

What should we learn from Fukushima?

World Nuclear University Summer Institute

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Failure Science?



--- Professor H. Hatamura ---

The NPO, Association for **the Study of Failure** offers methodologies to **prevent accidents or failures that may lead to economic loss or threaten human lives**, by conducting activities including education, organizing conferences, consultation, and broadcasting information through the INTERNET for citizens, corporations, administration and educational institutes.

Integrated science of engineering, management, ...

CA : Cause Analysis
FP : Failure Prevention
KD : Knowledge Distribution

What took place on March 11, 2011



- **14:46 The 2011 East Japan Earthquake (M9,0), 130km off the Island**
(even some seismometers were broken)
- **All units in the affected area were safely shut down**
- **15:00 ~ Tsunami hit the land**
maximum 40+m

NHK WORLD
NHK WORLD
各地に被害

仙台 青葉区
午後2時50



along broad areas of the Pacific coast. 23 deaths have been reported. Japan




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- **All units at Fukushima safely shut down**
- **15:00 Tsunami hit the land**
- **15000+ killed, 8000+ missing as of 17 June**

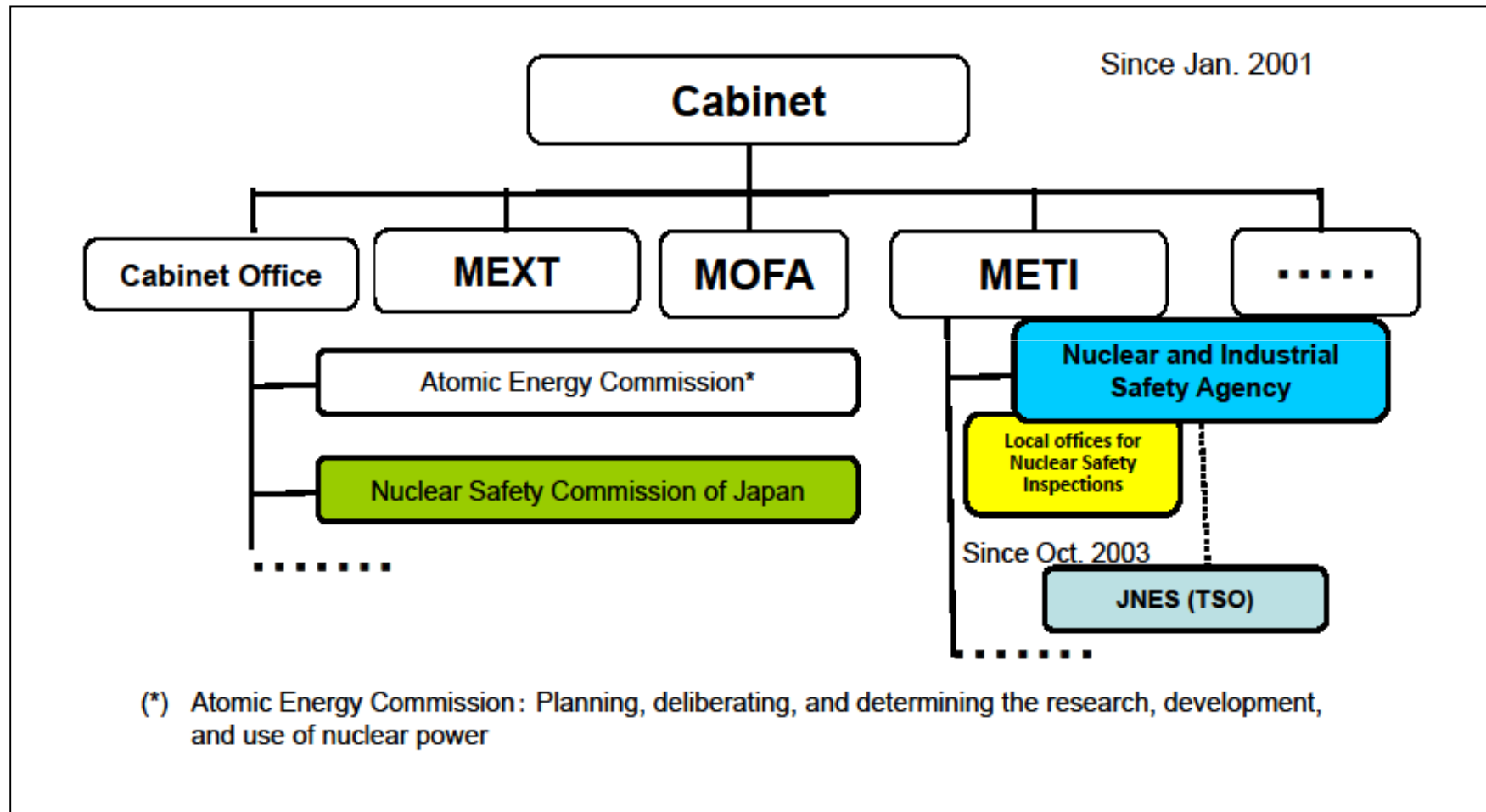
国内観測中上島十 M&R
NHK WORLD
大津波警報 各地に被害

岩手 久慈
午後3時すぎ

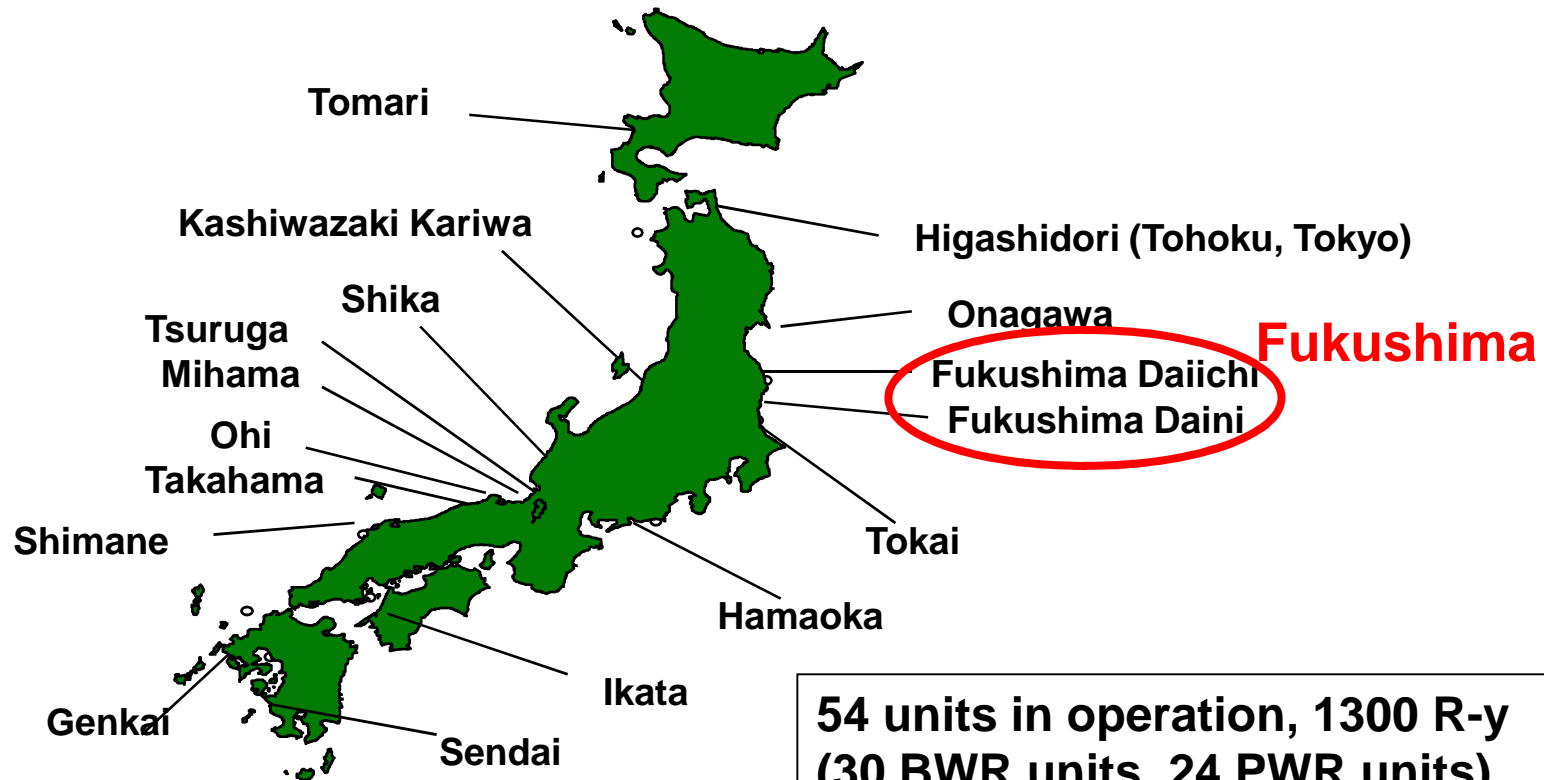
Taiwan in Jap  established telephone helplines exclusively for their nationals after Friday's major



