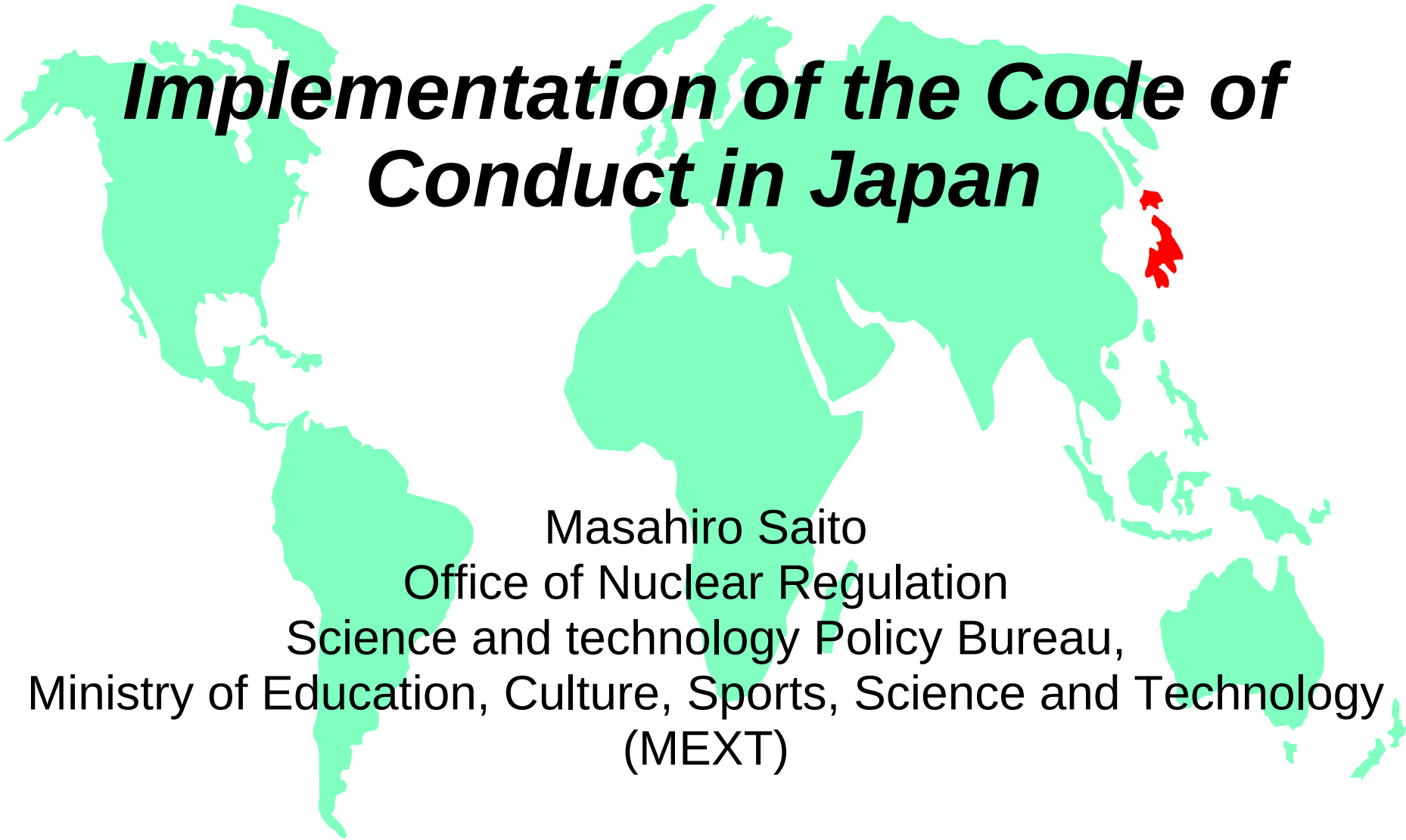
# *Implementation of the Code of Conduct in Japan*



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- Regulatory activities of MEXT
- Implementation of the Code of Conduct
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- Topics

# *History of Nuclear Energy in Japan*

1956 “Atomic Energy Basic Law” is enforced.
“Atomic Energy Commission” is established.
“Science & Technology Agency” is established.
“Japan Atomic Energy Research Institute” is established.
1957 IAEA is established, Japan affiliates IAEA.
“JRR-1” attains first criticality in Japan.
1963 “JPDR” generates first electric power in Japan.
1965 First commercial NPP “Tokai” starts operation.
1977 Experimental FBR “Joyo” starts operation.
1978 “Nuclear Safety Commission” is established.
1981 “Tokai Reprocessing Plant” starts operation.
1994 Prototype FBR “Monju” starts operation.
1998 “HTTR” starts operation.
1999 JCO Criticality accident
2000 “Special Law of Nuclear Emergency” is enforced.
2001 Reorganization of Japanese government &
Reallocation of regulation authority

