Summary of Safety Regulation in Japan

Nuclear and Industrial Safety Agency

24th May 2011

NISA Nuclear and Industrial Safety Agency

Nuclear Power Generation in Japan

- 54 units of commercial NPP in operation, (As of March 2011)
  - ➢ BWR 30 units, PWR 24 units

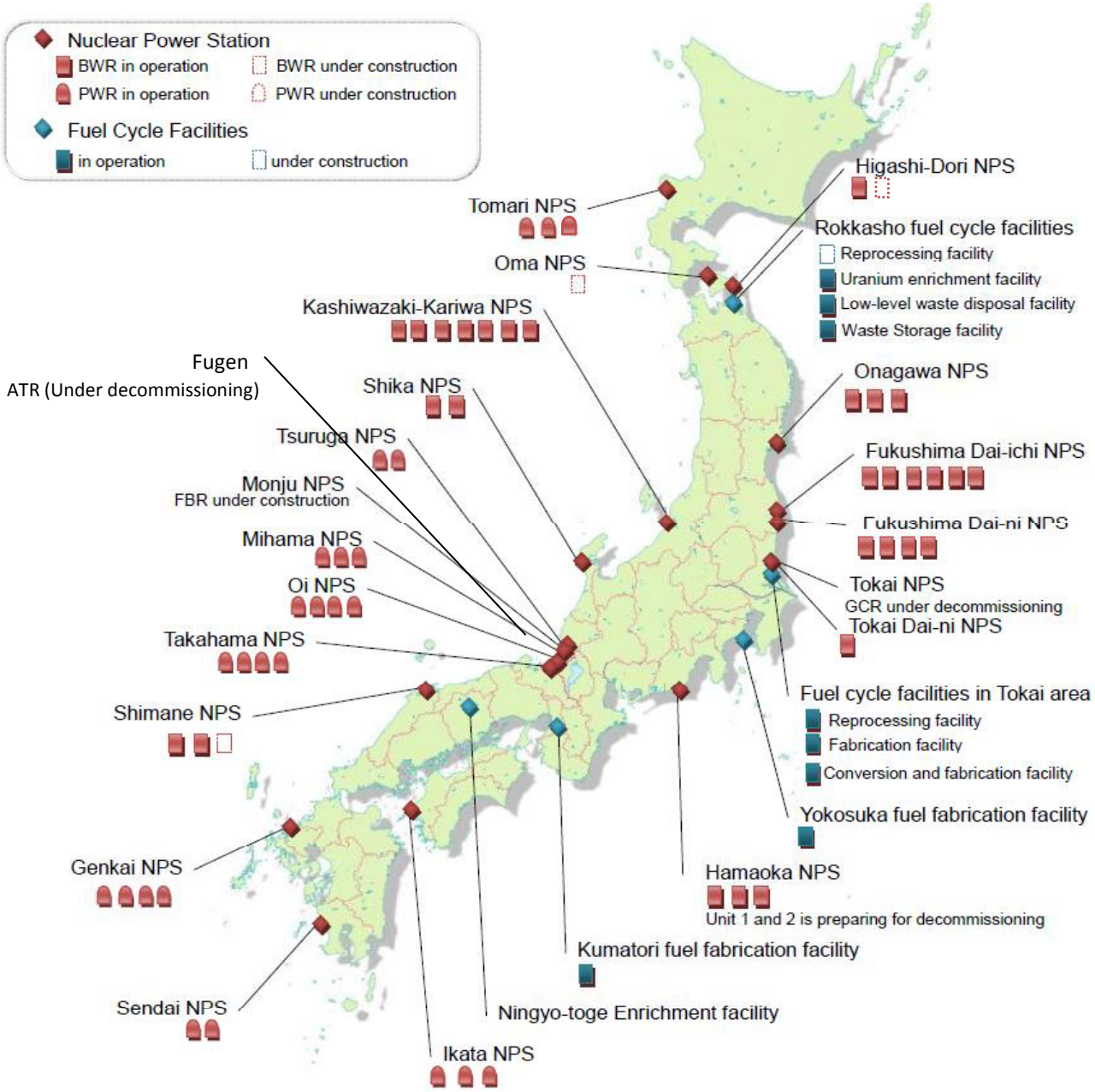
  Nuclear energy provides:
  – 29.3% of Japanese electricity power generation (As of the end of 2009FY)

