

# **Lessons Learned from the Fukushima Daiichi Accident, Actions Taken and Challenges Ahead**

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# (1) Establishment of Nuclear Regulation Authority (NRA)

# Impact of Fukushima Daiichi Accident

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Fukushima Daiichi Accident on 11 March, 2011 gave serious impact to the Japanese society, in addition to evacuation, including:

1. Government, licensees and experts lost public trust.
  2. People's attitude toward nuclear energy deeply divided.  
(60% of people against restart of NPPs)
  3. Reform of nuclear regulatory framework/organs was inevitable if Japan was to continue the use of nuclear energy.
- ✓ The Investigation Commission of the National Diet pointed out “Collusion” and “Regulatory Capture” of regulatory bodies as fundamental causes of the accident.
  - ✓ Harsh discussion took place between the ruling and opposition parties in the National Diet in 2012 regarding nuclear energy.

# Change in Regulatory Framework

## Structural defects before Fukushima Daiichi Accident

- ✓ Regulatory and promotional sections in the same ministry
- ✓ Different competent ministries for different types of facilities such as power reactors and research reactors
- ✓ “Double-checking” system made the regulatory responsibility rather ambiguous.
- ✓ Safety, security and safeguards under different jurisdictions



## New direction based on lesson learned from the accident

- ✓ Clear separation of regulation from promotion
- ✓ Integration of regulatory functions on all nuclear facilities and radiation sources.
- ✓ Integration of all nuclear regulatory functions; “3S”.



# Act for Establishment of NRA in 2012



The ruling and opposition parties had come to an agreement on the regulatory system bill after long discussions at the Diet and the bill was enacted on June 2013.

## 1. Independent and Integrated Commission (Article 3 Authority)

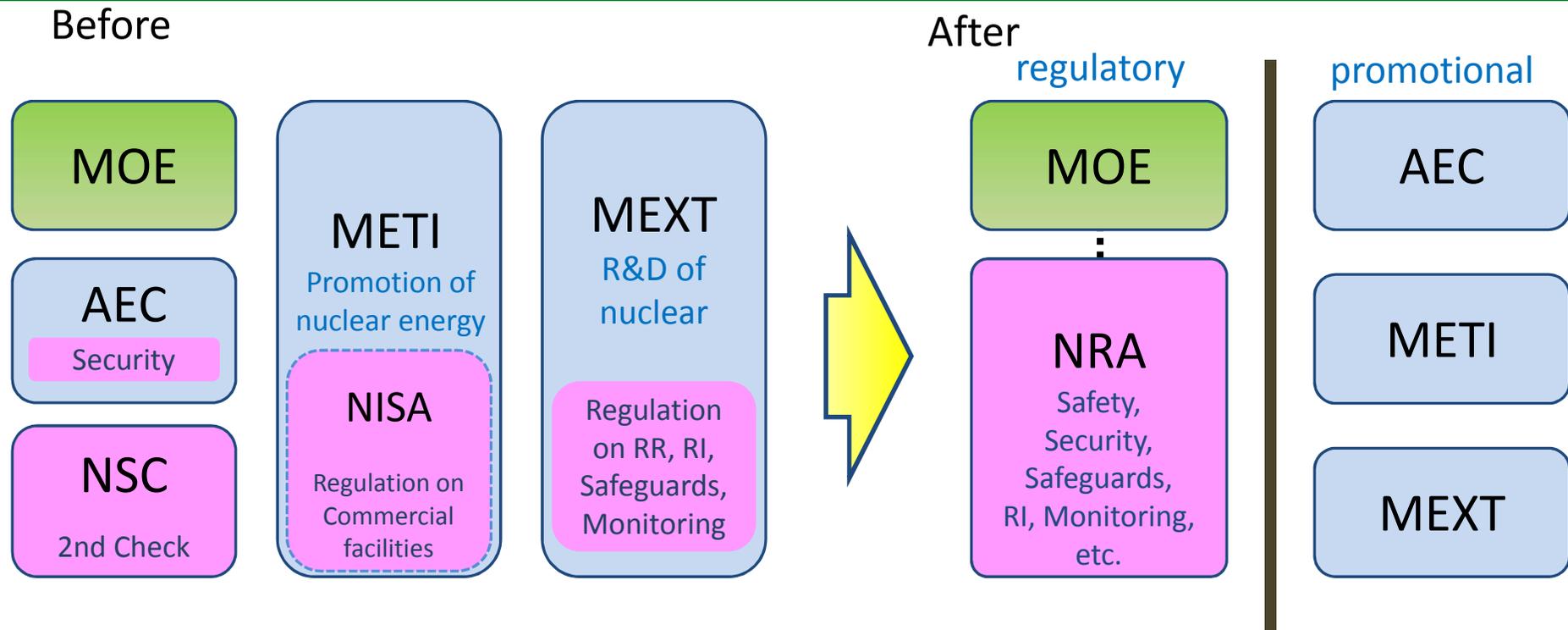
- ✓ Clear **separation of regulation** from promotion as an external organ of the Ministry of the Environment.
- ✓ **Integration of various authorities** from several organizations.

