NRA
Nuclear Regulation Authority

Proposed Regulatory Requirements in Japan

Toyoshi Fuketa
Nuclear Regulation Authority

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Introduction

On February 7, 2013, the Nuclear Regulation Authority submitted a draft gist of new regulatory requirements for preliminary public comment.

Close attention was given to several considerations during the draft preparation; most importantly lessons learned from the TEPCO's Fukushima Dai-ichi accident, IAEA safety standards and guidelines, and international best practices.

Various investigation reports and studies on the accident underlined certain vulnerability and failures in Japan's pre-existing nuclear safety systems, procedures and standards, including a lack of the back-fit system that applies revised standards to existing nuclear reactors. An absence of effective severe accident management measures, vulnerability in countermeasures against earthquakes and tsunamis, and insufficient preparations against common cause failures are examples. These lessons had to be squarely faced in the formulating new requirements.

After the current but preliminary round of public comment, a second round of a public consultation is then envisaged before a formal NRA decision.

Nuclear Regulation Authority

New regulatory organization in Japan

Reform of Nuclear Regulatory Organization

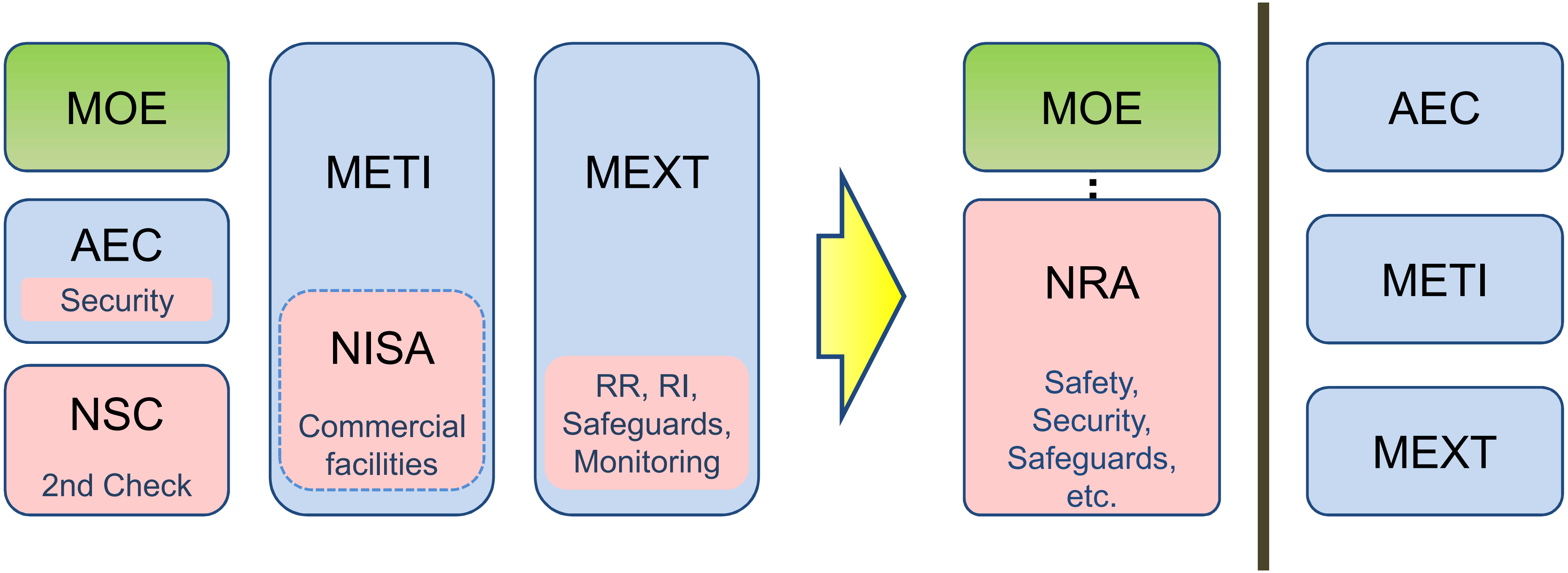
✓ Independence

Separate the functions for nuclear regulation and nuclear promotion, and establish the Nuclear Regulation Authority (NRA) as an independent commission body.

✓ Integration

Integrate nuclear regulation functions regarding safety, security, safeguards, radiation monitoring and radioisotopes regulation into the NRA.

Integrated and Independent



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)

Amendments to the Nuclear Regulation Act
promulgated in June 2012

- ✓ New regulation on severe accidents

  Legally-requested measures to prevent and to mitigate severe accidents.

- ✓ Regulation based on the state-of-the-art information

  Develop new regulatory standards and apply to existing nuclear facilities (backfitting).

  Introduce new systems, e.g. design certification.

- ✓ 40-years operational limit for NPPs

  Legally define the limit to 40 years.

  NRA can permit a less-than-20-years extension.