- 3 Plants under construction and 3 units in decommissioning stage

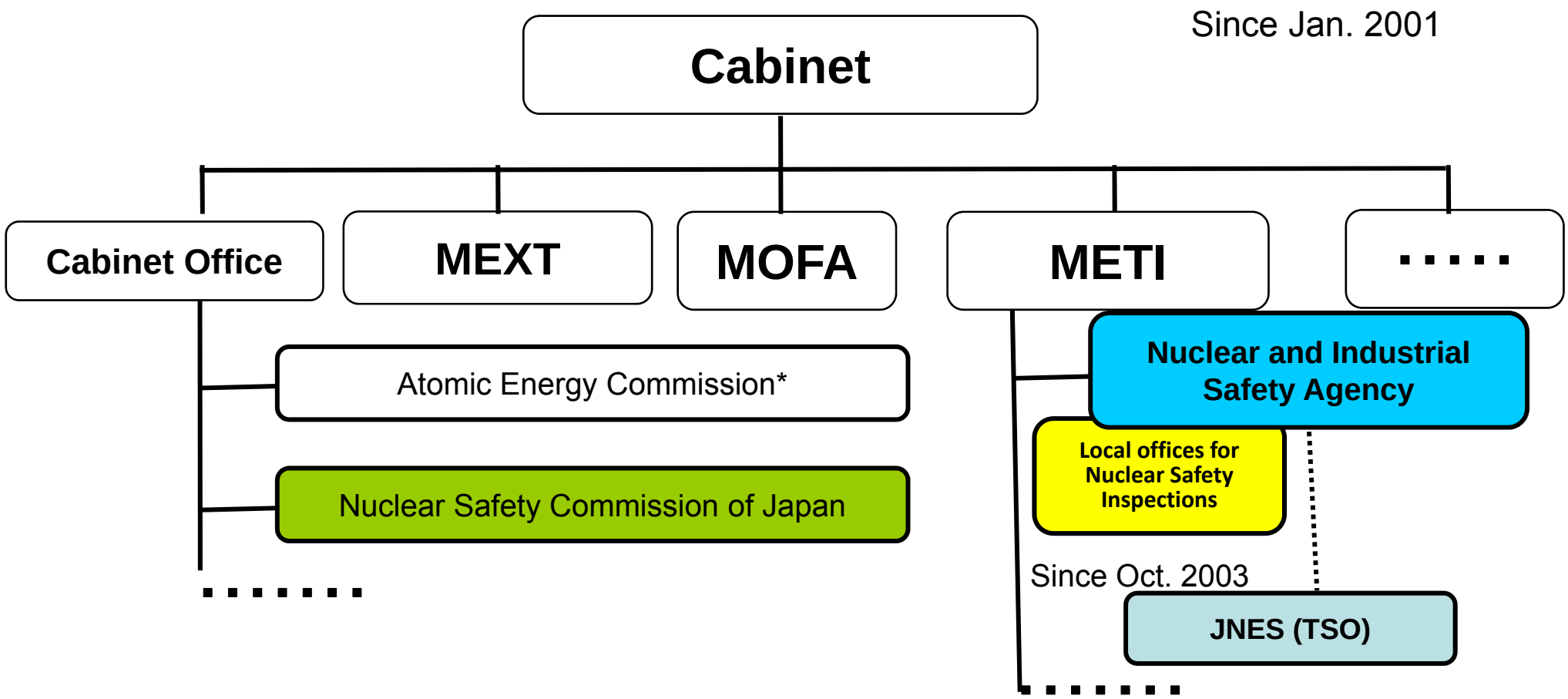
- 1 prototype FBR unit (Monju) in pre-operational phase and 1 ATR unit (Fugen) in decommissioning stage

FBR : Fast Breeder Reactor, ATR : Advanced Thermal Reactor

State of Nuclear Power Station, etc.



State of Safety Regulatory Bodies



(*) Atomic Energy Commission: Planning, deliberating, and determining the research, development, and use of nuclear power

Nuclear Safety Regulation System

- In January 2001, after the reorganization of ministries and agencies, the Ministry of Economy, Trade and Industry assumed sole responsibility for safety regulation of nuclear power application for energy use.
- As a part of administrative reform, the Nuclear and Industrial Safety Agency (NISA) was established as “a special organization” dedicated to the oversight of nuclear safety and industrial safety. The assurance of safety is an essential premise in securing stable and efficient energy supply and NISA was organized as an organization independent of the Agency for Natural Resources and Energy to implement safety regulation for Japanese citizens.
- NISA regulates nuclear operators as a primary regulatory agency and fulfils its accountability to the citizens, while the Nuclear Safety Commission (NSC) established in the Cabinet Office constantly monitors NISA's administrative activities (double check system).

- This regulation system, including the independence of a regulatory body, has been favorably appreciated, for instance, at the 2005 review meeting of the Convention on Nuclear Safety.
- "Safety the First" is the principle of this system, as can be seen in the actions taken for the self-imposed inspection data issue, the Mihama NPP accident, data falsification problem and Niigataken-chuetsuoki earthquake.
- NISA constantly reports its regulatory activities to the NSC for double check.

Roles of Safety Regulatory Bodies

Nuclear and Industrial Safety Agency (NISA)

- Enforcing safety regulation on nuclear facilities (Enforcement of regulatory authority)

Japan Nuclear Energy Safety Organisation (JNES)

- In charge of a part of regulatory inspections. Conducting safety analysis, safety research, and emergency preparedness.

Nuclear Safety Commission of Japan

- Monitoring and auditing safety regulatory activities of NISA, making recommendations as required, and requesting reports
- Developing basic guidelines about safety review

cf) Other Regulatory Bodies for Nuclear Safety

- Ministry of Education, Culture, Sports, Science and Technology (MEXT)
  - Radio isotopes, Use of nuclear material, Research Reactors, Safe guard(including NPP)
- Ministry of Health , Labour and Welfare(MHLW)
  - Medical application
- Ministry of Land, Infrastructure, Transport and Tourism(MLIT)
  - Onboard reactors, Marine transportation, etc.

