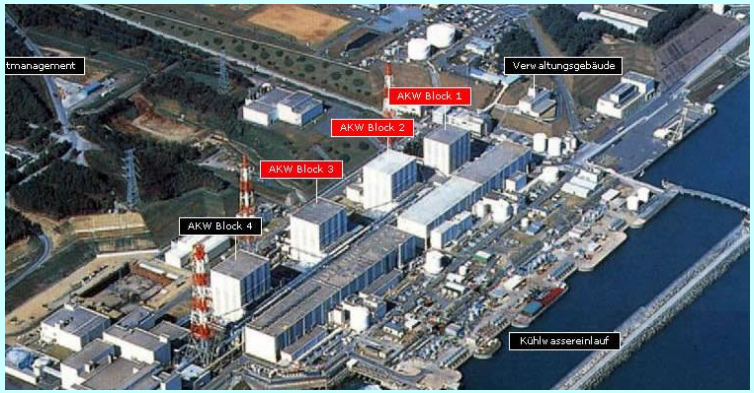
Lessons and Learned

Communication Problems of the Fukushima Nuclear Power Plant No.1 Accident



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Researcher, the National Diet of Japan Fukushima Nuclear Accident Independent Investgation

Co-Rapporteur for eHealt, ITU-D SG2 Q2/2

Professor, EMS Tokai University School of Medicine, Japan

Agenda

1. Who we are.
2. What happened, Fukushima Nuclear Power Plant Unit #1 ,#2, #3
3. Trouble and damage of the communication system in Fukushima
4. Conclusions

10 Years History of ITU e-Health Expert Training Courses Tokai University, Japan.

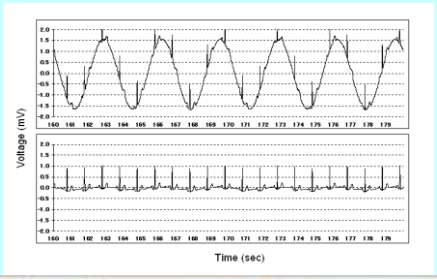
Document RGQ14-3/2/INF/22-E

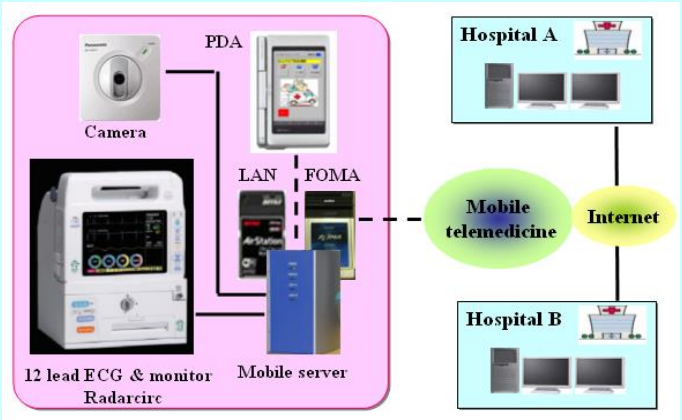
Tokai University Shonan Campus
Hiratsuka Kanagawa Japan

Tokai University Hospital
Isehara Kanagawa Japan

http://www.tsj.gr.jp/tsj/tumri/nakajima/index.htm

Novel Mobile Telemedicine System for Real-time Transmission of 12-lead ECG Data and Live Video from Moving Ambulance to Hospital





What does NBC mean?
Nuclear disaster

NBC stands for Nuclear, Biological, Chemical. It is a term used in the armed forces and in health and safety, mostly in the context of weapons of mass destruction (WMD)

ＮＢＣ対処訓練を行う陸自第２化学防護隊（北海道）

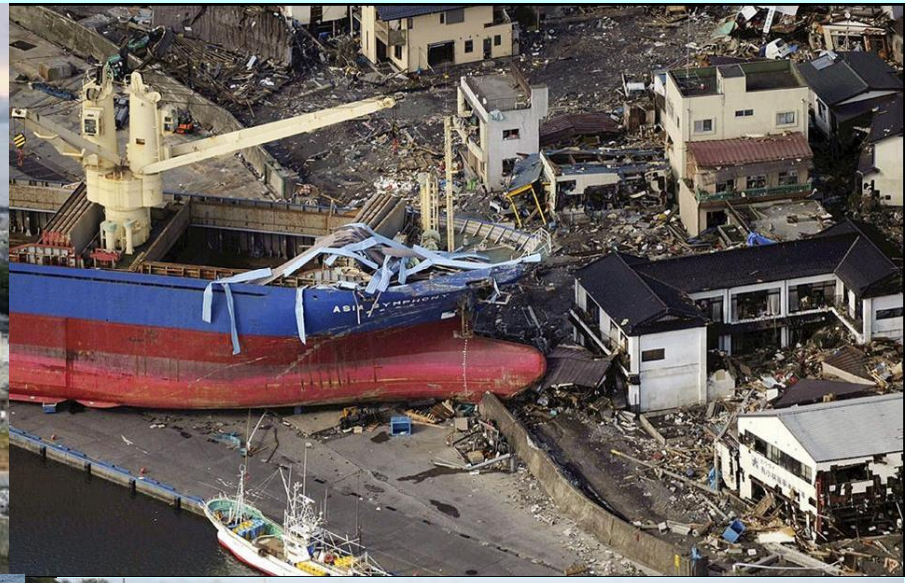
ITU-MIC Regional Meeting on ICT for e-Health