- ✓ Special regulation to disaster-experienced NPPs

Newly Proposed Regulatory Requirements for Light-Water Nuclear Power Plants

- ✓ Strengthening of Design Basis
- ✓ Severe Accident Measures
- ✓ Enhanced Measures for Earthquake/Tsunami

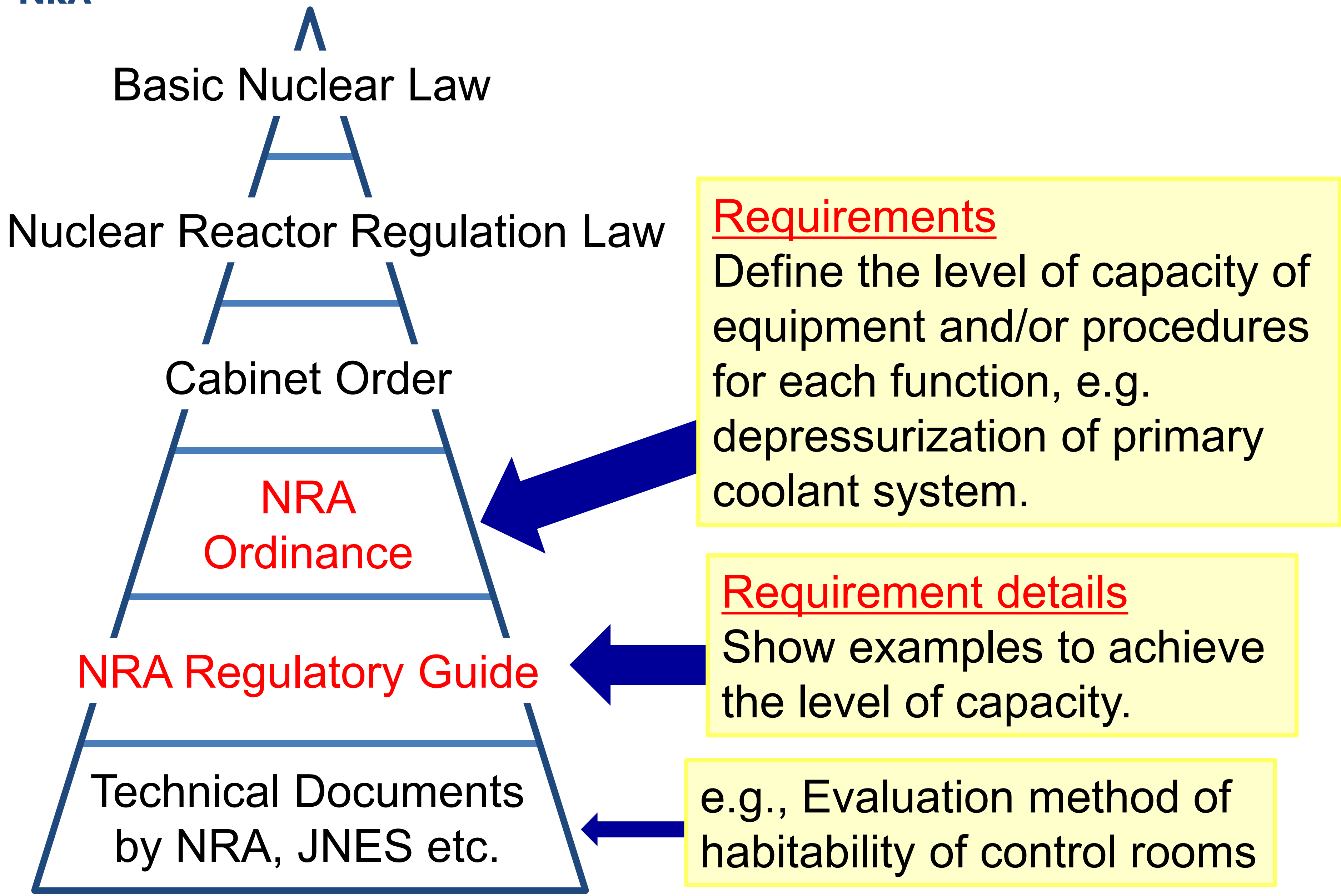
Policy in preparing new requirements

- ✓ Place emphasis on Defense-in-Depth concept
  - Prepare multi-layered protective measures and, for each layer, achieve the objective only in that layer regardless of the measures in the other layers.
- ✓ Eliminate common cause failures
  - Strengthen fire protection and measures against inundation.
  - Reinforce SSCs important to safety (eliminate shared use of passive components, if relied on for a long time).
- ✓ Assess and enhance protective measures against extreme natural hazards
  - Introduce accurate approaches in assessment of earthquake and tsunami and measures against tsunami inundation.
  - Make much account of “diversity” and “independence”, shift from “redundancy centered”.
- ✓ Define “functional” requirements
  - Provide flexibility in choosing acceptable measures.