Nuclear and Industrial Safety Agency : NISA

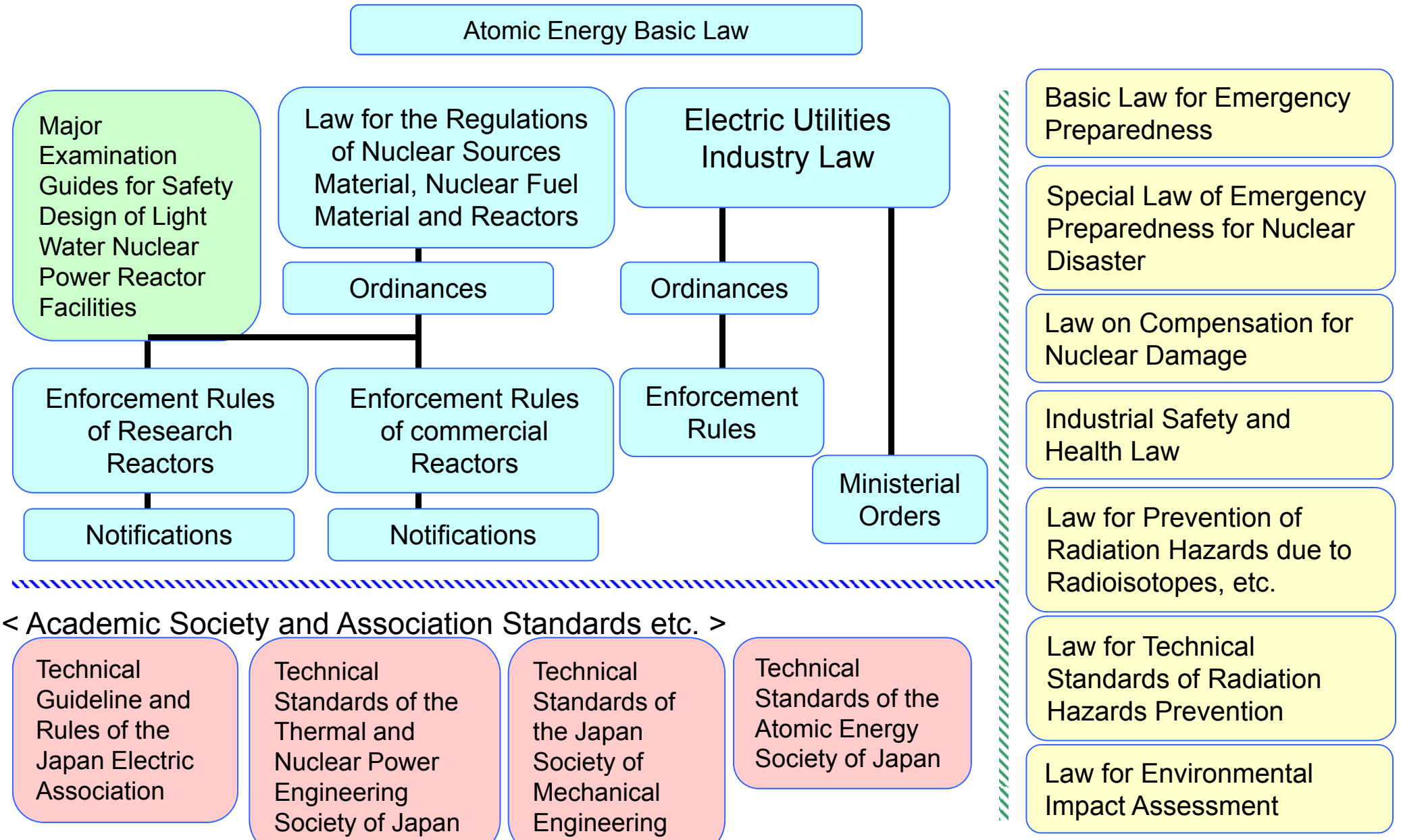
(As of April 2011)

- Established: 6 January 2001
- Mission: Ensuring nuclear safety and industrial safety
- Number of personnel: about 783
- Number of persons involved in nuclear safety:

  about 366 including about 100 resident inspectors

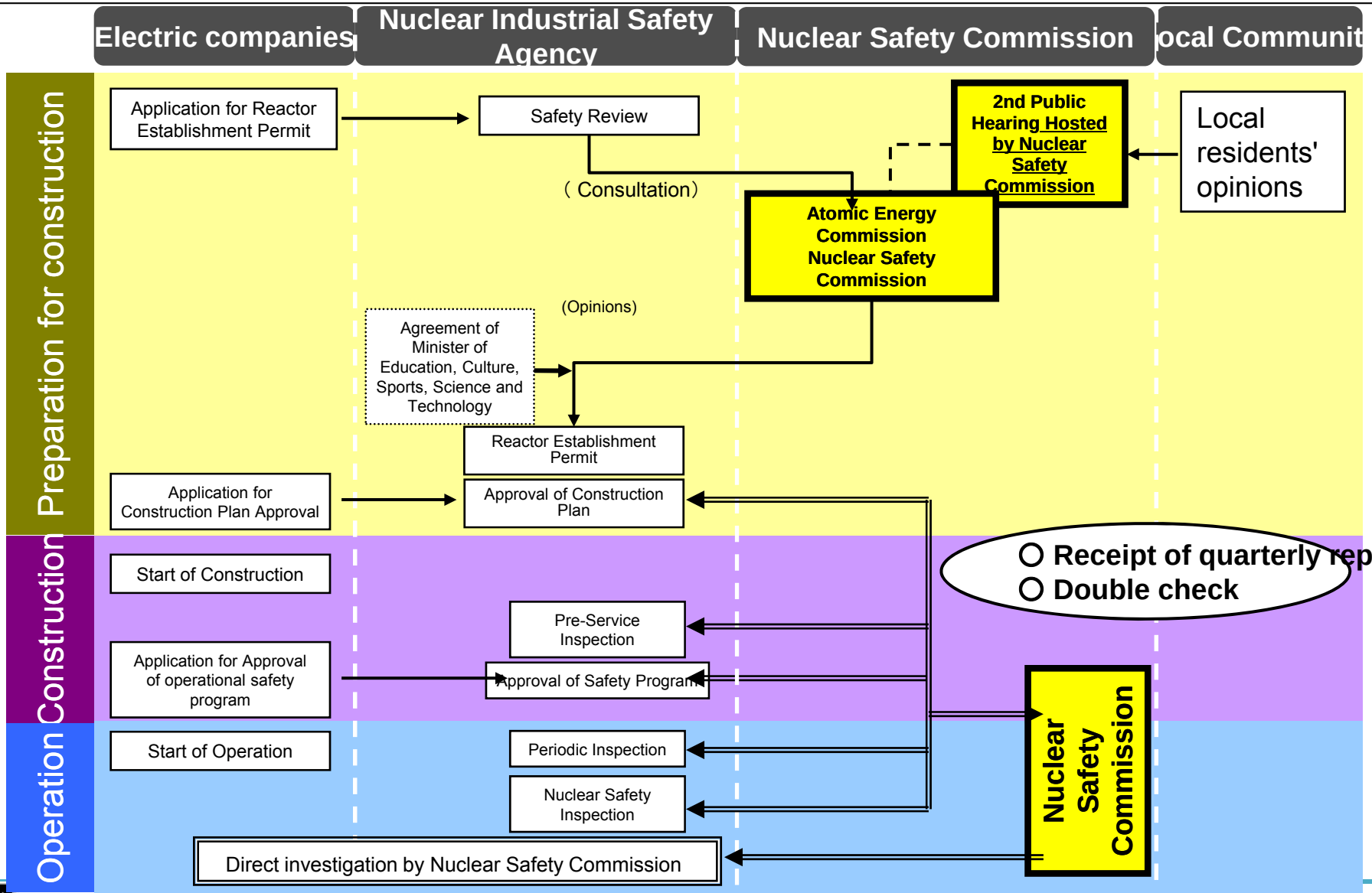
- Regulatory coverage:
  - –Nuclear safety
    Refining, Nuclear fuel fabrication/enrichment,
    Nuclear power plants, Interim storage, Reprocessing,
    Waste disposal, Transport Casks
  - –Electricity and gas safety
  - –Industrial safety
  - –Mining safety, etc.

Nuclear Safety Legislation



Overall Structure of Nuclear Safety Regulation

- Safety regulation is implemented stepwise from the preparation phase of constructing nuclear power stations to the operation phase.
- In addition to NISA's check, the NSC implements double check in each phase.



Outline of the Special Law of Emergency Preparedness for Nuclear Disaster

1. Outline of the Special Law

- To clarify the responsibility of licensees.
- To ensure the system for prompt initial actions during emergency.
- To enhance collaboration among the national government, the relevant local governments and licensees.
- To enhance the role of the national government having nuclear expertise.

2. Approach after establishment of the Special Law for Nuclear Emergency

- To locate 20 Off-Site Centers (facilities for bases of emergency response) and provide equipment for communication of information.
- To assign about 60 Senior Specialists for Nuclear Emergency at Off-Site Centers.
- To conduct nuclear emergency exercises.

Requirement on External Events

◆ Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities

Guideline 2. Design Considerations against Natural Phenomena

(1)SSCs with safety functions shall be assigned to appropriate seismic categories, with the importance of their safety functions and possible safety impacts of earthquake-induced functional loss taken into consideration, and be designed to sufficiently withstand appropriate design seismic forces.

(2) SSCs with safety functions shall be so designed that the safety of the nuclear reactor facilities will not be impaired by other postulated natural phenomena than earthquake. SSCs with safety functions of especially high importance shall be of the design that reflects appropriate safety considerations against the severest conditions of anticipated natural phenomena or appropriate combinations of natural forces and accident-induced loads.

Guideline 3. Design Considerations against External Man-Induced Events

(1) SSCs with safety functions shall be so designed that the safety of the nuclear reactor facilities will not be impaired by postulated external man-induced events.

(2) The nuclear reactor facilities shall be so designed that structure, systems and components with safety functions are protected by appropriate means against any unjustifiable access by third persons.

◆ Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities

Defense in Depth

In order to apply defense in depth fundamentals to design of nuclear installations, the Regulatory Guide for Reviewing Safety Design stipulates the following items.

- The first protection is preventive measures for the occurrence of an abnormal event. More specifically, the first protection implies such measures of designing with a safety margin, implementing strict quality control in fabrication, inspecting the facilities and component to be fabricated as required by the design, and preventing degradation of performance through monitoring, check and maintenance during the operation. Each component, equipment and system of nuclear reactor facility is to be designed considering the importance of its safety function, and the quality control during design and manufacturing is to be conducted corresponding to the importance of safety function.
- The second protection is to prevent expansion of abnormalities. More specifically, the second protection implies the early detection of the abnormal condition, its correction or taking measures in advance to prevent the progression into an accident.
- The third protection is to mitigate the consequence of an accident. More specifically, the third protection implies taking measures to ensure the safety of the public in the vicinity by mitigating the consequence of the accident.