Tokyo Japan,10-11 March 2011

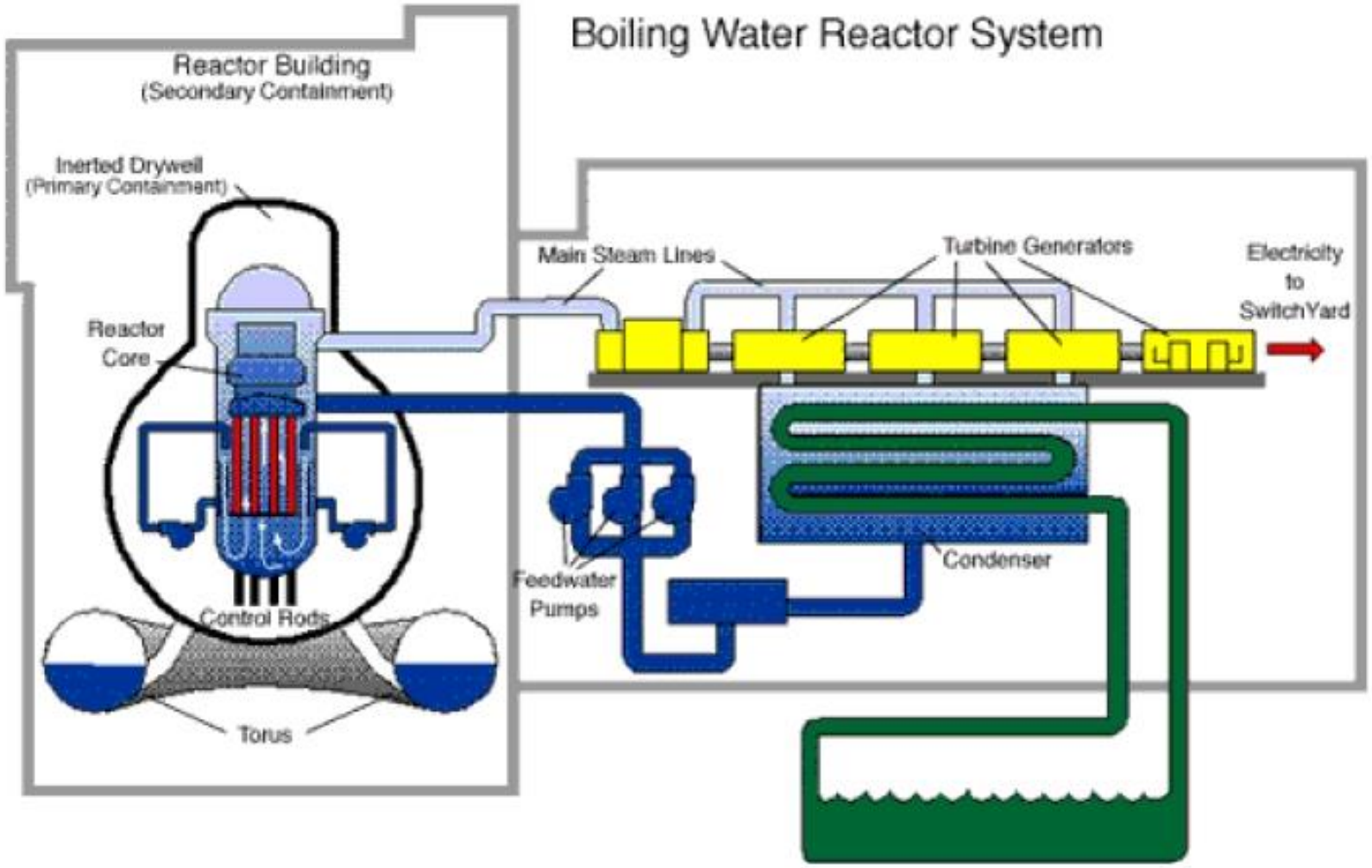
Rapporteur and Vice Rapporteurs for Q14

The Great East-Japan Earthquake

stroke on March 11, 2011



Boiling Water Reactor System



Fukushima Daiichi NPP

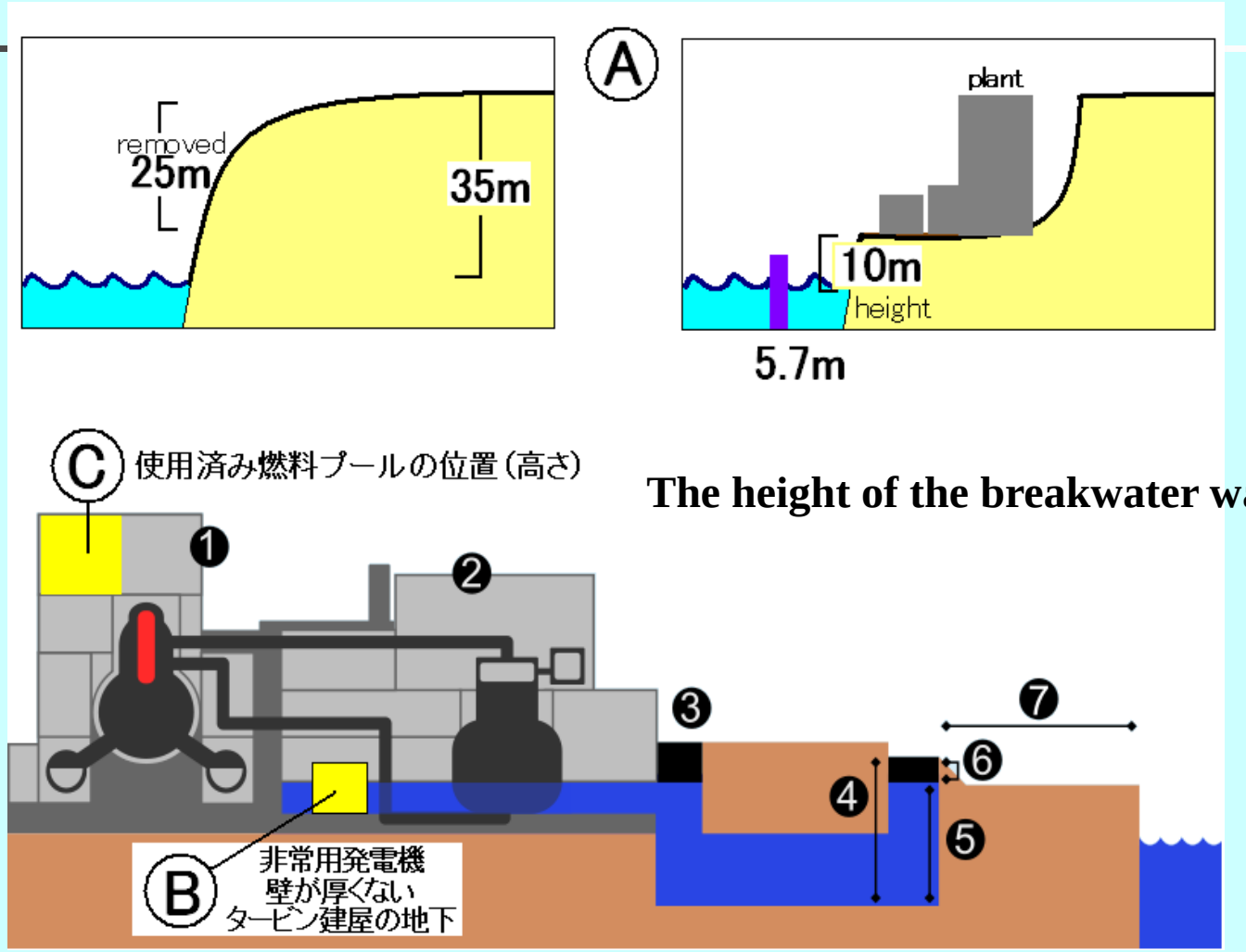
Fukushima Dai-ichi NPP

	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

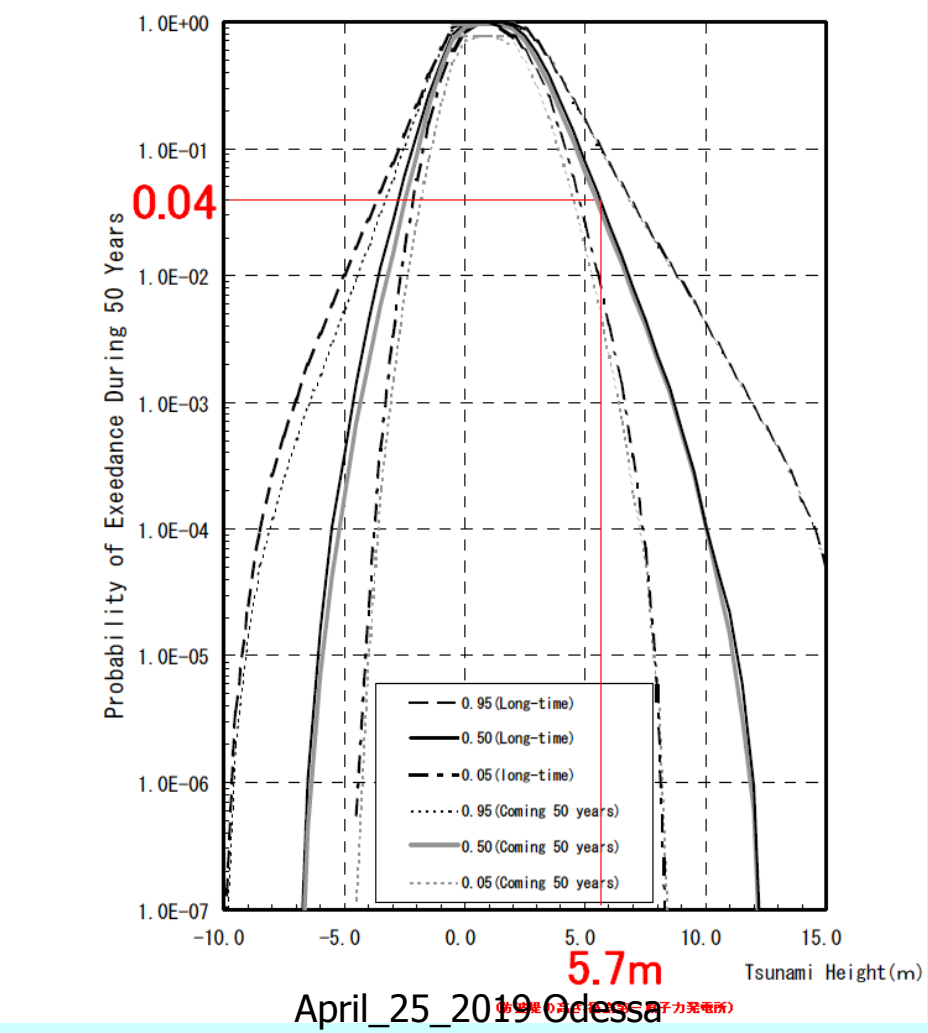
Before construction, it was the hill of the altitude of 35m. As the ability of the seawater suction pump of GE was low, so sharpened it to an altitude of 10m expressly and built a power station



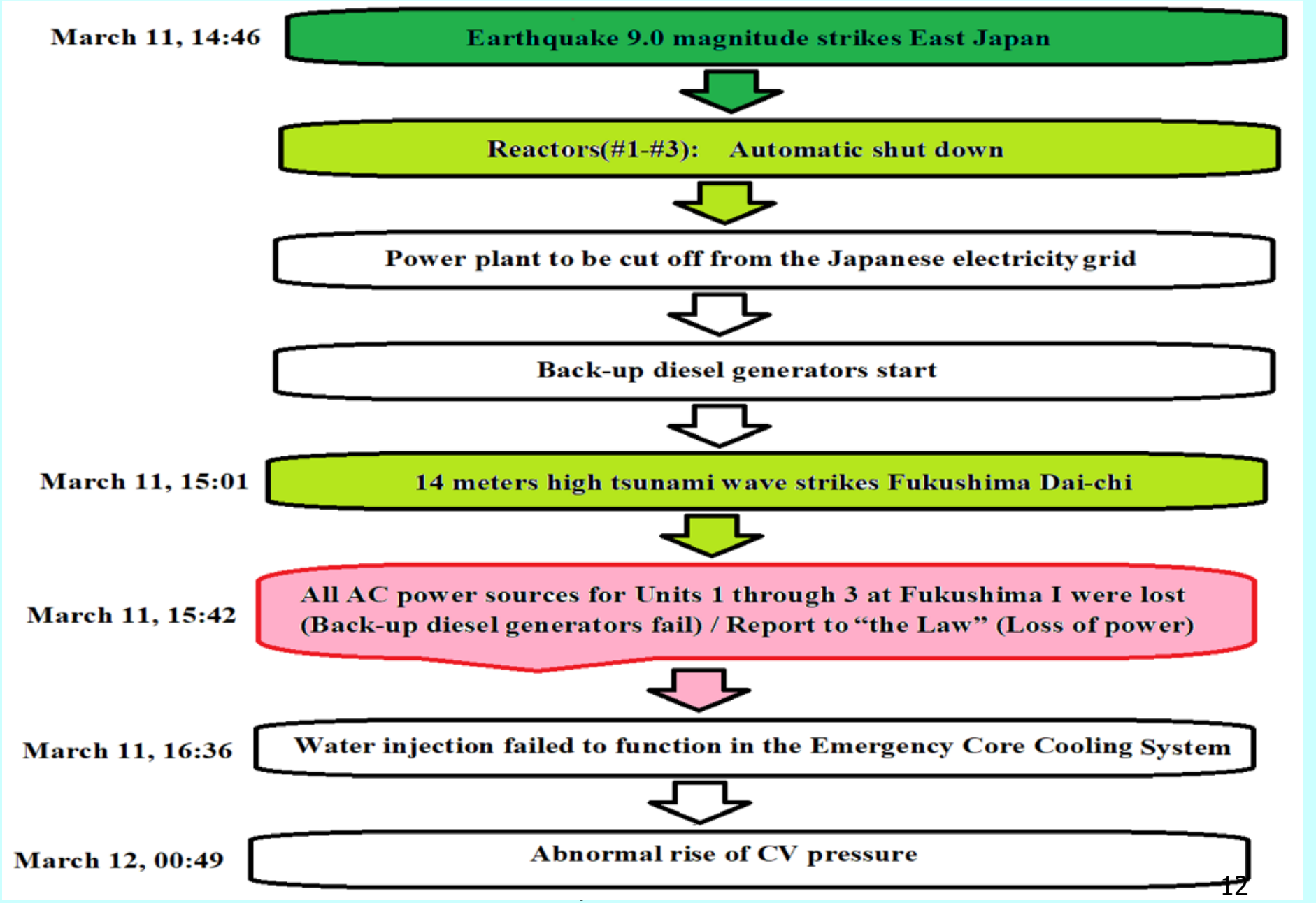
The height of the breakwater was 5.7m.

Tokyo Electric employee reports to an academic society before the Fukushima nuclear power plant accident

the Probability of Expectance during 50 Years Tsunami over the water wall of 5.7m by 4% !!!