Against severe accident and terrorism

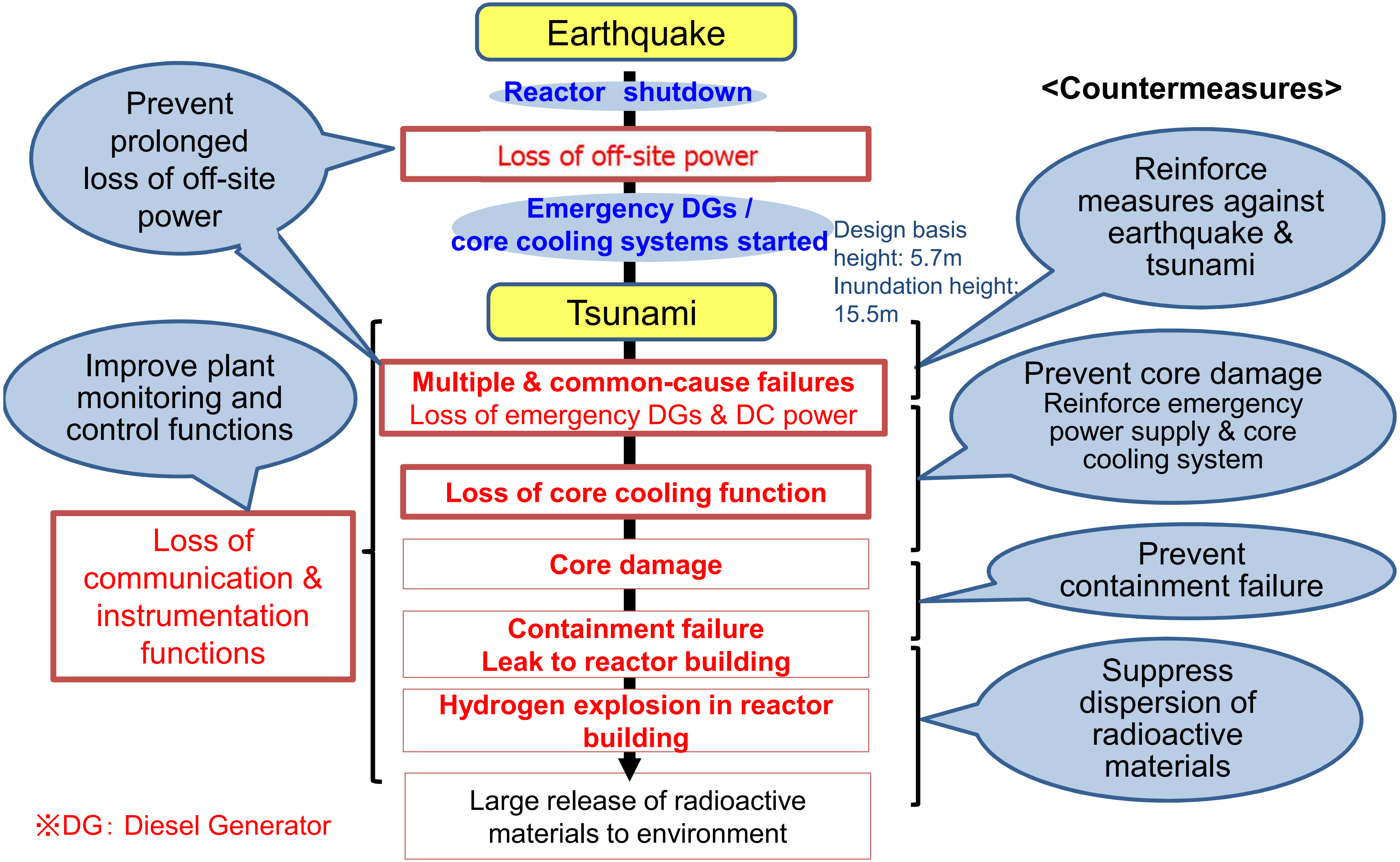
- ✓ Prepare multi-layered protection for “prevention of core damage”, “maintaining containment integrity”, “controlled release by venting”, and “suppression of radioactive materials dispersion”.
- ✓ Use mobile equipment as a base, as in U.S., and enhance reliability with permanent systems/equipment.
- ✓ Enhance protective measures in spent fuel pool.
  - Water level measurement, alternative water supply, spray.
- ✓ Improve command communication and instrumentation.
  - Reinforced seismic-resistance of on-site emergency response center, improved reliability/durability of communication system, enhanced instrumentation including in spent fuel pool.
- ✓ Introduce “Specialized Safety Facility” against intentional aircraft crash.