Requirements relating Multiple Units and SBO

◆ Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities

Guideline 7. Design Considerations for Shared Use

SSCs with safety functions shall be so designed that in case they are shared by two or more nuclear reactor facilities, the safety of the reactors will not be impaired by the shared use.

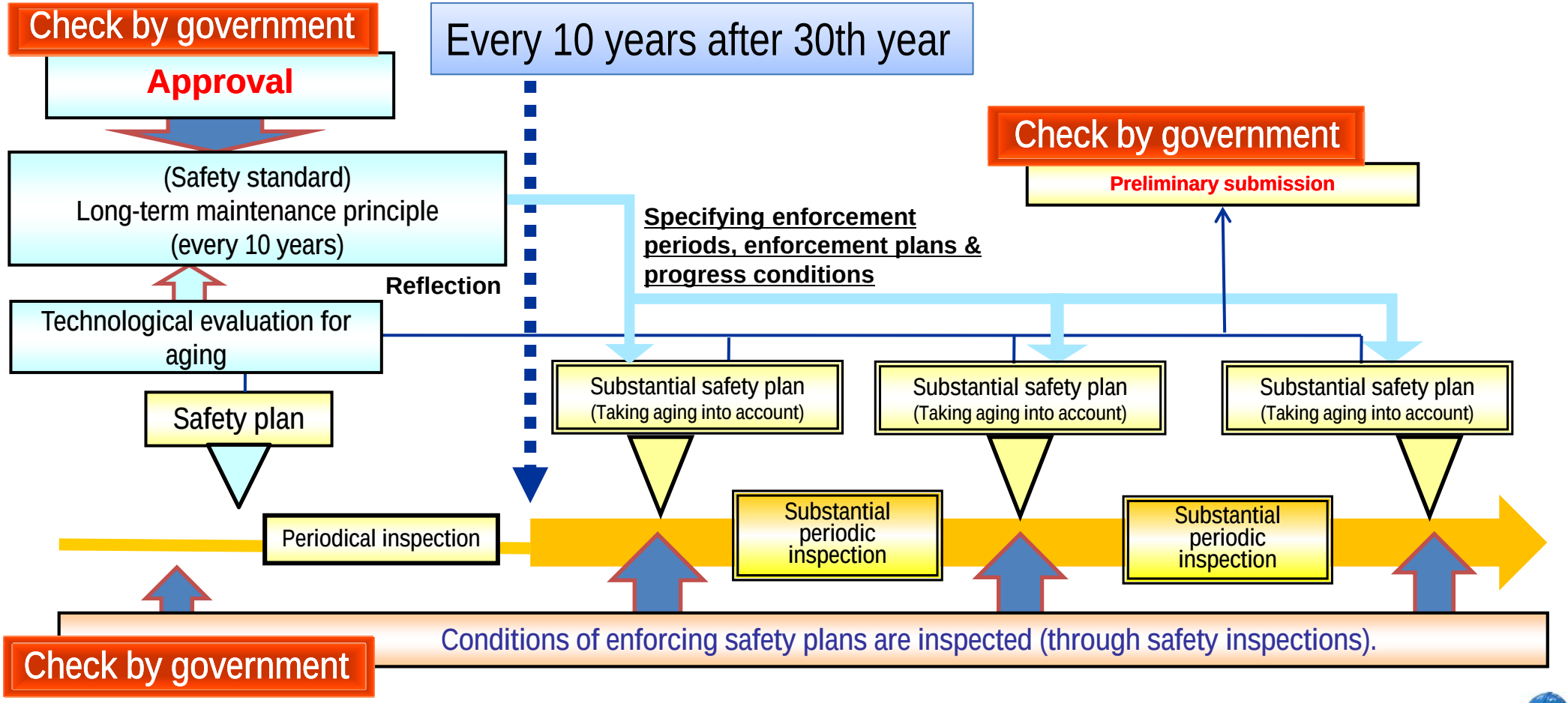
Guideline 27. Design Considerations against Loss of Power

The nuclear reactor facilities shall be so designed that safe shutdown and proper cooling of the reactor after shutting down can be ensured in case of a short-term total AC power loss.

Aging Management

Improved Aging Preventive Measures for Power Plants

- For plants that have been used for thirty years after start of operation, the licensees were obliged to evaluate expected deteriorations and extract the preventive measures based on the results. (Technological evaluation for aging)
- The licensees establish the long-term maintenance principles (ten-year maintenance and inspection plans) based on the technological evaluation for aging and the government approves them.
- The long-term maintenance principles are reflected upon the safety plans created by the licensees in every periodic inspection and the government checks the implementation status.



Severe Accidents (1/2)

Licensees of reactor operation in Japan have voluntarily implemented their own measures for preventing severe accidents and mitigating the impacts based on “Accident management as measures against severe accidents in light water nuclear power reactor facilities (formulated by the NSC on May 28, 1992, and partially revised on October 20, 1997).”