Episode after the major earthquake



DC 115V power supply battery

Opened AO valve by a nitrogen gas cylinder for the vent decompression

Confirmation of a blowout panel

Japanese government report to IAEA
Fukushima "worse than meltdown?"

Deterioration in nuclear reactors' condition

(hours after Great East Japan Earthquake)

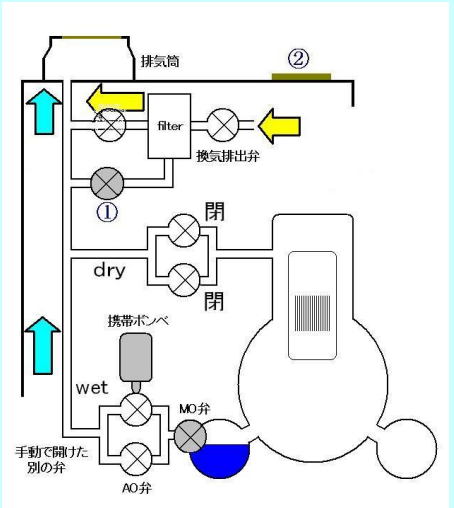
	STATE OF NUCLEAR REACTORS	ANALYSIS BY NISA	ANALYSIS BY TEPCO
No. 1 reactor	start of damage to reactor core	3 hours later	4 hours later
	breach of pressure vessel	5 hours later (8 p.m. on March 11)	15 hours later
No. 2 reactor	start of damage to reactor core	77 hours later	77 hours later
	breach of pressure vessel	80 hours later (10:50 p.m. on March 14)	109 hours later
No. 3 reactor	start of damage to reactor core	44 hours later	42 hours later
	breach of pressure vessel	79 hours later (10:10 p.m. on March 14)	66 hours later

Mark I :Unit #1 of BWRS

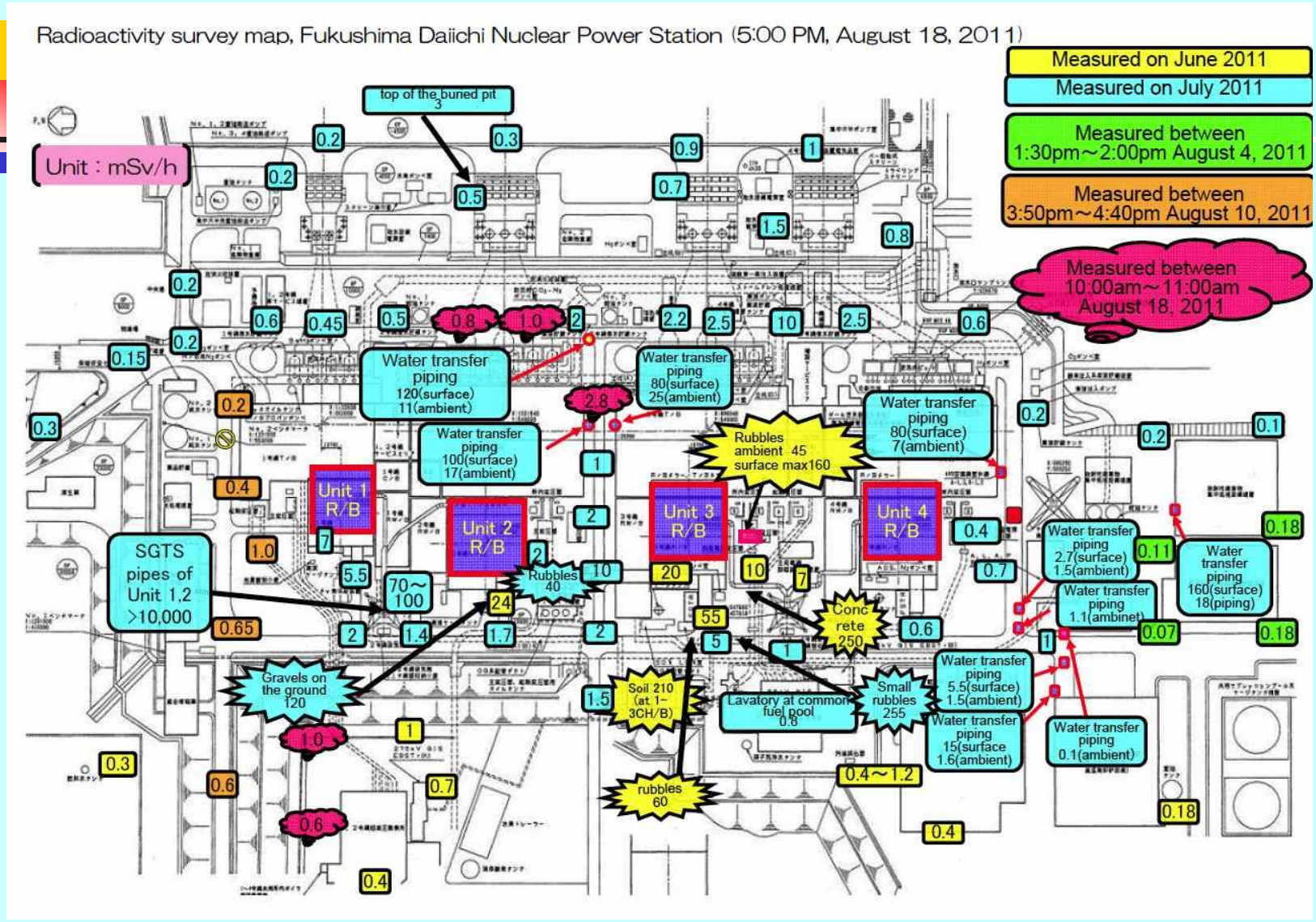
Core fusion and Hydrogen explosion by the countercurrent to the vent gas

Unit Mark I lost its all power supplies shortly after the arrival of the tsunami. The isolation condensers (IC) seemed to have lost its functionality as its isolation valves were fully or almost fully closed by the fail-safe circuits. But at the initial stage of the accident, appropriate corrective actions were not taken, nor were instructions given.

By the operators mistake, IC was switched off. As a result, within early stage of 24 hours, MarkI caused core fusion.



State of Fukushima No. 1 NPP, as of August 30: c. Site debris and contamination



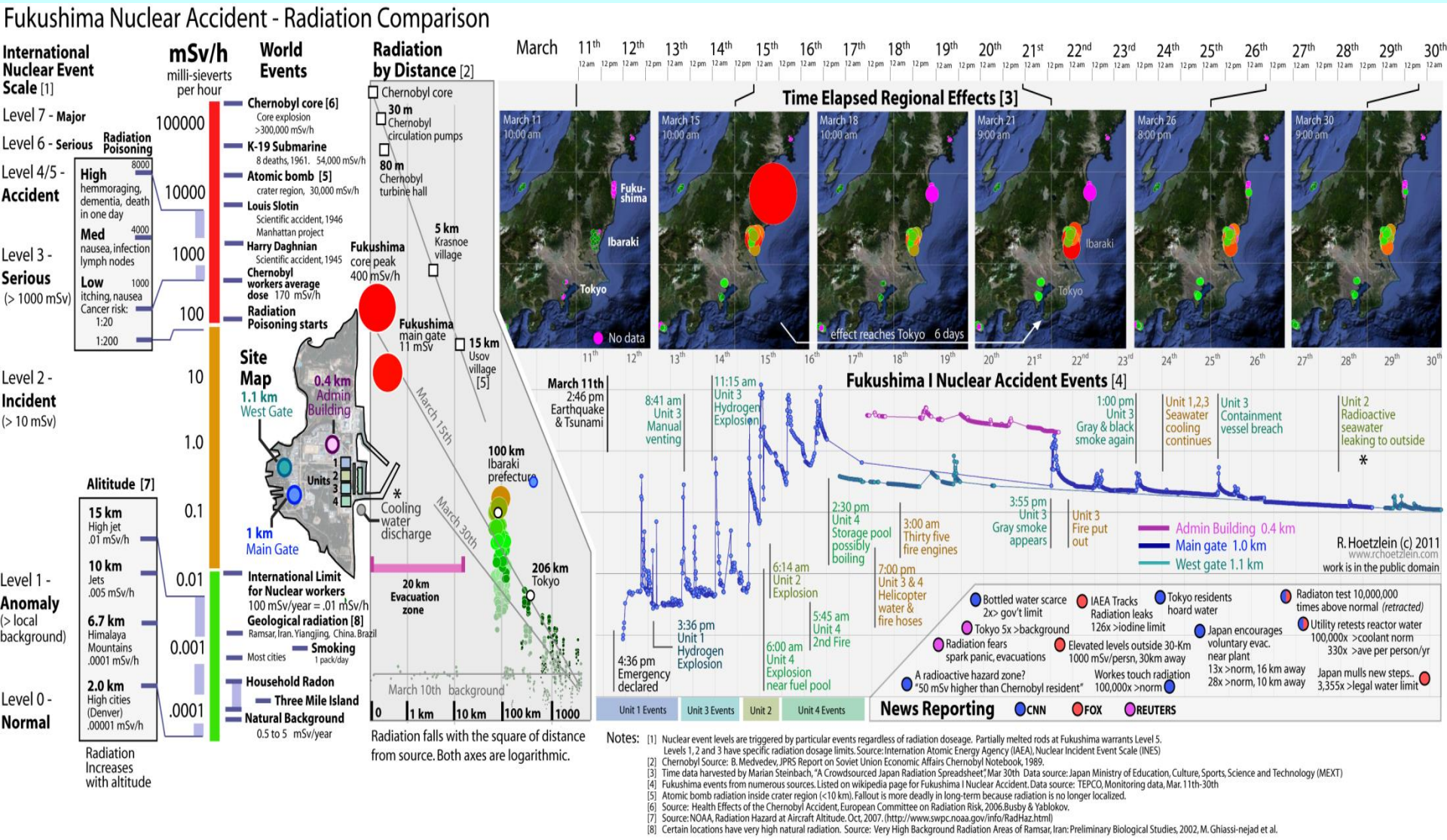
Source: TEPCO, *Survey map of Fukushima Daiichi Nuclear Power Station, August 22, 2011.*

Because a blowout panel dropped naturally,

the II unit #2 didn't explode

The hydrogen vent gas flowed backward from an opened valve into the I unit building and exploded several hours later.