FYI: Existing Nuclear Regulatory Body



FYI: Existing Nuclear Power Stations

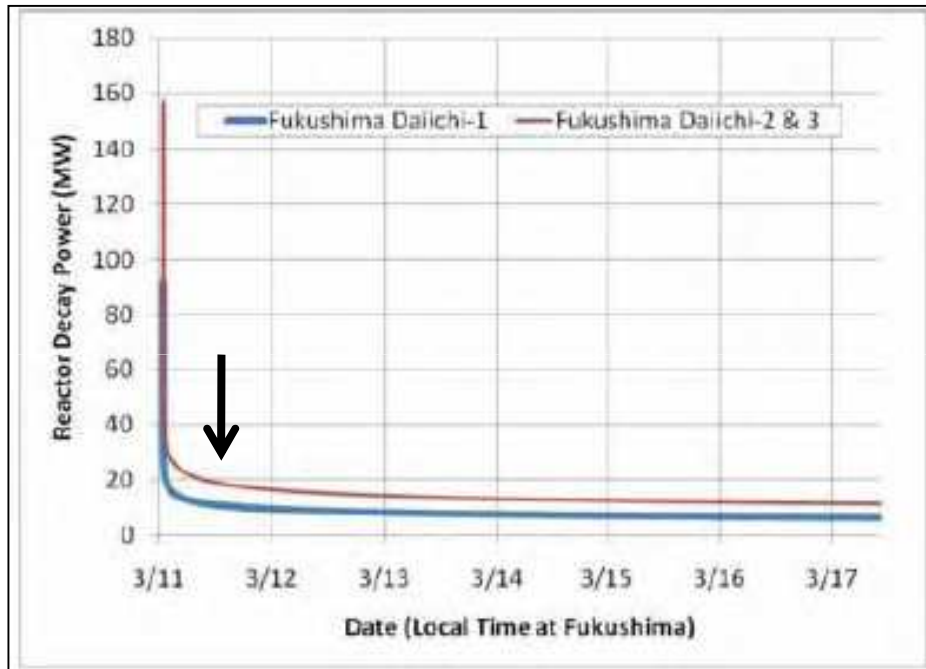


**54 units in operation, 1300 R-y
(30 BWR units, 24 PWR units)
Total Capacity: ~50GW, 20%
Share in total generation : 30%**

FYI: Status of Fukushima at the Earthquake

Unit	At the Earthquake
Daiichi (1F) Unit 1	In operation → Automatic shutdown
1F Unit 2	In operation → Automatic shutdown
1F Unit 3	In operation → Automatic shutdown
1F Unit 4	Outage
1F Unit 5	Outage
1F Unit 6	Outage
Daini (2F) Unit 1	In operation → Automatic shutdown
2F Unit 2	In operation → Automatic shutdown
2F Unit 3	In operation → Automatic shutdown
2F Unit 4	In operation → Automatic shutdown

FYI: Estimated residual heat in the reactor



LT	Unit 1	Unit 2&3	%
14:46, 11/3	92.0 MW	156.8 MW	6.60 %
15:30, 11/3	19.1	32.5	1.37
20:00, 11/3	12.8	21.9	0.92
14:46, 12/3	9.1	15.5	0.65
20/3	6.1	10.5	0.46
1/4	5.2	8.8	0.37
1/7	3.7	6.3	0.26
1/10	3.3	5.6	0.23

Rated power: Unit 1: 460MWe (1,380 MW-th), Unit 2&3: 784MWe (2,381MW-th)

FYI: Acronyms

- METI – Ministry of Economy Trade and Industry
- NISA - Nuclear and Industrial Safety Agency
- JAIF - Japan Atomic Industrial Forum Inc.
- JNES – Japan Nuclear Energy Safety Organization

- AM - accident management
- B-DBE - beyond design basis event
- MCR - main control room
- RHR – Residual Heat Removal
- SAM - severe accident management
- SBO - station blackout
- SFP - spent fuel pool
- SPEEDI - System for Prediction of Environmental Emergency Dose Information

Content

- 1. What happened, how it developed?***
- 2. Immediate impacts***
- 3. Government responses and actions to take***
- 4. General discussions***