Typical facility modifications for preventing severe accidents and mitigating the impacts are as follows:

PWR:

- Alternative recirculation (installation of alternative recirculation pumps, or core flooding using the containment spray system by installing the tie-line between the containment spray system and the residual heat removal system)
- Containment natural convection cooling (utilization of the nonsafety grade containment recirculation unit)
- Alternative component cooling (utilization of the HVAC chilled-water, etc.)
- Water injection into a reactor containment (utilization of fire pumps)
- Common usage of power supply among units (usage of power from the neighboring nuclear installation through the tie-line)
- Controlled combustion for hydrogen-concentration control (hydrogen combustion by igniters; only for the ice condenser type PWR)

BWR:

- Alternative recirculation (installation of alternative recirculation pumps, or core flooding using the containment spray system by installing the tie-line between the containment spray system and the residual heat removal system)
- Alternative reactivity control (recirculation pump trip and alternative automatic control rod insertion)
- Alternative cooling water injection (utilization of the condensate water makeup system and the fire protection system)
- Automatic reactor depressurization (automatic depressurization by the reactor low water level signal)
- Heat-removal from a reactor containment (pressure venting for preventing vessel rupture and utilization of drywell cooler, etc.)
- Power supply system (common usage of power supply among the neighboring nuclear installations)

Severe Accidents (2/2)

- For implementing accident management, the licensees of reactor operation have been developing the accident management measures progressively, substantiating the facilities as mentioned above during the outage of the periodic inspection as well as establishing operational measures such as implementing system, procedures, education of personnel, etc.
- The accident management measures that were prepared by licensees of reactor operation were reported to NISA in May, 2002, together with the PSA results of internal events for representative reactor types for the purpose of quantitatively verifying the effectiveness of enhancement of the safety. NISA evaluated the effectiveness of the accident management measures, and based on the opinion of specialists of the "Accident Management Workgroup" established under the Nuclear and Industrial Safety Subcommittee, compiled the evaluation report in October 2002, which was submitted to the NSC.
- The PSA results of the internal events for all commercial power reactor facilities under operation (other than representative reactor types) were reported to NISA by the licensees of reactor operation in March 2004. The development programs of the accident management for commercial nuclear installation under construction were reported to NISA by the licensees of reactor operation for three units in July 2003, and one unit in March 2008. The evaluation results were reported to the NSC by NISA in September 2003 and in October 2008 respectively. The NSC evaluated the reports and concluded that they were reasonable in December 2003, and in January 2009 respectively.

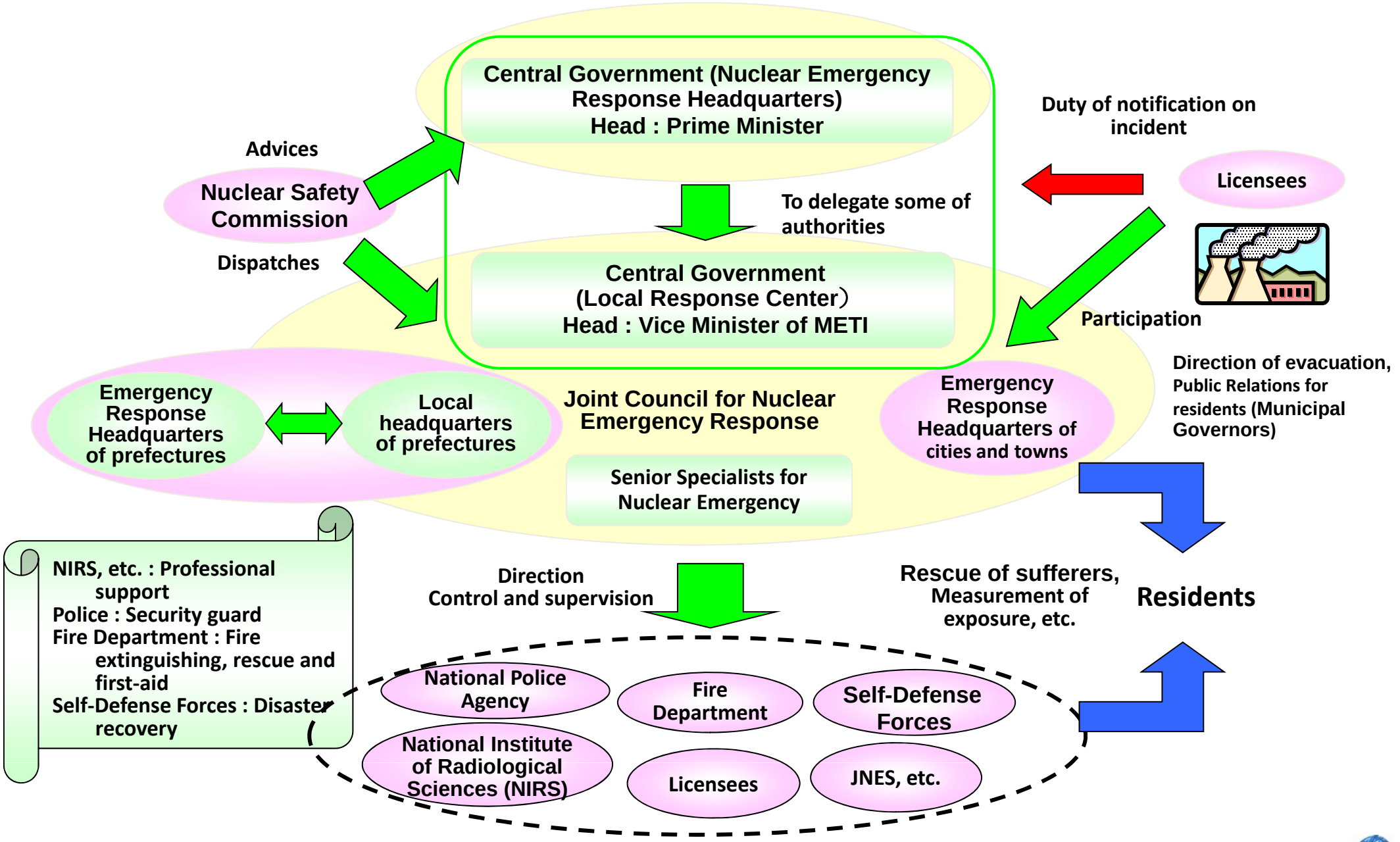
Measure taken after Earthquake and Tsunami