# *Regulatory Activities of MEXT, Office of Nuclear Regulation*

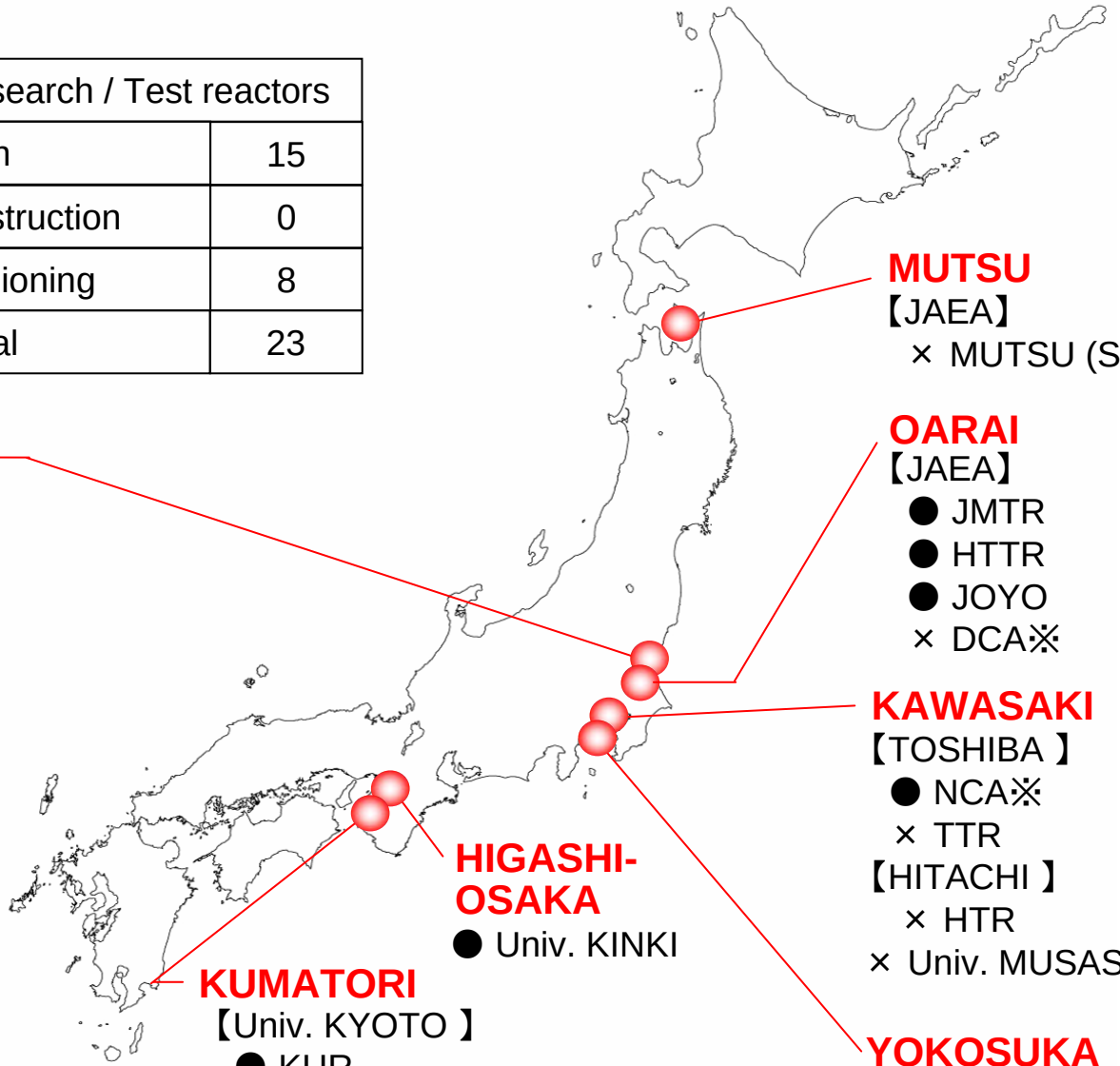
## Number of License for research reactor & nuclear material use

| Type of License | Number of License |
|---|---|
| **Research / Test Reactor** | **15 (in operation)**<br>**8 (Decommissioning)** |
| **Nuclear Fuel Material User**<br>**Large Size☆**<br>**Small Size** | <br>**16**<br>**about 200** |
| **Nuclear Source Material User** | **15** |

☆Defined by ordinance.
e.g. Pu > 1g (>450g for sealed Pu), Spent fuel > 3.7 TBq, U-233 > 500g etc.