Trend of the radiation exposure dose



from the web
http://japan.resiliencesystem.org/fukushima-nuclear-accident-radiation-comparison

Applying Chernobyl evacuation criteria to Fukushima

- **Red and most yellow is > Chernobyl relocation zone (>1480 kBq/m^2)**
- **Rest of yellow, green, light blue and some dark blue is > Chernobyl dose reduction zone**
- **Cs 137 T1/2 =30 years**

Comparison from Chernobyl

Xe133	**167%**
I131	**9%**
Cs134	**38%**

(courtesy Prof. Tilman Ruff, Nossal Institute for Global Health)

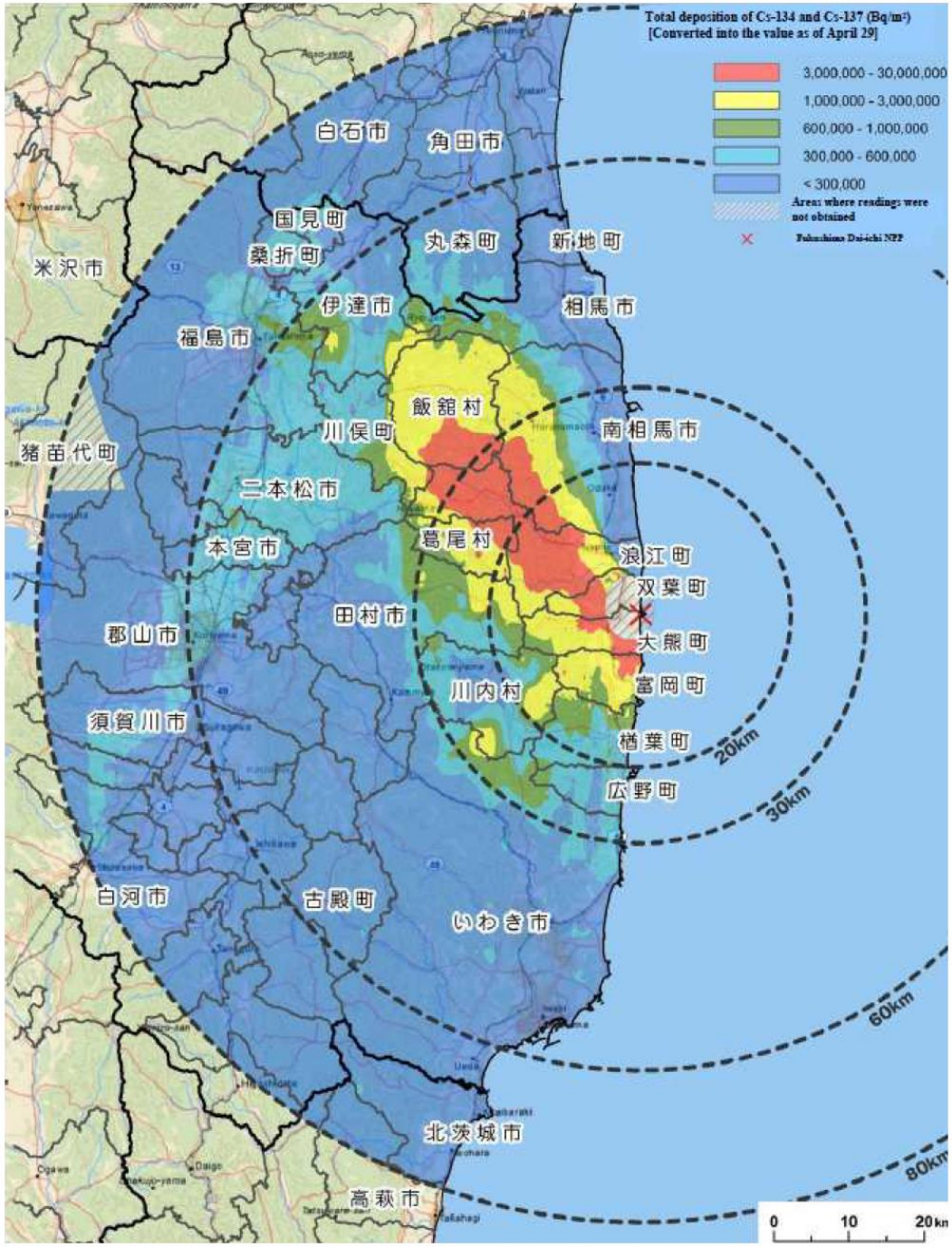
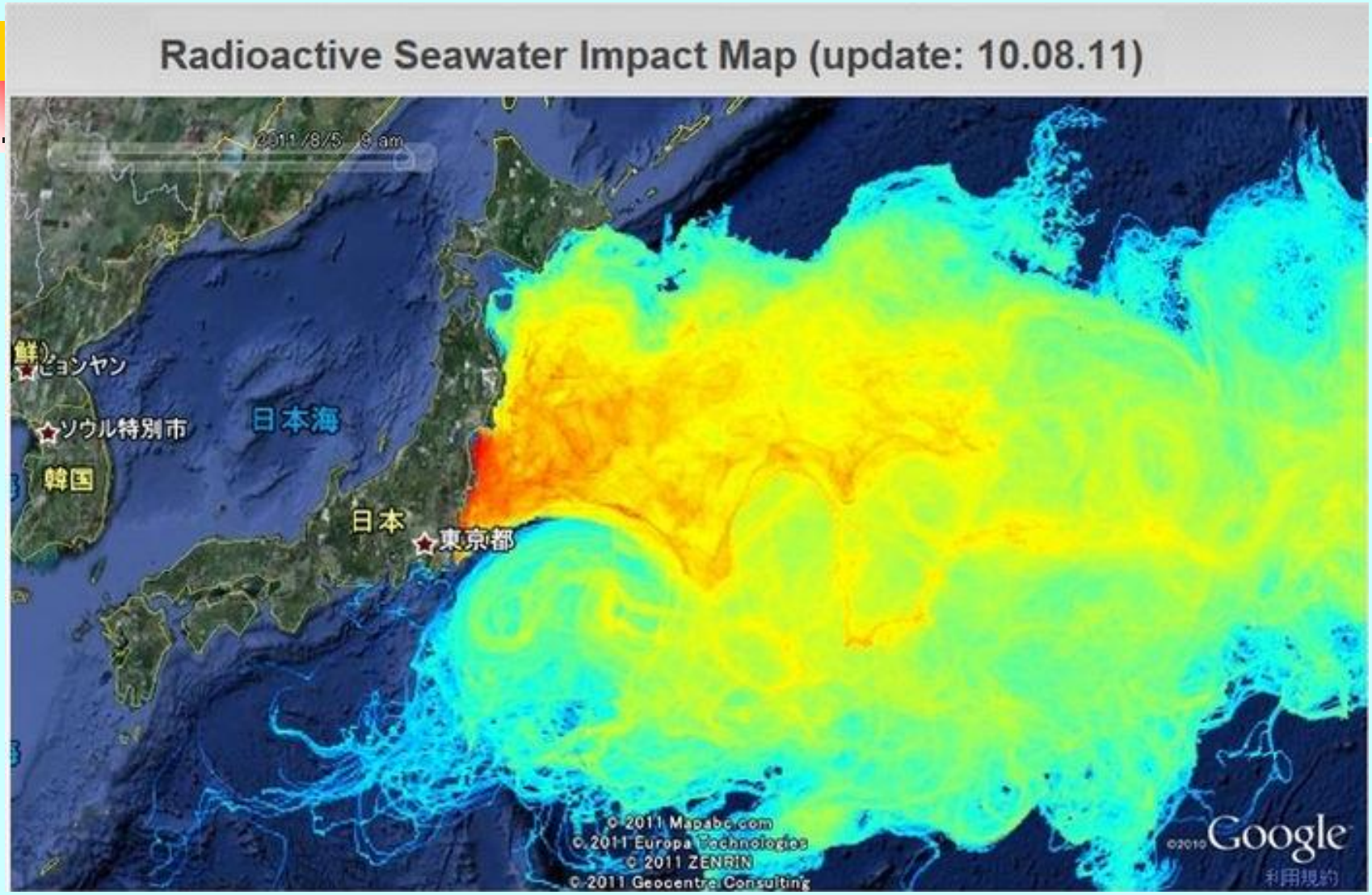


Figure 25 Total surface deposition of Cs-134 and Cs-137 inside the 80-km zone of Fukushima Daiichi power plant. Source: MEXT

Marine Pollution



The contaminated water is not controlled at all.

Summary of Accidents

Falling water levels uncover cores 1, 2, and 3

- Cores mostly uncovered for 8 to 20 hours
- Fuel temperature rises to 1200oC and as much as 2500oC
- Zirconium cladding burns: $Zr + 2H_20 = ZrO_2 + 2H_2$
- Hydrogen and noble gases vented as vessel pressure rises