Structure of NPP Regulation Legislation



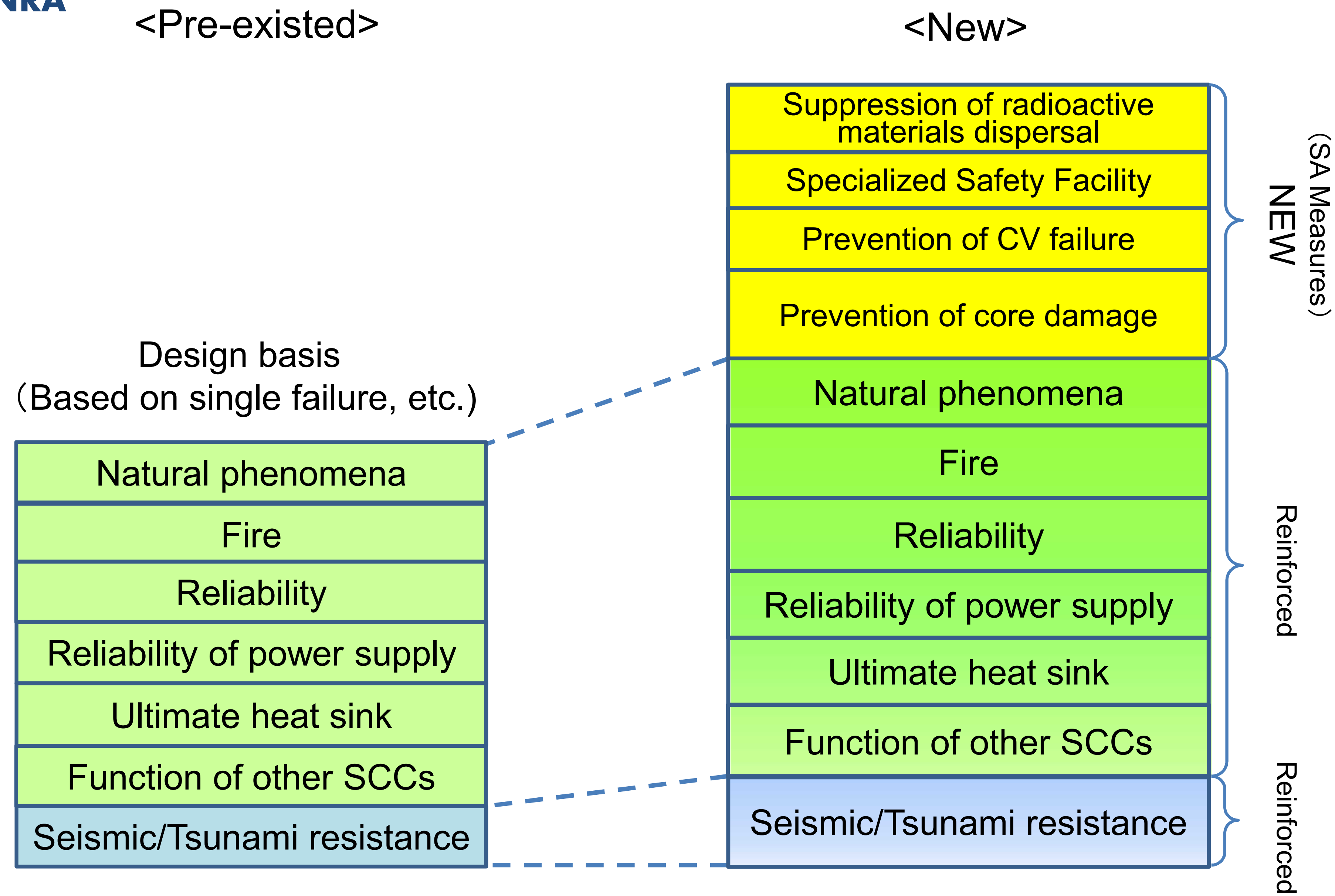
Progression of Fukushima-Daiichi Accident and Countermeasures

<Accident Progression>



※DG: Diesel Generator

Structure of proposed requirements



Strengthening of Design Basis

1) Comprehensive consideration of natural hazards such as volcano, tornado and forest fire in addition to earthquake and tsunami, etc.

2) Reinforcement of fire protection measures

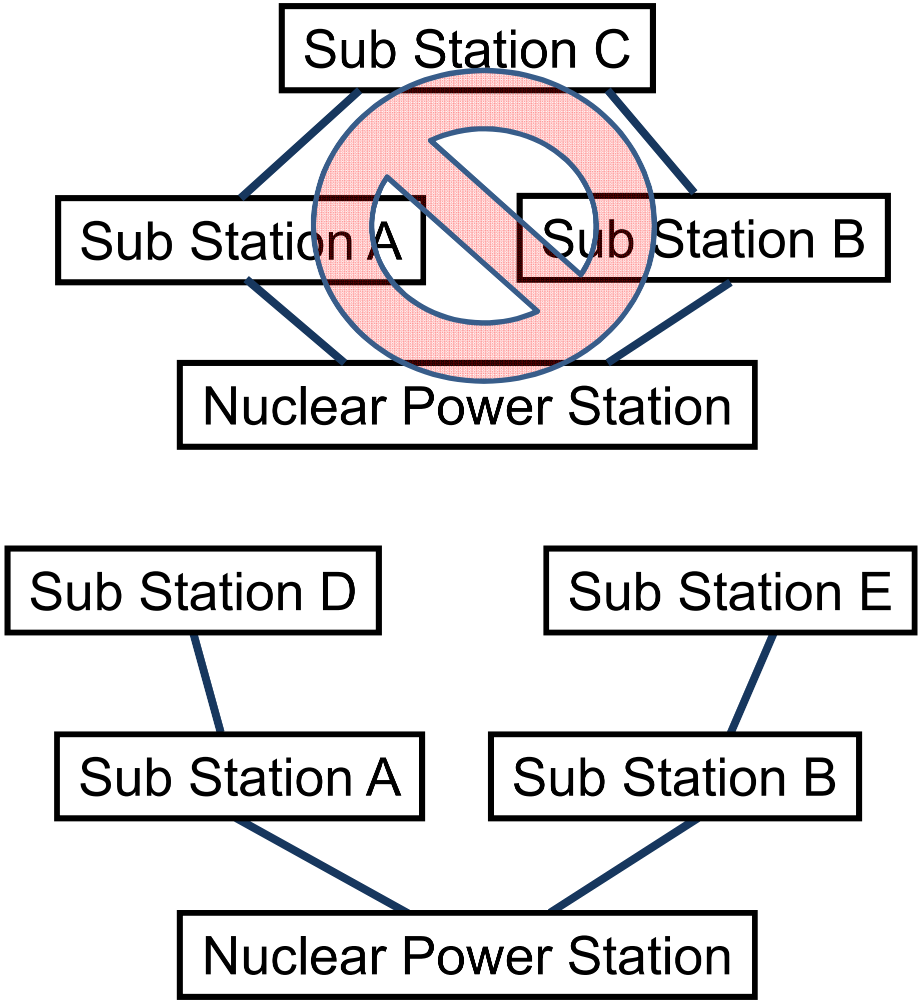
3) Enhanced reliability of SSCs important to safety (Redundancy of piping, if relied on for a long time)