# Site map of Research / Test Reactors in Japan (as of April 2007)

| Number of Research / Test reactors | |
|---|---|
| ● In Operation | 15 |
| ◍ Under Construction | 0 |
| ╳ Decommissioning | 8 |
| Total | 23 |



**MUTSU**
【JAEA】
× MUTSU (SHIP)

**OARAI**
【JAEA】
● JMTR
● HTTR
● JOYO
× DCA※

**KAWASAKI**
【TOSHIBA 】
● NCA※
× TTR
【HITACHI 】
× HTR
× Univ. MUSASHI

**YOKOSUKA**
× Univ. RIKKYO

**TOKAI**
【Univ. TOKYO 】
● YAYOI
【JAEA】
● STACY※
● TRACY※
● NSRR
● JRR-3
● JRR-4
● FCA※
● TCA※
× JRR-2
× VHTRC※

**HIGASHI-OSAKA**
● Univ. KINKI

**KUMATORI**
【Univ. KYOTO 】
● KUR
● KUCA※

※ Critical Assembly

# Summary of Research and Test Reactors in Japan

【Research and Test Reactor 】

| Operating Organization | Alias | Location | Core Type | Thermal Power | License Date | First Critical |
|---|---|---|---|---|---|---|
| JAEA | ＪＲＲ－３ | Tokai, Ibaraki pref. | Enriched uranium fueled, Light water moderated reactor | 20MW | 1984/12/19 (Modified) | 1990/3 |
| | ＪＲＲ－４ | 〃 | Enriched uranium fueled, Light water moderated reactor | 3.5MW | 1962/4/7 | 1965/1 |
| | ＮＳＲＲ | 〃 | Enriched uranium–zirconium hydride fuel – moderator utilized TRIGA-type reactor | Normal 300kW<br>Pulse 23,000MW | 1973/3/27 | 1975/6 |
| | JMTR (Japan Material Test Reactor) | Oarai, Ibaraki pref. | Enriched uranium fueled, Light water moderated tank-type reactor | 50MW | 1965/7/23 | 1968/3 |
| | HTTR | 〃 | Uranium oxide fueled, High temperature gas-cooled reactor | 30MW | 1990/11/22 | 1998/11 |
| | Experimental Fast Reactor (JOYO) | 〃 | Uranium-Plutonium Mixture oxide fueled, Sodium-cooled fast reactor | MK-I core 75MW<br>MK-II core 100MW<br>MK-III core 140MW | 1970/2/12<br>1978/9/20<br>1995/9/28 | 1977/4<br>1982/11<br>2003/7 |
| University of Kinki | UTR-KINKI | Higashi-Osaka, Osaka Pref. | Light water moderated, graphite reflected, Heterogeneous enriched uranium thermal reactor | 1W | 1960/8/12 | 1961/11 |
| University of Kyoto | KUR | Kumatori, Osaka pref. | Enriched uranium fueled, Light water-moderated, tank-type reactor | 5MW | 1962/3/15 | 1964/6 |
| University of Tokyo | YAYOI | Tokai, Ibaraki pref. | Uranium fueled, air cooled fast reactor | 2kW | 1968/12/12 | 1971/4 |
| Total | | | | 9 units | | |

# Summary of Critical Assemblies in Japan

## 【Critical Assembly】

| Operating Organization | Alias | Location | Core Type | Thermal Power | License Date | First Critical |
|---|---|---|---|---|---|---|
| JAEA | T C A | Tokai, Ibaraki pref. | Enriched uranium/plutonium fueled, Light water moderated reactor | 200W | 1961/9/29 | 1962/8 |
| | FCA | | Enriched uranium/plutonium fueled, Fast reactor | 2kW | 1965/9/20 | 1967/4 |
| | STACY | | Enriched uranium/plutonium fueled, Tank-type reactor | 200W | 1988/10/7 | 1995/2 |
| | TRACY | | Uranium solution fueled, Tank-type reactor | Normal power 10kW Transient 5000MW | 1988/10/7 | 1995/12 |
| TOSHIBA Corporation | NCA | Kawasaki, Kanagawa Pref. | Low enriched uranium fueled, Light water moderated reactor | 200W | 1962/7/24 | 1963/12 |
| University of Kyoto | KUCA | Kumatori, Osaka pref. | Enriched uranium fueled, Multi-core type critical assembly (Solid moderated and light water moderated ) | 0.1kW Peak power 1kW | 1982/8/24 | 1974/8 |
| Total | | | | 6 units | | |