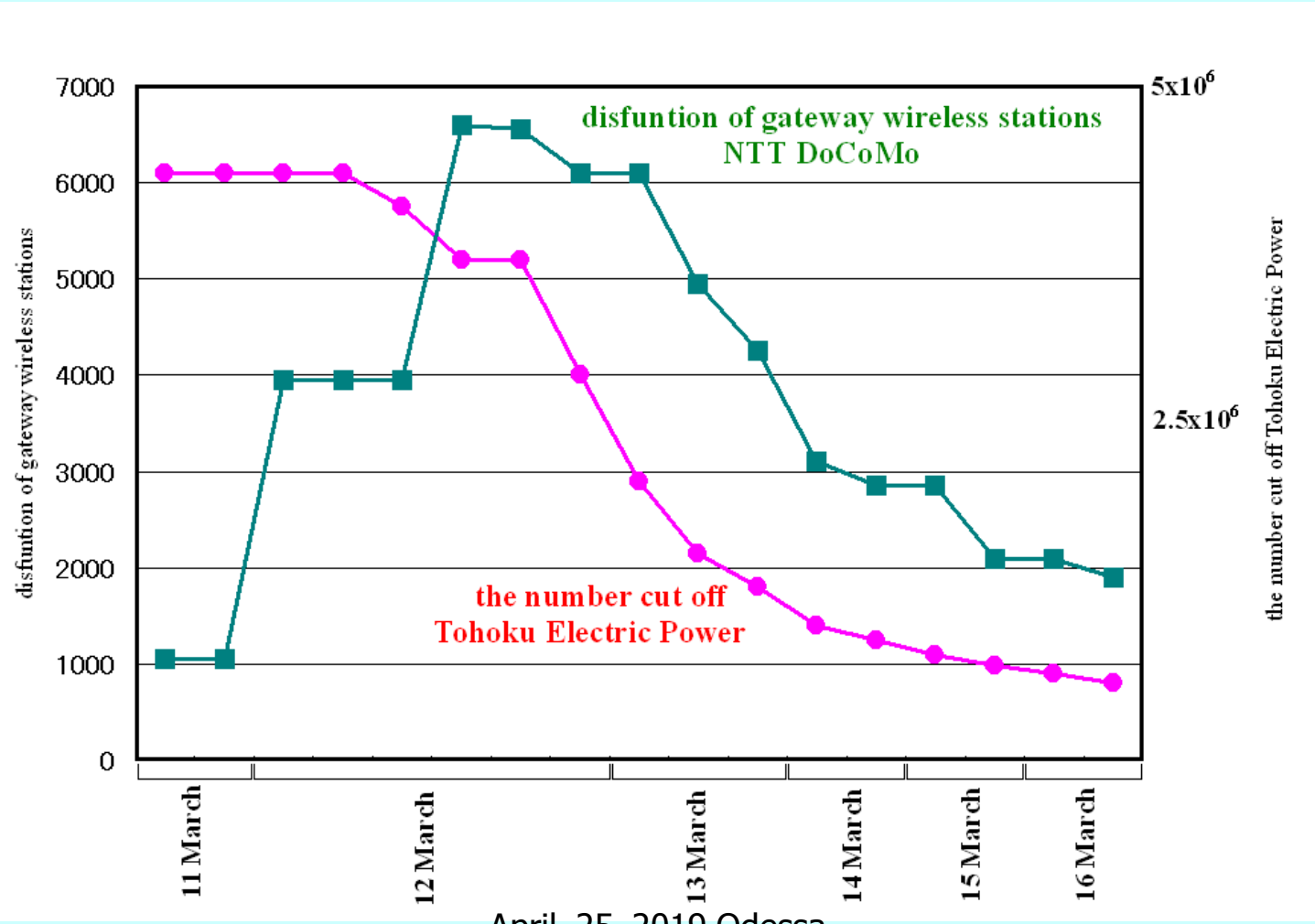
  But the vent's exhaust is inside the building's service level
- Random spark ignites the hydrogen; blows off frangible panels

  Looks much worse that it really is

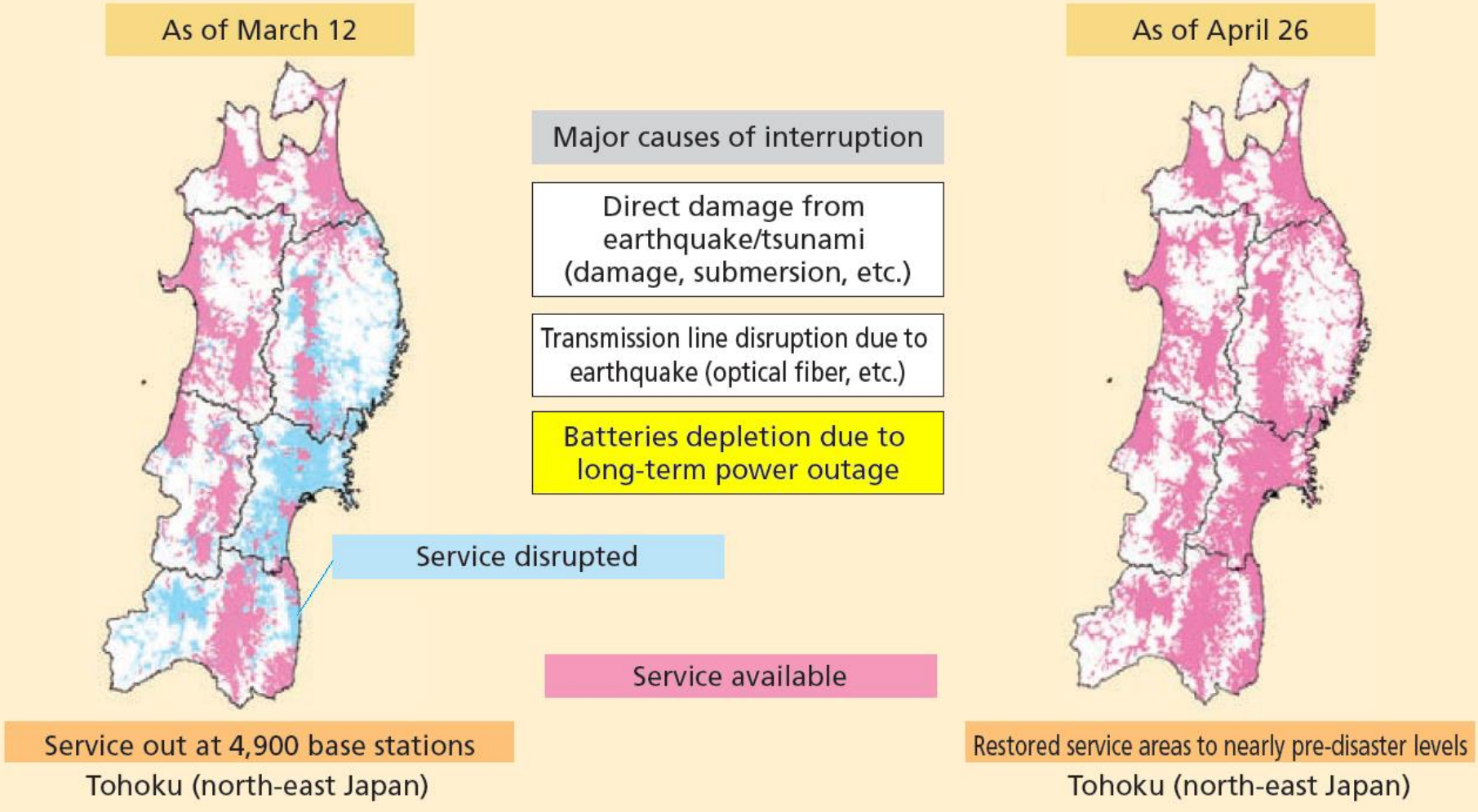
Spent fuel cooling pools also begin to dry up

- Spent fuel still warm ? and hastens water's evaporation
- Goes unnoticed because monitors are dead and no one up there

Relationship between Cut-off Electric Power and Loss-function Stations of NTT DoCoMo



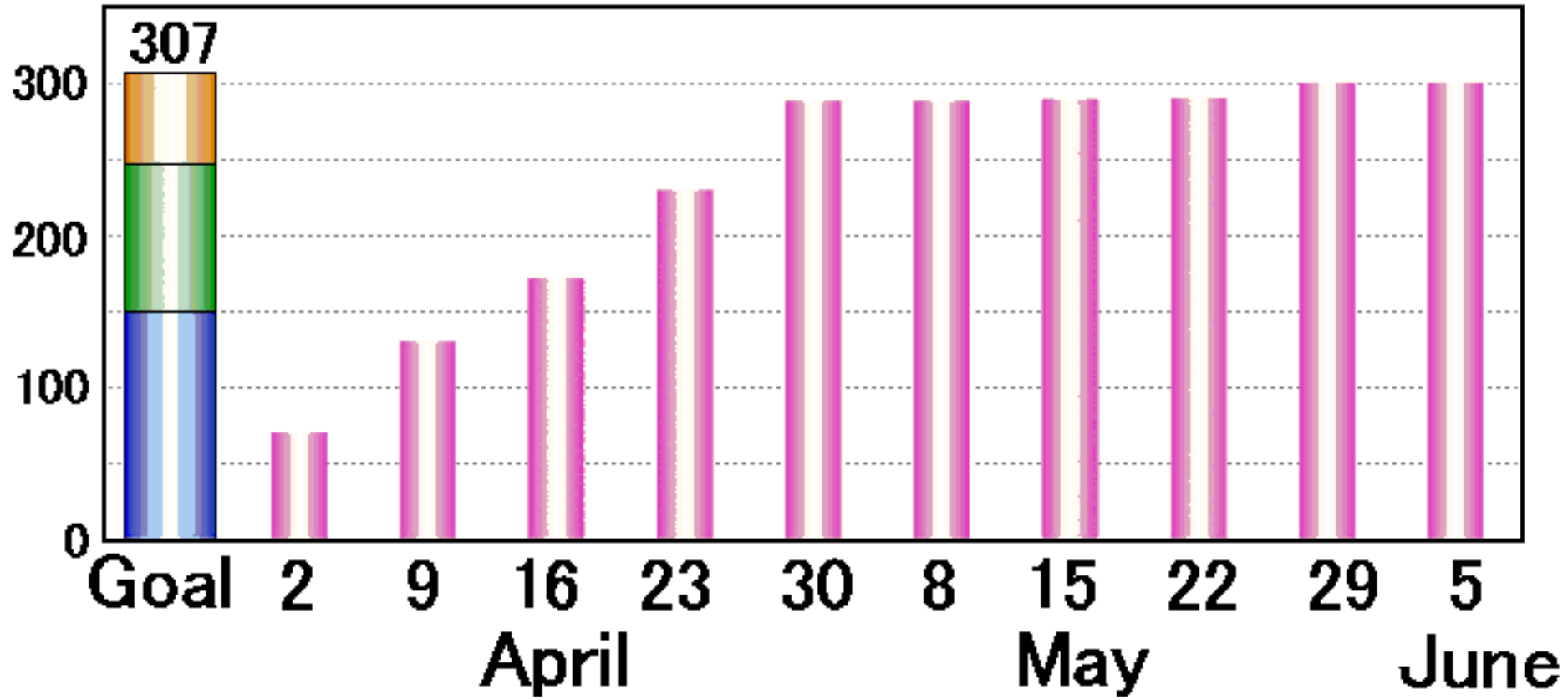
Great East-Japan Earthquake Service Area Restoration Status