## 2. Drastic Amendments of Relevant Acts and Regulations

- ✓ Development of **new regulatory requirements**
- ✓ Introduction of **“back-fitting”** system
- ✓ Introduction of **40-year operating period**  
(Extension possible up to 20 years once.)
- ✓ Prohibition of staff rotation to promotional side (**“No-return rule”**)



# Independence and Integration



- AEC : Atomic Energy Commission
- METI : Ministry of Economy, Trade and Industry
- MEXT : Ministry of Education, Culture, Sports, Science and Technology
- MOE : Ministry of the Environment
- NISA : Nuclear and Industrial Safety Agency (abolished)
- NSC : Nuclear Safety Commission (abolished)

# NRA's Core Values and Principles

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## ■ Mission

Our fundamental mission is to protect the general public and the environment through rigorous and prudent regulations of nuclear activities.

## ■ Guiding Principles for Activities

- (1) Independent Decision Making
- (2) Effective Actions
- (3) Open and Transparent Organization
- (4) Learning and Commitment without Complacency
- (5) Agile Response to Emergency

## ■ Integrated Management System

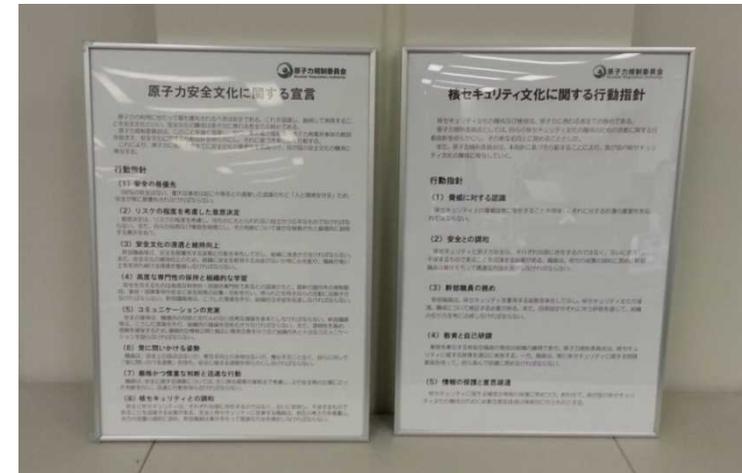
Started implementation in April, 2015.

# Fostering Safety and Security Culture



## ■ The Statement on Nuclear Safety Culture (in May 2015)

1. Priority to safety
2. Risk awareness and decision-making
3. Fostering, sustaining and strengthening safety culture
4. Learning organization
5. Communication
6. Questioning attitude
7. Rigorous and prudent judgment and action with agility
8. **Harmonization with nuclear security**



## ■ The Code of Conduct on Nuclear Security Culture (in Jan. 2015)

1. Awareness of a threat
2. **Harmonization with nuclear safety**
3. Initiative of senior management
4. Education and self improvement
5. Protection of information and communication

## (2) New Regulatory Requirements for Nuclear Facilities

# New Requirements Based on Lessons Learned

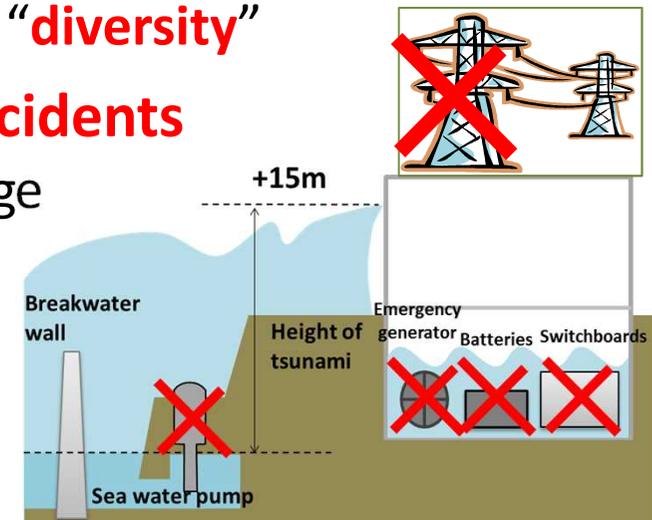


- Large scale **common cause failures** due to extreme natural hazards led to long lasting **SBO / LUHS**, resulting in **severe accidents**.