4) Reinforcement of off-site power supply (connection to different substations through multiple lines)

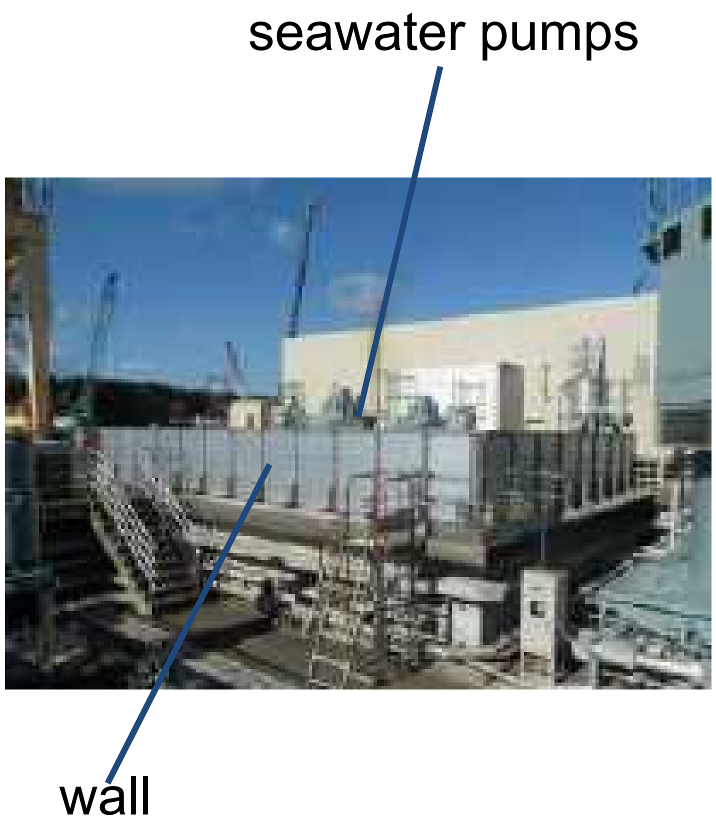
5) Protection of systems for Ultimate Heat Sink (Protection of seawater pumps, etc.)

Examples of Strengthening of Design Basis

4) Reinforcement of off-site power supply (connection to different substations through multiple lines)



5) Protection of systems for Ultimate Heat Sink (Protection of seawater pumps, etc.)



Prevention of Core Damage

Requirements for measures to prevent core damage assuming beyond design-basis accidents

Beyond-DBAs including the followings:

1) ATWS
2) Loss of reactor cooling function (at high pressure)
3) Loss of reactor depressurization function
4) Loss of reactor cooling function (at low pressure)
5) Loss of UHS System
6) Loss of support function (makeup water, power supply)
7) Others identified by IPE and IPEEE

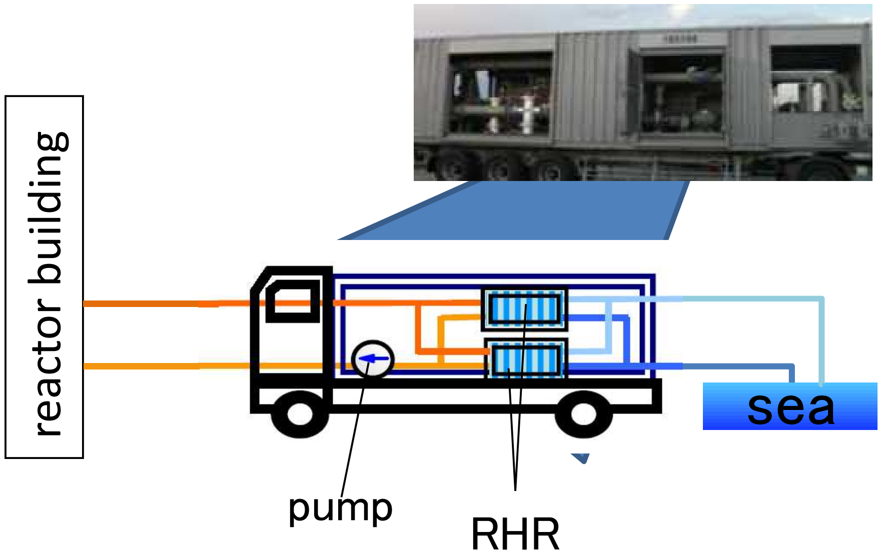
Examples of measures against core damage