NTT DoCoMo's website
http://www.nttdocomo.co.jp/english/binary/pdf/corporate/technology/rd/technical_journal/bn/vol13_4/vol13_4_096en.pd

Recovered base stations of NTT DoCoMo after the disaster

< Fukushima, Miyagi, Iwate >



Disaster Prevention, Caution Communication System in Japan

1. **Cities, towns and villages disaster prevention administration radio**

2. **LASCOM :Local Authorities Satellite Communications Organization**

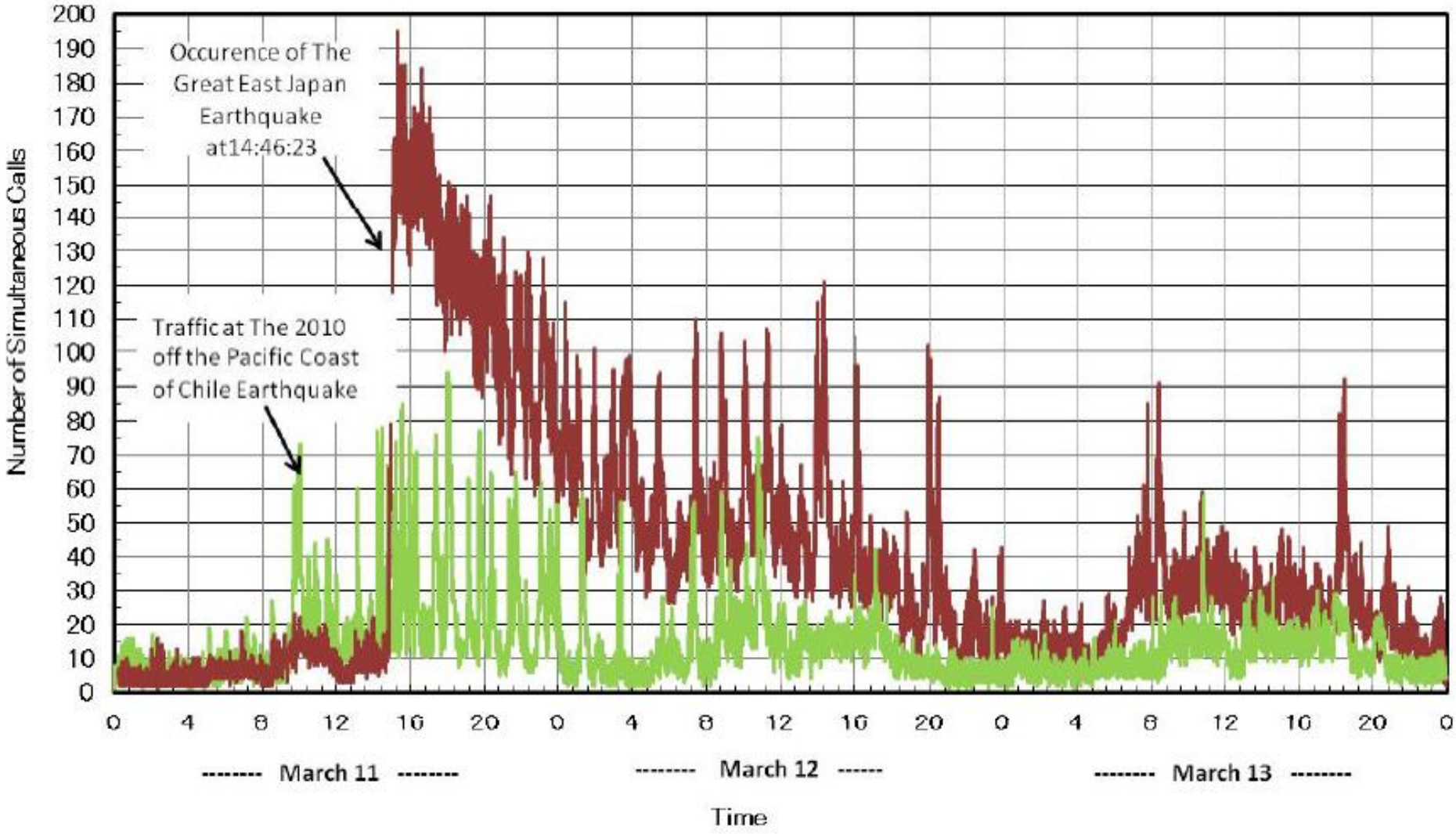
3. **Nuclear Power Plant Satellite Networks**

Inmarsat after March, 2010, such as JAEA, Ministry of Education, Culture, Sports, Science and Technology, a nuclear power plants

4. **J-ALERT** National second warning system

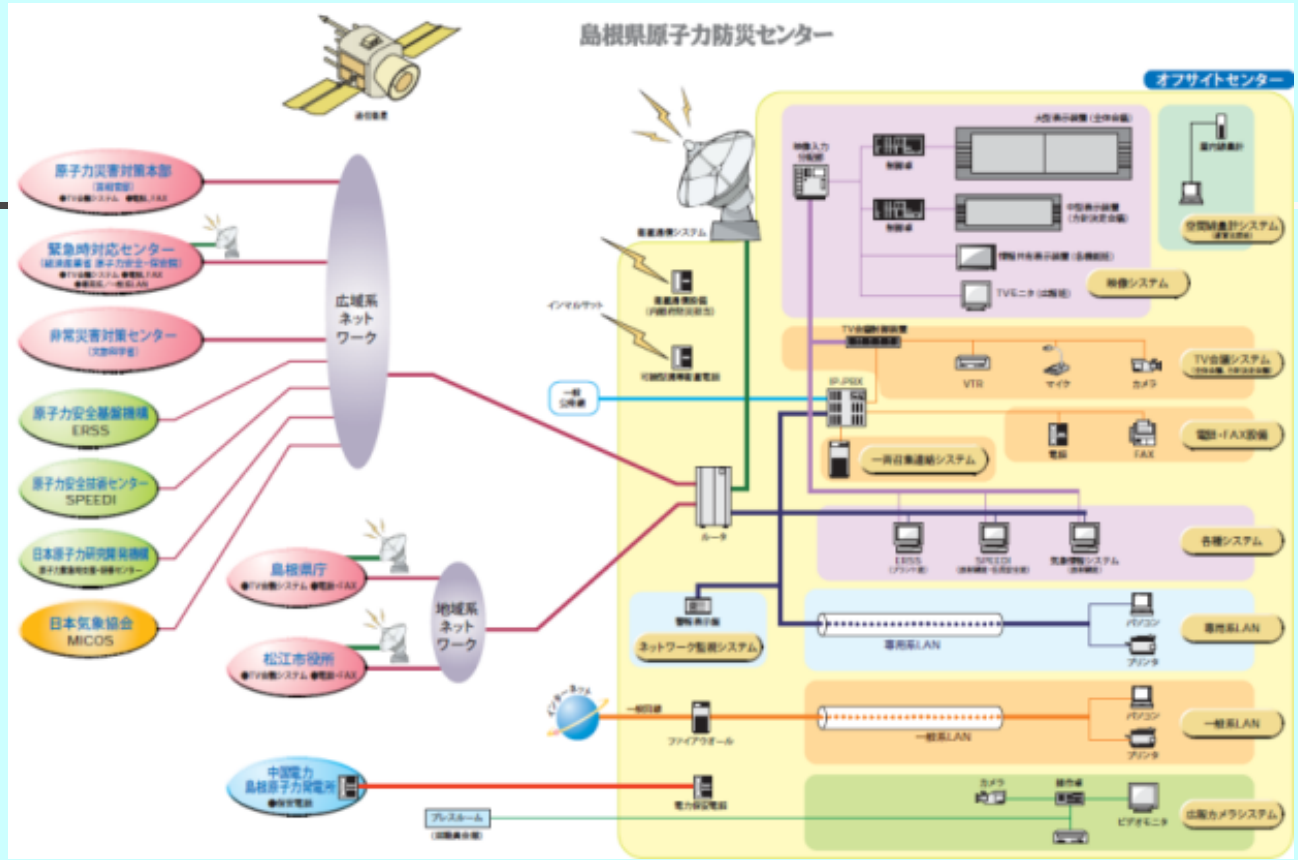
transmits emergency information to the people in case of critical situation

Number of concurrent use of communication channels



This graph represents how much communication has been made at the same time.

Loss of functionality at the Off-site Center



The Off-site Center of the Fukushima Dai-ichi NPS was located about 5km from the Fukushima Dai-ichi site but it could not function as intended.

The Act on Special Measures Concerning Nuclear Emergency Preparedness (“Nuclear Emergency Preparedness Act”) and the Nuclear Emergency Response Manual of the Government stipulate that once a nuclear accident occurs, a local nuclear emergency response headquarters (“local NERHQ”) shall be established close to the accident site, as the center of the emergency response coordination. A local NERHQ is to be located at a local standing facility for emergency responses and measures (“Off-site Center”).

Trouble of the circuit of the SPEEDI

SPEEDI :Prediction of Environmental Emergency Dose Information

The Network System for Prediction of Environmental Emergency Dose Information (SPEEDI) is expected to play an important role in protecting local population from radiation exposure and the planning of evacuation.