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



# Comparison between Previous and New Requirements

<Previous requirement>

<New requirement>

Design basis to prevent severe accidents  
(Confirm that a single failure would not lead to core damage)

Fire protection
Reliability of power supply
Function of other SSCs*
Natural phenomena
Seismic / Tsunami resistance

4<sup>th</sup> Layer  
of DiD\*

3<sup>rd</sup> Layer  
of DiD

Response to intentional aircraft crash
Suppression of radioactive materials dispersal
Prevention of CV failure & large release
Prevention of core damage (Postulate multiple failures)
Internal flooding (New)
Fire protection
Reliability of power supply
Function of other SSCs
Natural phenomena (Volcano, Tornadoes, Forest fire: New)
Seismic / Tsunami resistance

(Against SA\* & Terrorism) Reinforced & New  
& New  
& New

# Measures against Tsunamis



## ■ Accurate Evaluation Method on Earthquake and Tsunami ; Particularly Enhanced Tsunami Measures

More stringent standards on  
Tsunami



Define “Design Basis Tsunami” that exceeds the largest in the historical records and require to take protective measures such as breakwater wall based on the design basis tsunami

Enlarged application of higher  
seismic resistance

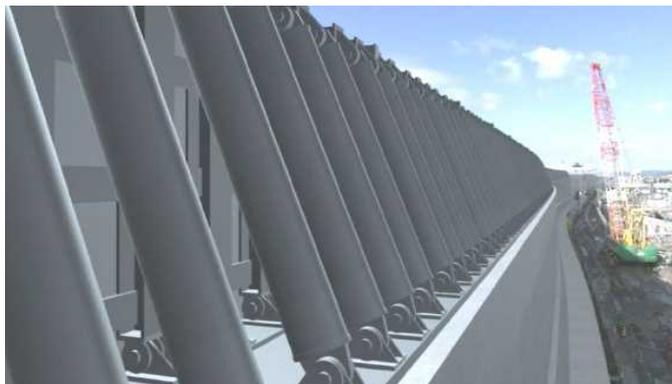


SSCs for Tsunami protective measures are classified as Class S equivalent to RPV\* etc. of seismic design importance classification

\*RPV: Reactor Pressure Vessel

< Example of tsunami countermeasures (multiple protective measures) >

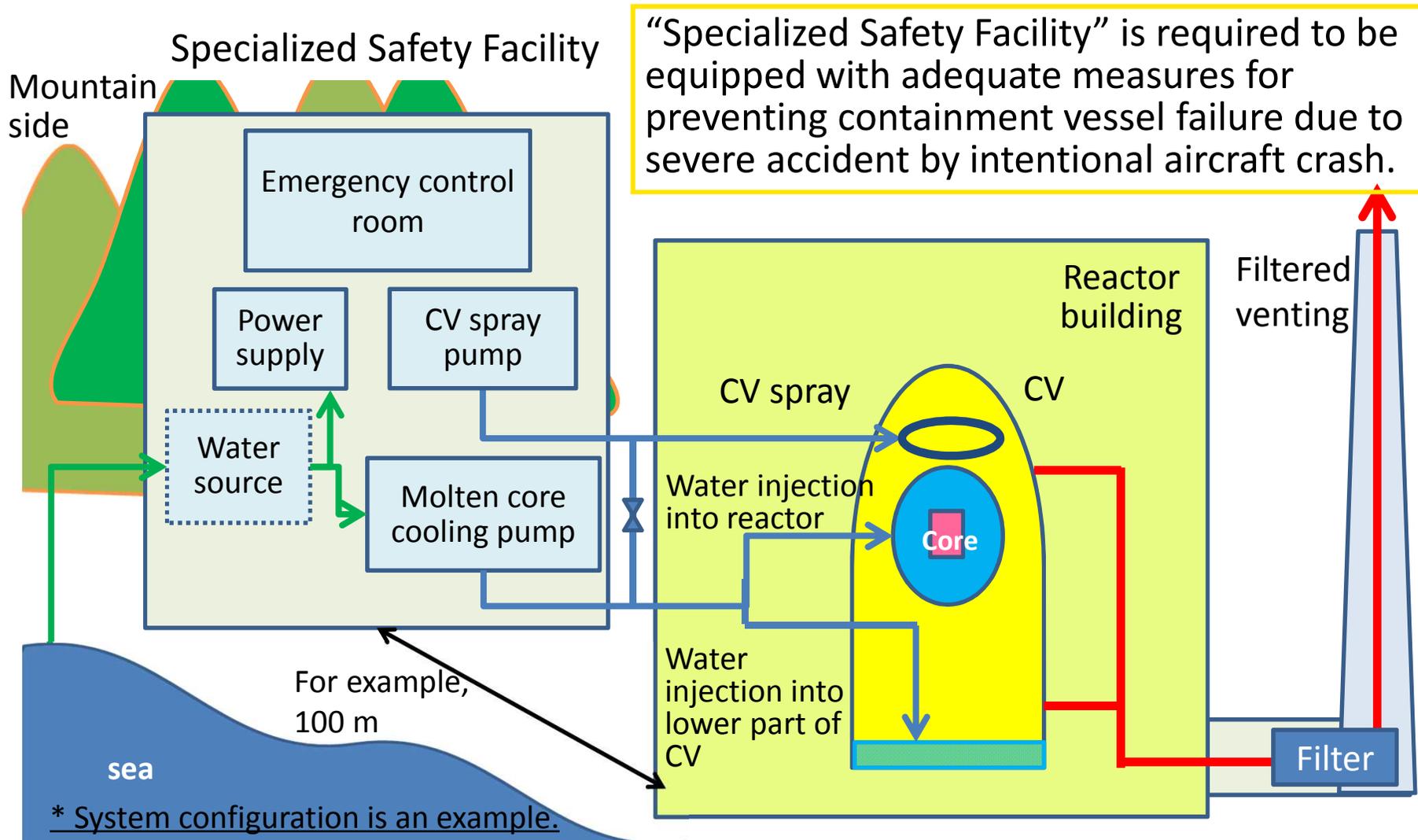
Breakwater Wall  
(prevent inundation to the site)