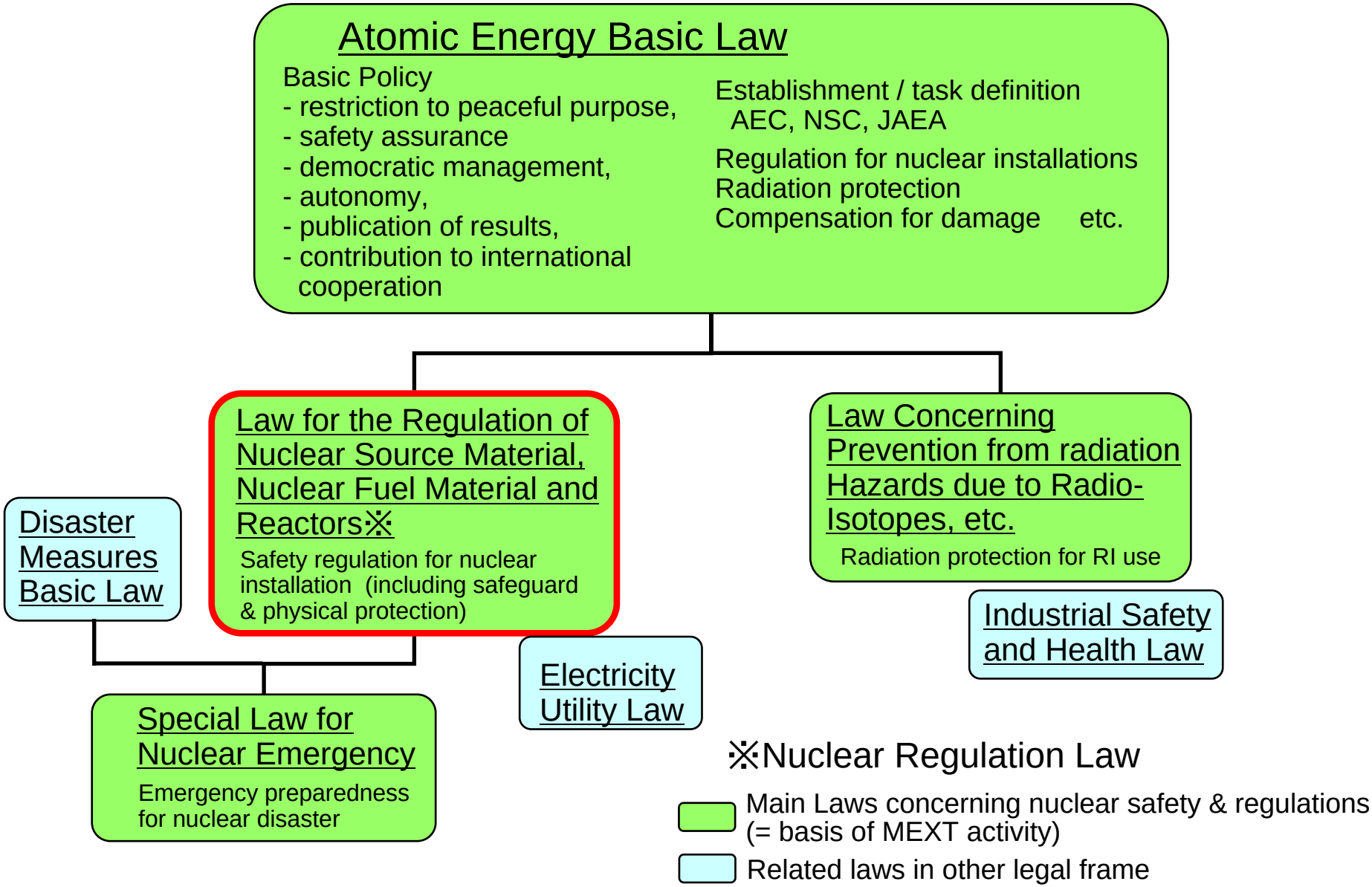
# Implementation of the Code of Conduct In Japan

## Role of the State: The National safety framework

- ***Law and Regulations (Code paragraph 9)***
- ***Regulatory authority (Code paragraph 10,11)***
- ***Governmental Emergency Response (Code paragraph 14)***
- ***Legal and Infrastructure arrangements for Decommissioning (Code paragraph 15)***