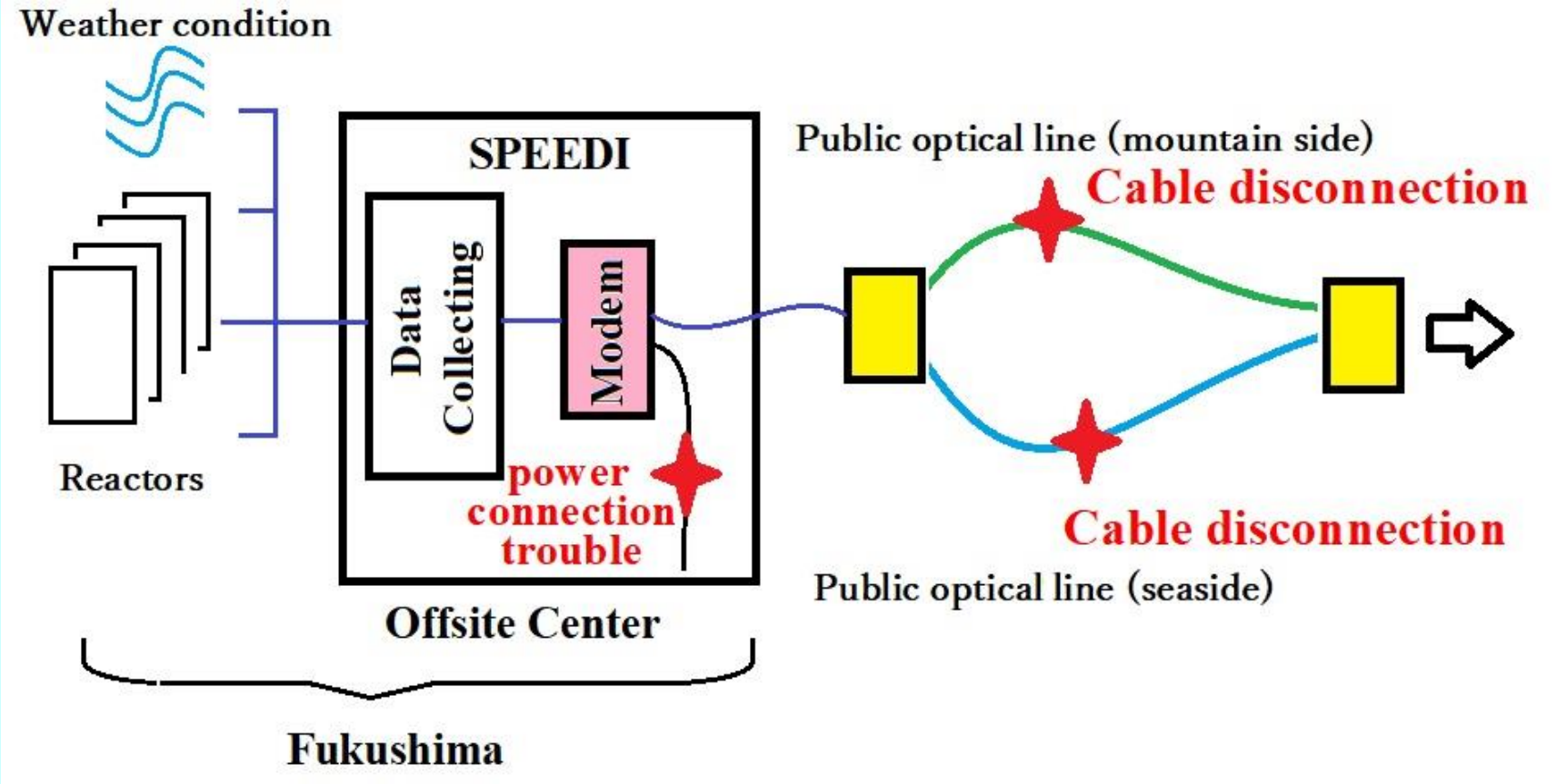
However, the system was not utilized when evacuation was instructed.

The communication links were **disrupted for 2 months** and inoperative due to the earthquakes, and the SPEEDI could not receive the basic source term information of released radioactivity.

It was therefore not possible for the SPEEDI to estimate atmospheric dispersion of radioactive materials on the basis of the basic source term information.

Trouble of the circuit of the SPEEDI

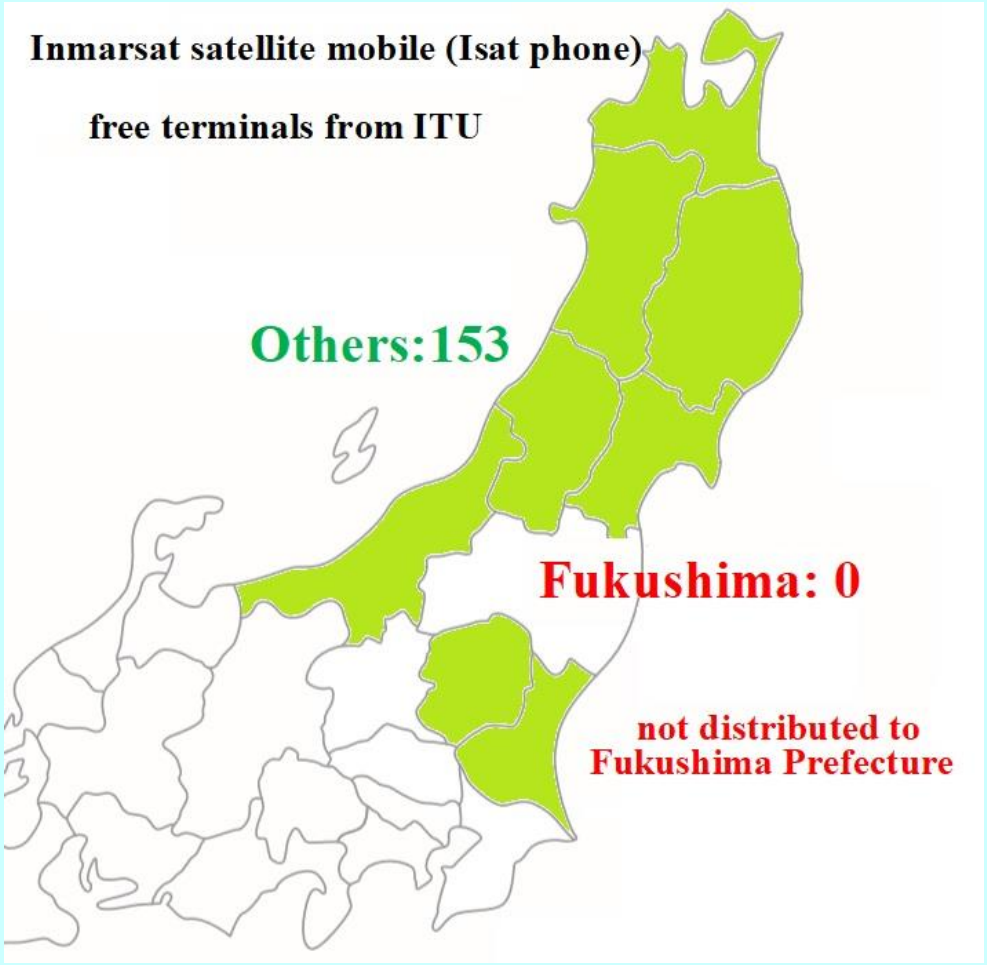
SPEEDI :Prediction of Environmental Emergency Dose Information