5) Loss of UHS System

Alterative UHS System

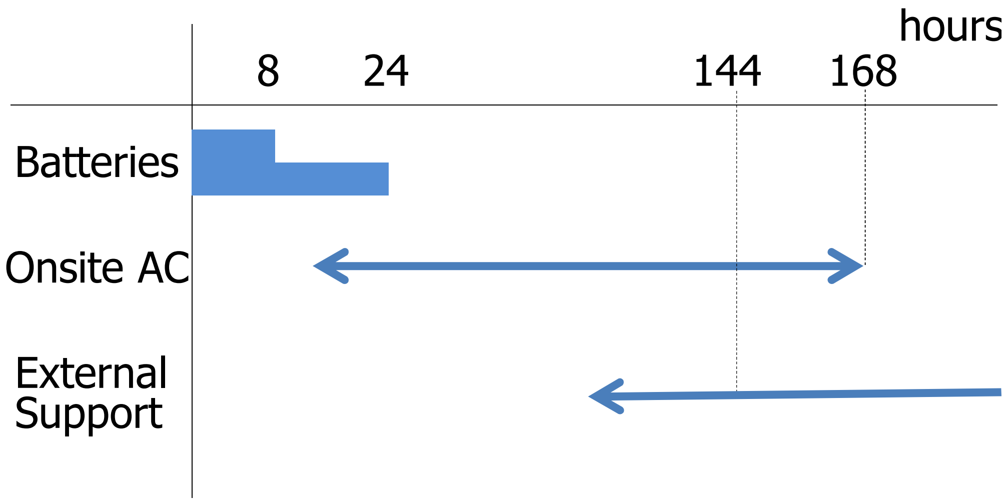
PWR
- ✓ Through main steam relief valves to the atmosphere
- ✓ Sea water injection to RHR-S

BWR
- ✓ Filtered venting system
- ✓ Mobile RHR



6) Loss of support function(SBO)

- ·Batteries(8hours without load shedding + 16hours with load shedding)
- ·Alternative onsite AC power for 7 days
- ·External Support by the 6th day



Alternative onsite AC power (Power Vehicle)