Tsunami Guard  
(prevent water from flowing into the building)



# Measures against Intentional Aircraft Crash, etc.



For BWR, one filtered venting for prevention of containment failure and another filtered venting of Specialized Safety Facility are acceptable solution.

# Summary of New Regulatory Requirements



- Place emphasis on **defense-in-depth** concept
- Assess and enhance protective measures against **extreme natural hazards**
- Take measures against **severe accidents** and **terrorism**
- Eliminate **common cause failures**
- Make much account of “**diversity**”, shifting from “redundancy centered”



# Status of Conformity Reviews



A total of **16** PWRs and **10** BWRs have filed application, out of which **five** PWRs received the NRA's permission for changes in reactor installation. Among them, **two** PWRs restarted.

As of April, 2016

		Permission for Changes in Reactor Installation	Approval of Plan for Construction Works	Approval of Operational Safety Programs	Inspection
Sendai	Unit 1	Sept. 2014	Mar. 2015	May 2015	Completed Sept. 2015
	Unit 2	Sept. 2014	May 2015	May 2015	Nov. 2015
Takahama	Unit 3	Feb. 2015	Aug. 2015	Oct. 2015	Completed Feb. 2016
	Unit 4	Feb. 2015	Oct. 2015	Oct. 2015	Ongoing
Ikata	Unit 3	July 2015	Mar. 2016	Under Review	Ongoing

## 2. Challenges Ahead: Outcome of IRRS Mission

# IRRS Mission in Japan : 11th-22th, Jan. 2016



*Team Leader : Philippe Jamet*

(Commissioner of the Nuclear Safety Authority (ASN) of France)

*Deputy Team Leader : Carl-Magnus Larsson*

(Chief Executive Officer, Australian Radiation Protection and Nuclear Safety Agency)

*Team Coordinator : Gustavo Caruso*

(Director of the Office of Safety and Security Coordination, IAEA )



# Good practices



- The swift establishment of a legal and governmental framework that supports a new **independent** and **transparent** regulatory body with increased powers.
- NRA's prompt and effective incorporation of lessons learnt from the Fukushima Daiichi accident in the areas of **natural hazards, severe accident management, emergency preparedness** and **safety upgrades of existing facilities**, into Japan's new regulatory framework.

# Recommendations and Suggestions



(Examples)

- The NRA should work to **attract competent and experienced staff**, and **enhance staff skills** relevant to nuclear and radiation safety through education, training, research and enhanced international cooperation.
- Japanese authorities should **amend relevant legislation** to allow NRA to **perform more effective inspections** of nuclear and radiation facilities.
- The NRA and all entities it regulates should continue to **strengthen the promotion of safety culture**, including by fostering a questioning attitude.

# Challenges Ahead



- The final mission report will be provided in around this April, but NRA has already begun to improve regulatory activities on a voluntary basis.

- **Improvement of regulatory inspection**
- **Human resource development** etc.

NRA plans to make the report public.

- NRA will make efforts to further enhance nuclear safety and security in Japan through IRRS Follow-up Mission a few years later.



*Thank you for your attention.*