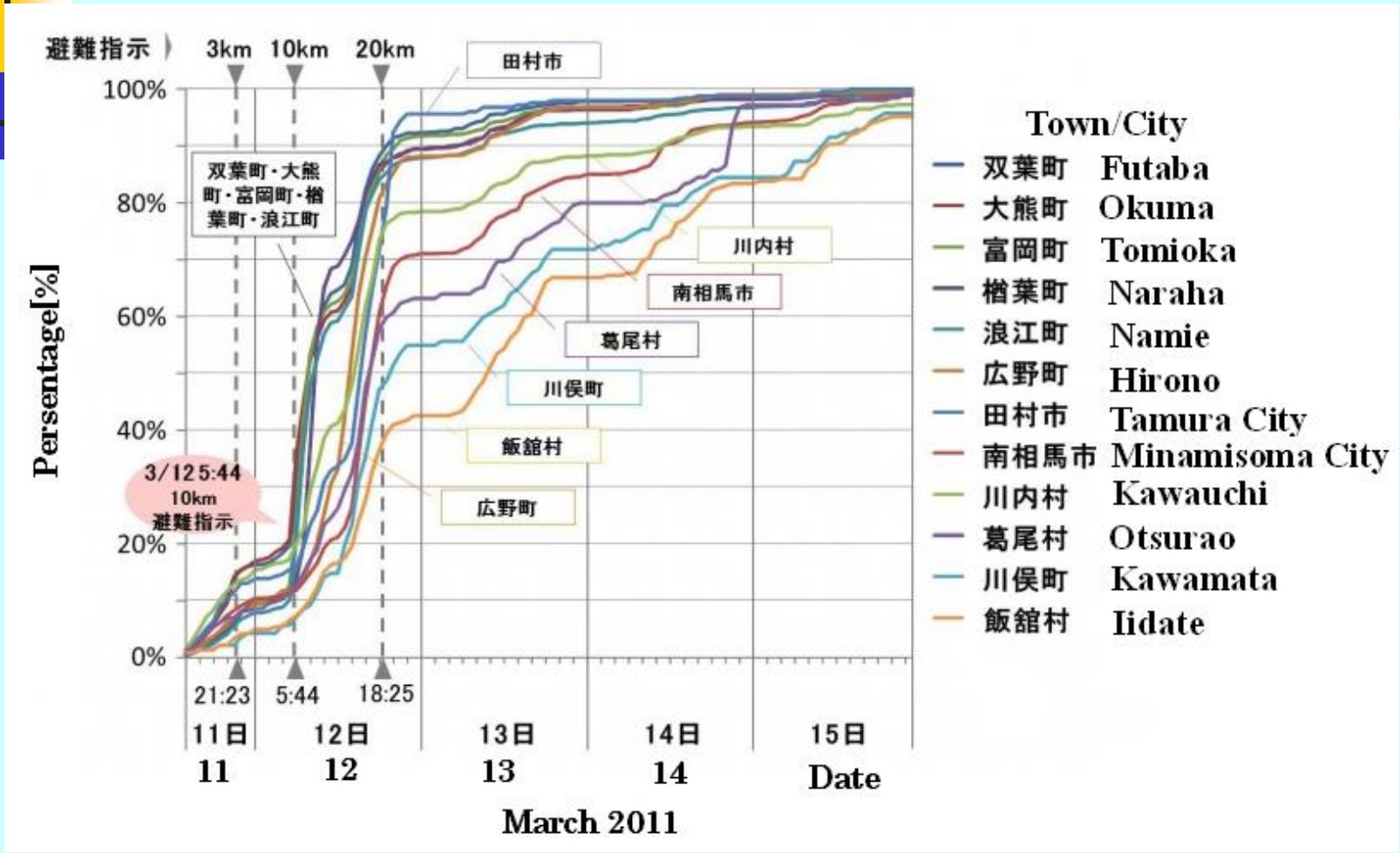
ITU Inmarsat mobile phone

153 terminals for free

Why? Not distributed in Fukushima

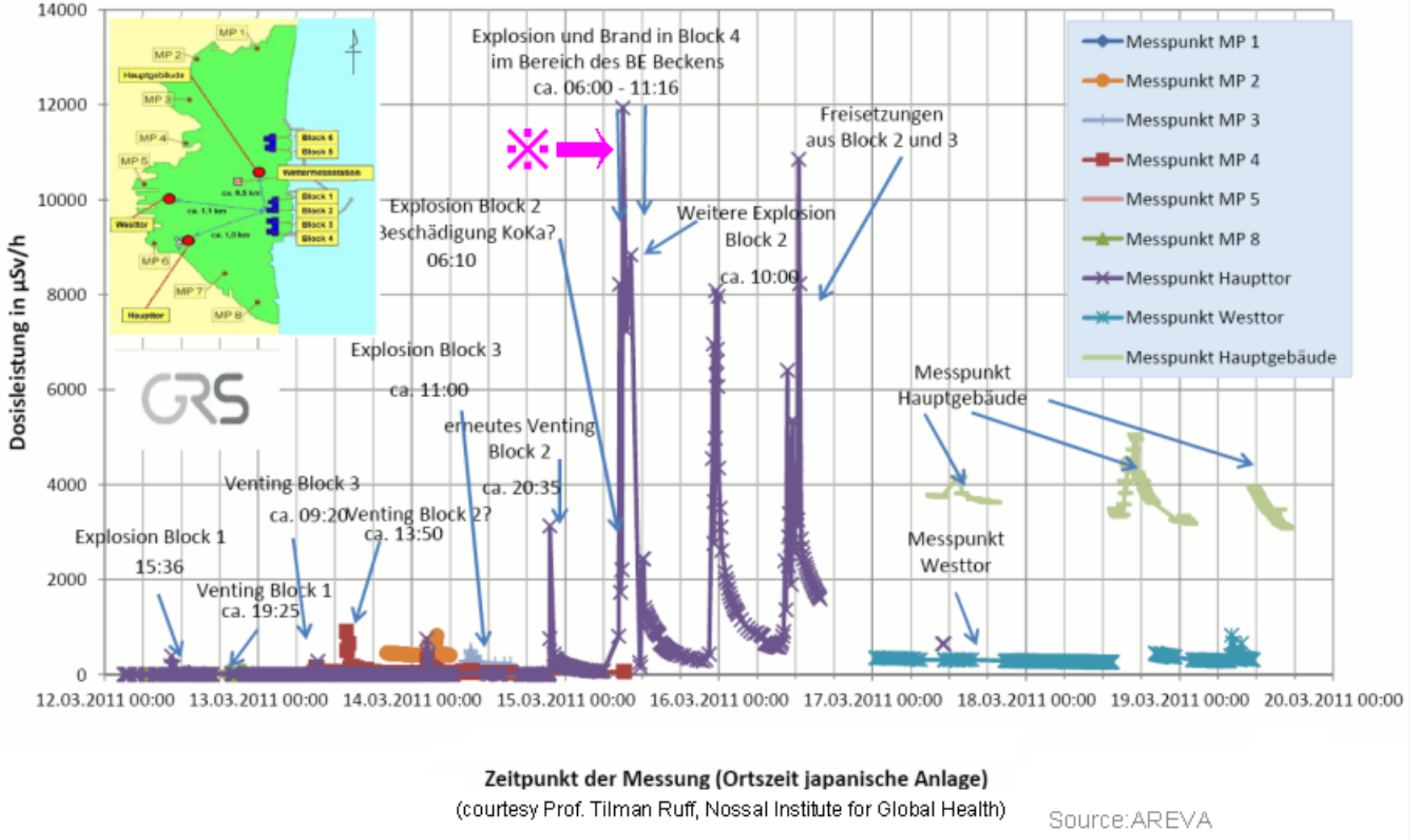


Delay of an evacuation directive and the evacuation order



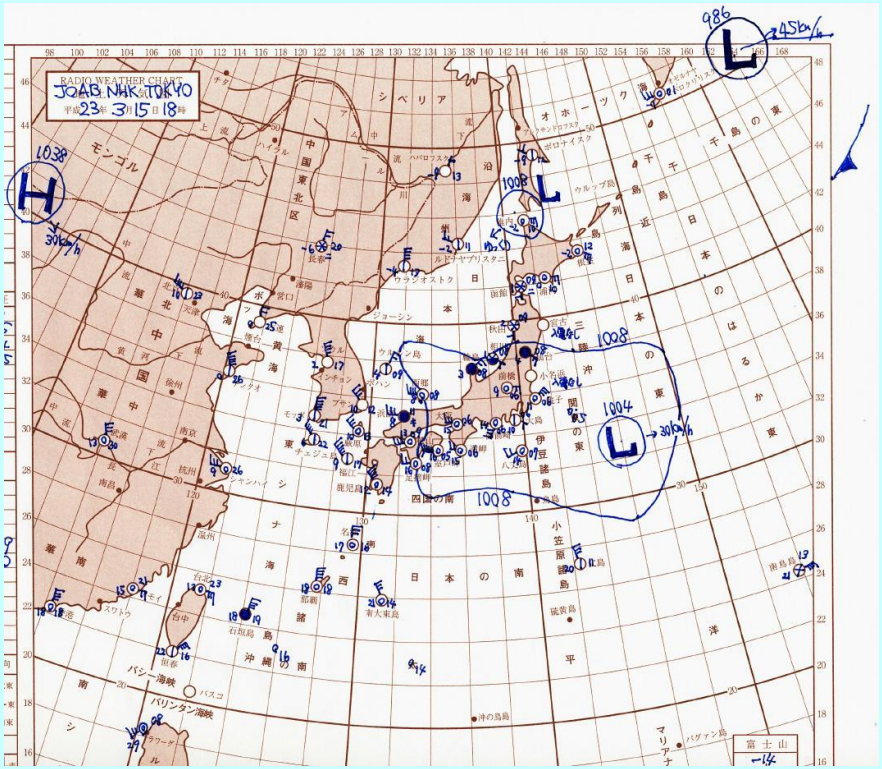
Information was delay in the outside of the concern area where a nuclear power plant was located. These inhabitants failed to get out in time and received useless radiation exposure.

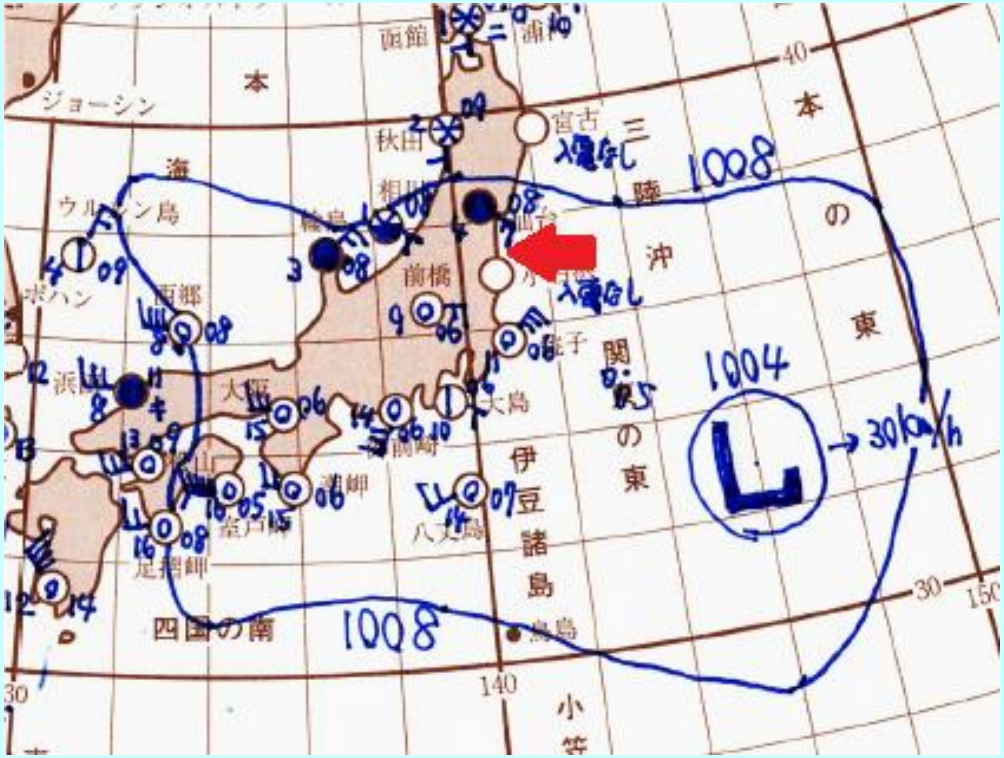
Radiation releases, 11-20 March 2011



(courtesy Prof. Tilman Ruff, Nossal Institute for Global Health)

Dictation Notice of Weather Map
by NHK AM Radio on March 15, 2011





Stable Iodine after Fukushima

1. Regrettably, the Government did not give prompt orders for administering stable iodine after the nuclear accident. Even though some municipal authorities had stocks of stable iodine, they were not distributed. Some municipalities, such as Futaba and Tomioka, distributed stable iodine without orders from the Government.
2. The decision to administer stable iodine had been delayed because of apprehension of potential harmful side effects that iodine prophylaxis could cause. However, it is an accepted position in radiological medicine that even where the absorbed dose is less than 100mGy, stable iodine should be administered, as it does not entail any significant health hazards.

Conclusions
Disaster Communications and Medicine

- The gateway stations for Mobile phone were unable to function.
- Even the mayor of the district concerned knew the evacuation advisory to hear via only police radio for the first time.
- Many residents of Fukushima were intellect and ignorant of the order of " the Final Decision :evading“ Therefore **the exposure doses of many inhabitants increased.**
- Communication was insufficient, and **stable iodines were not able to be given to inhabitants.**

Nakajima's Personal Impression

1. The risk of nuclear power plant accident is similar to a Formula 1(racing car) running at full speed on a public road without brakes. It has to crash.

2. Whatever politicians or the Government said, they were only lies.

3. They learned absolutely nothing even after the nuclear disaster.

4. Nuclear sector can't go on just doing business as usual, may be all over the world.