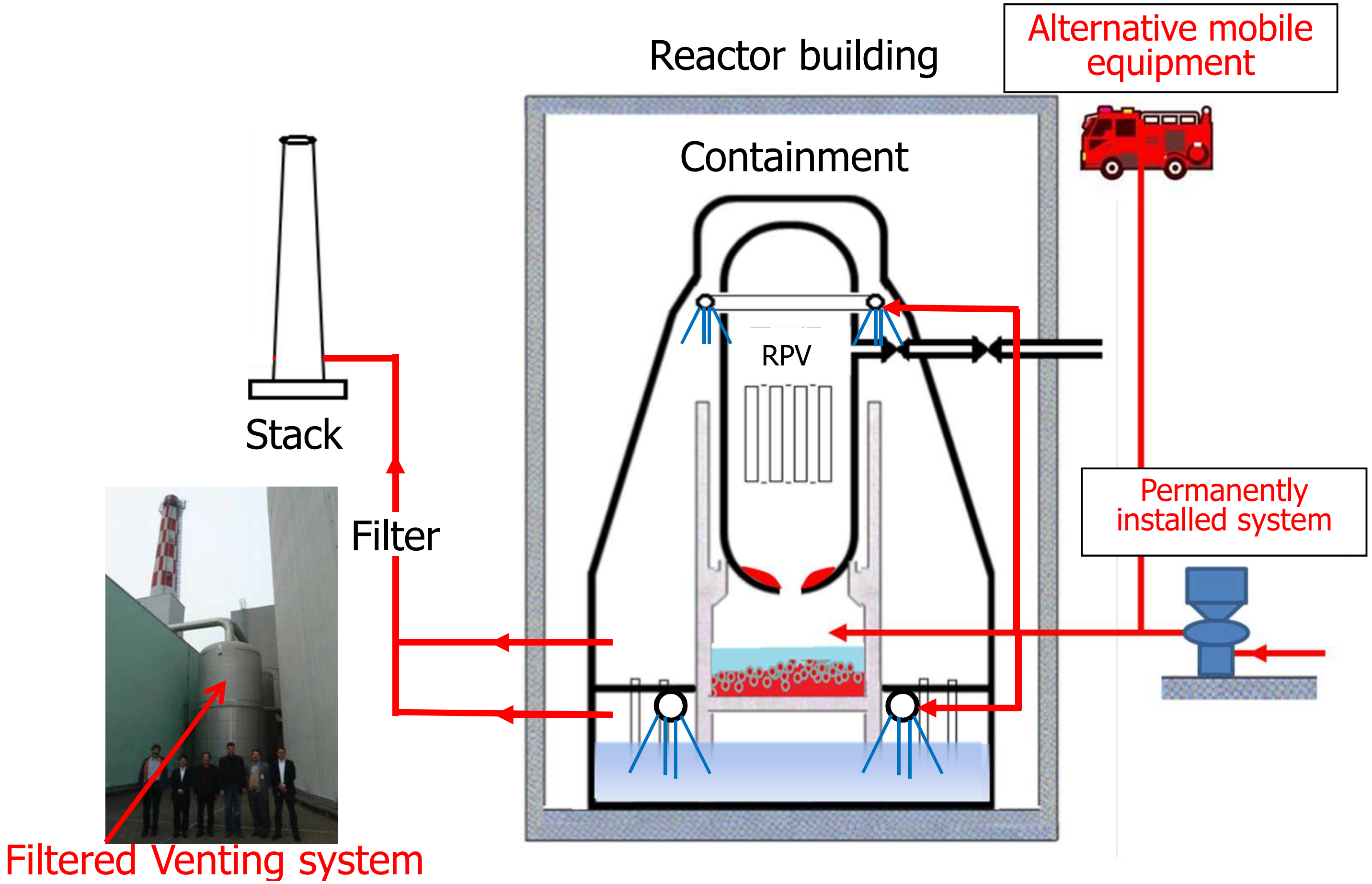
Prevention of Containment Failure

Requirements for measures to prevent containment failure after core damage

1) Cooling and depressurization of CV, reduction of release of radioactive materials (e.g., CV spray))
2) Heat removal from CV and depressurization of CV (e.g., Filtered venting)
3) Cooling of molten core at the bottom of CV and inside RPV (e.g., water injection)
4) Prevention of DCH (e.g., depressurization of RPV)
5) Prevention of hydrogen explosion inside CV (e.g., igniter)

Examples of measures against CV failure (BWR)

1) CV spray to cool and depressurize CV, and reduce release of radioactive materials.
2) Filtered venting to reduce the pressure and temperature inside CV in addition to reducing radioactive materials while exhausting.
3) Water injection system into lower part of CV to prevent CV failure due to molten core (mobile pumps, hoses etc.)



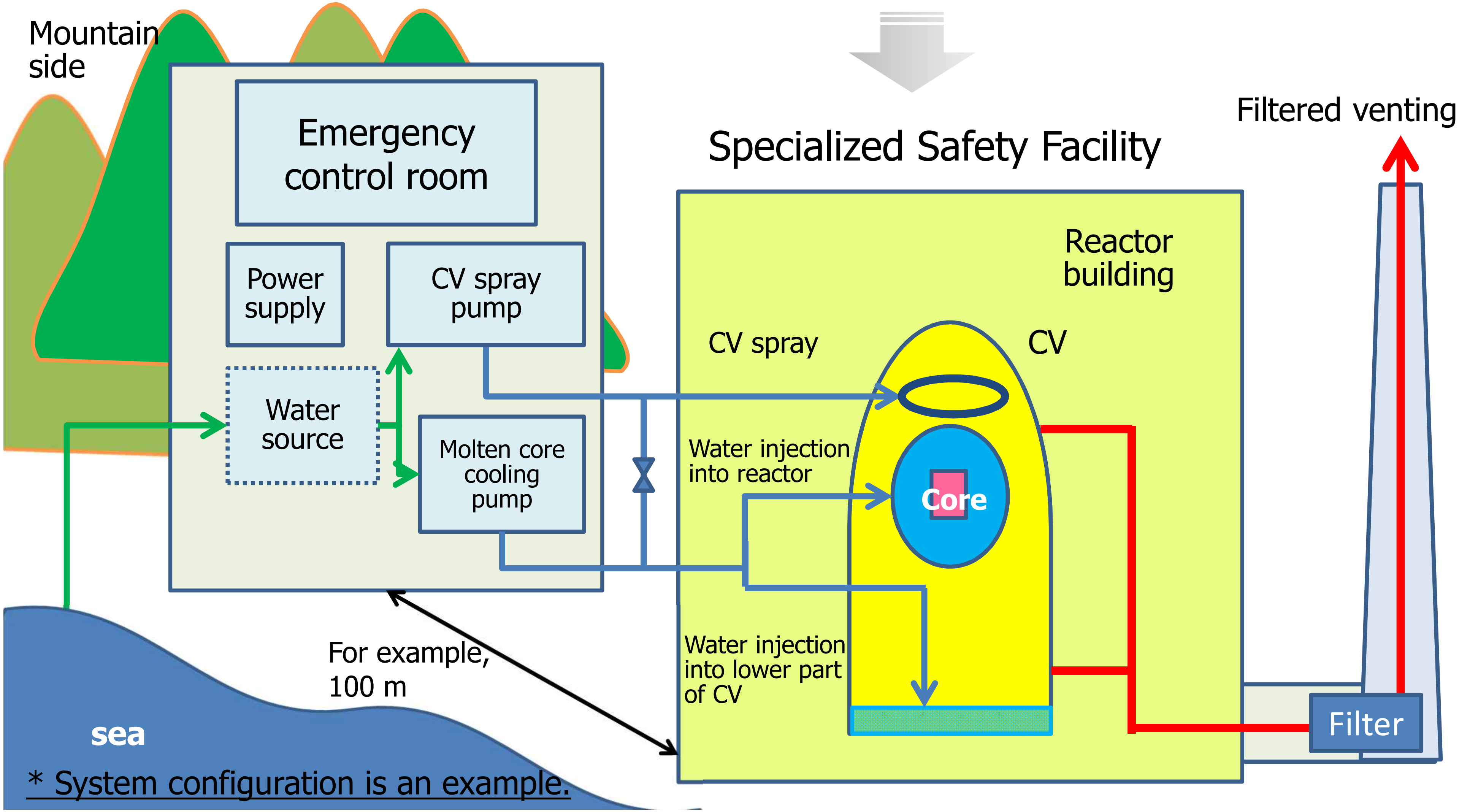
SA Measures (Others)