- Based on the confirmed results conducted to date, NISA determine whether emergency safety measures are being appropriately implemented as reported from each electric utility.

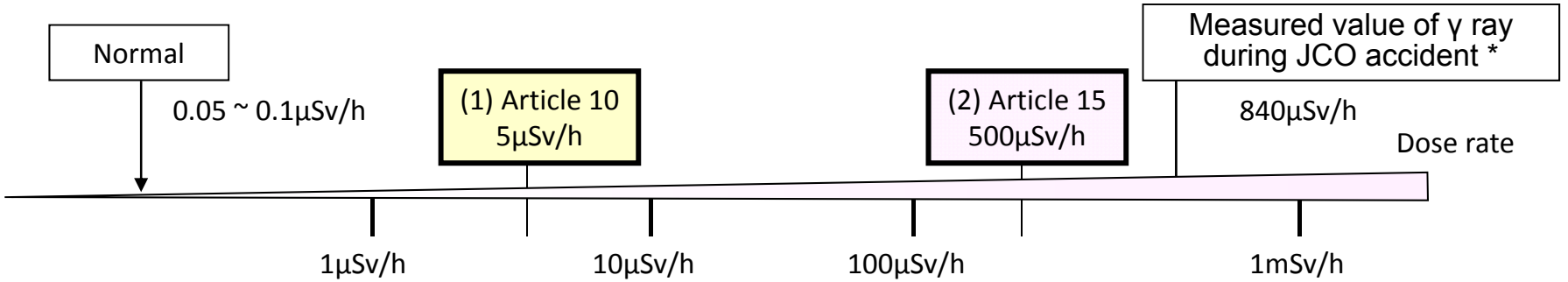
		Short term	Mid to long term
Matters to confirm		●Measures against Loss of All AC Power Supply ●Measures against Inundation of Buildings	● Measures to Improve Reliability due to Speeding Up the Cold Shutdown ● Measures to Protect Against Tsunami
Results of Confirmation& Evaluation	Summary of evaluation	Confirm that Emergency Response Plans have been drafted in consideration of assumed damage by a tsunami	Confirm that a plan has been drafted for improving a reliability by speeding up cold shut down and a measurement to protect against a Tsunami
	Result of confirmation	•Operational safety programs and documented procedure were stipulated in the emergency response plan. •Clearly stipulated in the programme that the head of NPP could give the authorisation for the implementing the vents and water(including seawater) injection. •NPP has the required capacity and number of power vehicles, in order to provide electricity to run a important functions. •Pump trucks,etc have the ability to supply the required capacity of water to remove the decay heat •Drills for measures against loss of all AC power supply due to a tsunami are implemented and the implementation procedures are established.	•Confirmed that a plan has been drafted for a large-size generator built on a high ground. •Confirmed the plan to introduce air-cooling type emergency generators that would satisfy the required capacity for each reactor within 1 to 2 years •Confirmed the plan that would realise within2 to3 years a stronger water tight structure to protect the machines and apparatus important for reactor safety.

Nuclear Emergency Preparedness and Response System

~ Framework for Nuclear Emergency Response System during Nuclear Emergency ~



Criteria for Reporting and Nuclear Emergency Declaration during Occurrence of Incident



<Criteria for reporting>

Criteria of reporting to relevant parties by licensee and events to be reported

(Article 10, Special Law for Nuclear Emergency)

(1) Radiation dose of 5μSv/h is detected for more than 10 minutes by radiation monitoring facility installed in the vicinity of the site boundary.
(2) Radioactive material equivalent to radiation dose of 5μSv/h at the site boundary considering diffusion and other effects is detected for more than 10 minutes at normal release point such as stack.
(3) Radiation dose of 50μSv/h and radioactive material equivalent to 5μSv/h are detected in the vicinity of the controlled area.
(4) The state where criticality accident occurs or could occur.
(5) When the reactor cannot be shut down by the insertion of control rods, and others