Requirements for measures to prevent
reactor building damage, fuel damage in SFP, etc.

1) Prevention of hydrogen explosion at reactor building, etc.
2) Cooling at SFP
3) Prevention of fuel damages during shutdown
4) Emergency Response Center

Measures against Intentional Aircraft Crash, etc.

Require "Specialized Safety Facility" to mitigate release of radioactive materials after core damage due to intentional aircraft crash



For BWR, one filtered venting for prevention of containment failure (p.10) and another filtered venting of Specialized Safety Facility are acceptable solution.

Suppression of release/dispersion of radioactive materials

Assuming CV failure, require outdoor water spraying equipment, etc. (Suppression of dispersion of radioactive materials by water spraying to reactor building)

Water-spraying training with a large scale bubble water cannon system (Osaka and Wakayama wide area cooperative disaster prevention committee)

(Pictures cited)
Fire fighting white paper, 2011 edition, http://www.fdma.go.jp/html/hakusho/h23/h23/html/2-1-3b-3_2.html

Enhanced Measures for Earthquake/Tsunami

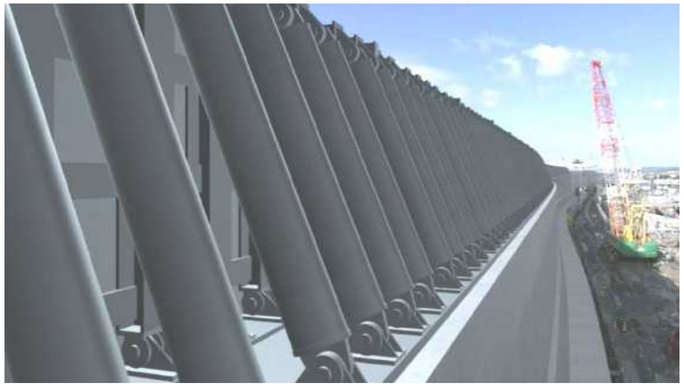
Accurate Evaluation Method on Earthquake and Tsunami; Particularly Enhanced Tsunami Measures

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

＜Example of tsunami measures（multiple protective measures）＞

○ Breakwater Wall
（prevent inundation to site）



○ Tsunami Gate
（prevent water penetration into the building）

More stringent criteria for active faults

Active faults with activities later than the Late Pleistocene (later than 120,000-130,000 years ago) be considered for seismic design

Activities in the Middle Pleistocene (later than 400,000 years ago) be further investigated if needed

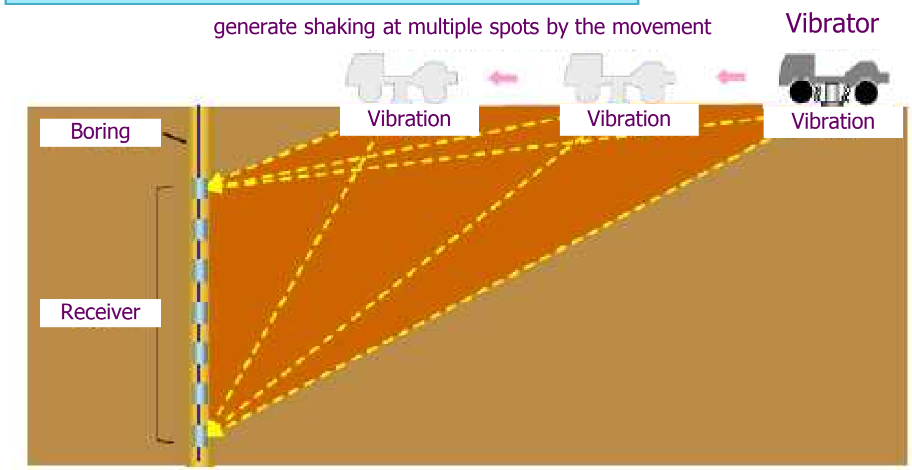
More precise methods to define design basis seismic ground motion

3D observation of underground structure of the site

Clarification of requirements for "displacement and deformation" in addition to the seismic ground motion

Class S buildings should not be constructed on the exposure of active faults

Example of geophysical exploration



The underground structure is explored by generating a vibration by vibrator and analyzing the signals received in a borehole.

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Thank you for your attention.