<Criteria for nuclear emergency declaration>

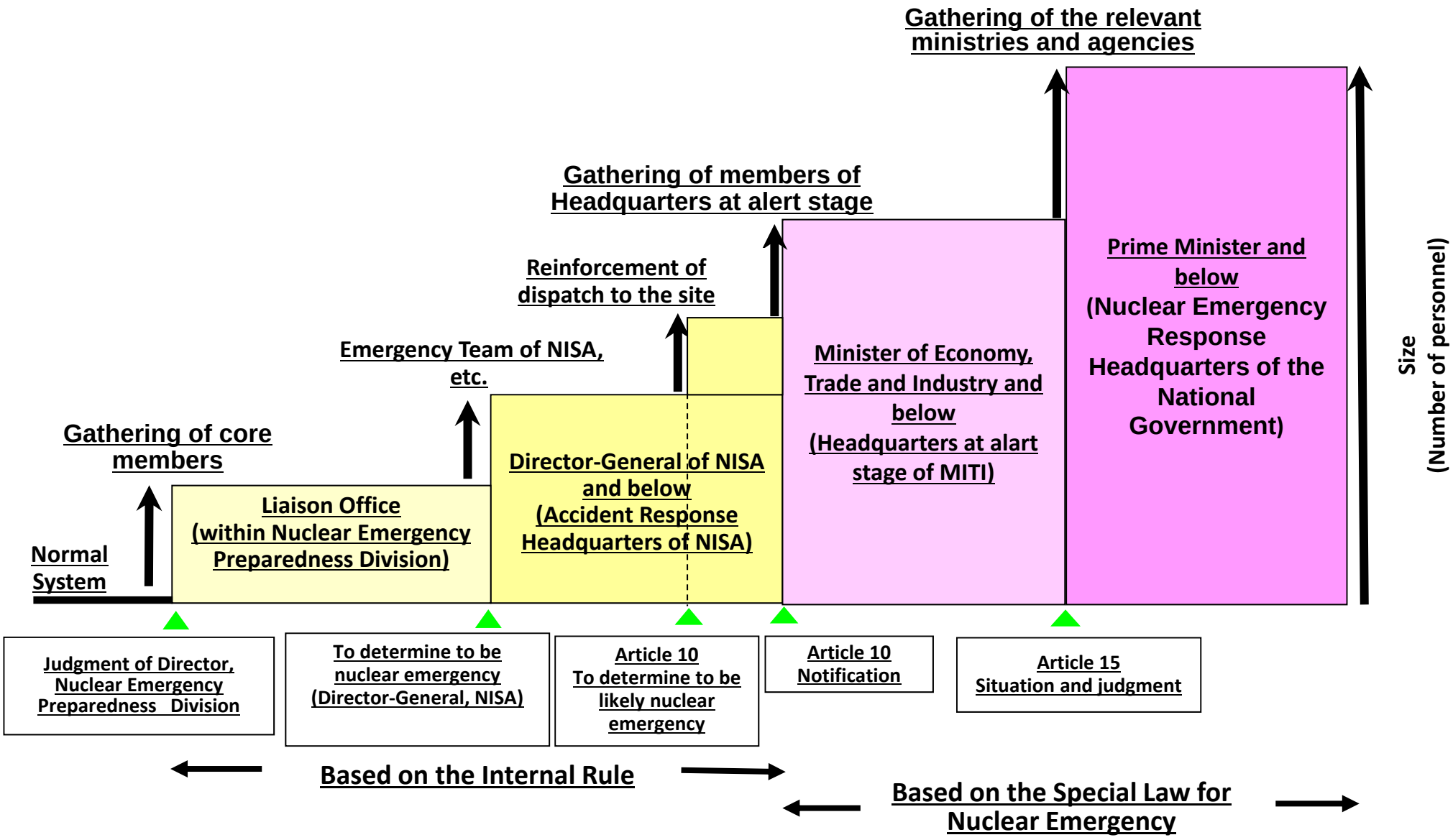
Criteria and events for nuclear emergency declaration and establishment of Nuclear Emergency Response Headquarters

(Article 15, Special Law for Nuclear Emergency)

(1) Radiation dose of more than 500μSv/h is detected by radiation monitoring facility installed in the vicinity of the site boundary or installed by the relevant prefecture.
(2) The value 100 times of the value specified for the reportable event is detected at the normal release point such as stack, in the vicinity of the controlled area and at the place 1 m apart from transport cask respectively.
(3) Critical state in the other place than the inside of the reactor itself.
(4) The reactor cannot be shut down by the injection of liquid poison (boric acid solution) in addition to the insertion of control rods.

Nuclear Emergency Preparedness and Response System

~ Framework for Nuclear Emergency Response System during Nuclear Emergency ~



Facilities of Base for Emergency Response (Off-Site Centers)

Off-site centers are the facilities where the relevant parties such as the national government, prefectures, cities, towns and others gather together to coordinate and promote smoothly the activities for nuclear emergency response, and are located in the prefectural area having nuclear facilities and were designated by the national government in advance.

▲ : Designated by METI (16)
● : Designated by METI and MEXT (4)

Fukui Pref.


Fukui Pref. Mihama Off-site Center


Fukui Pref. Ohi Off-site Center


Fukui Pref. Tsuruga Off-site Center


Fukui Pref. Takahama Off-site Center


Hokkaido Off-site Center


Ishikawa Pref. Shika Off-site Center


Higashidori Off-site Center

Rokkasho Off-site Center


Miyagi Pref. Off-site Center


Niigata Pref. Kashiwazaki-Kariwa Off-site Center


Fukushima Pref. Off-site Center


Shimane Pref. Off-site Center


Saga Pref. Off-site Center

Osaka Pref. Kumatori Off-site Center

Kanagawa Pref. Yokosuka Off-site Center


Kagoshima Pref. Off-site Center


Ehime Pref. Off-site Center


Kamisaibara Off-site Center


Shizuoka Pref. Hamaoka Off-site Center


Ibaraki Pref. Off-site Center