# Law and Regulations (Code paragraph 9)

## Legislation for Nuclear Safety Regulation in Japan



# *Flow of Safety Regulation for Research Reactor*

**Stepwise approach**

## Planning & design phase

- Licensing for the reactor installation (double check by NSC)
- Approval for the design and method of construction
- Approval for the method of welding

## Construction phase

- Welding inspection *1
- Pre-service inspection

*1 The inspection is delegated to an independent administrative organization (JNES)

## Operation phase

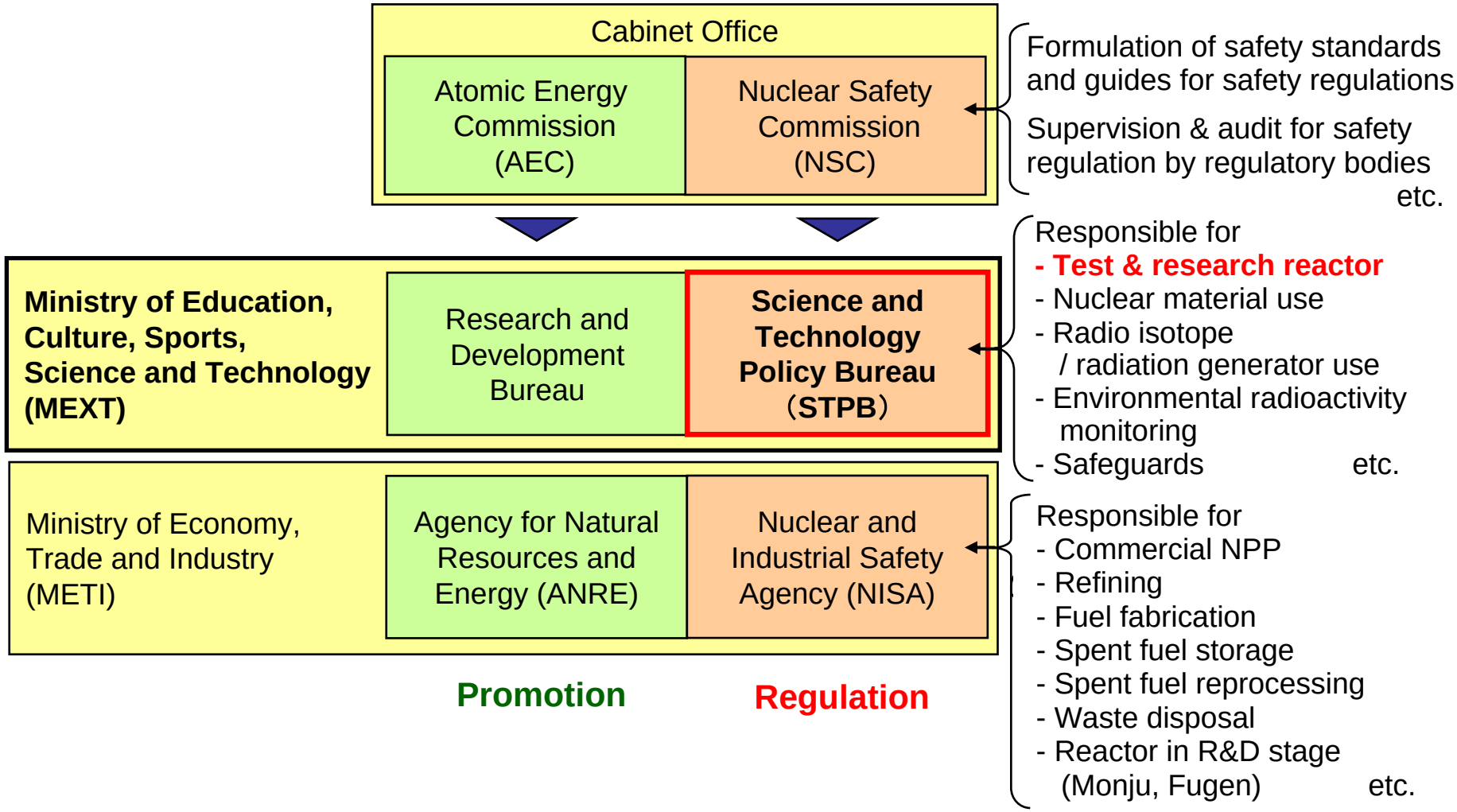
- Approval for the safety manual
- Approval for the physical protection manual
- Designation of the chief technician of reactors
- Periodical safety inspection (once a quarter)
- Periodical hardware inspection (once a year)  etc.

## Decommissioning phase

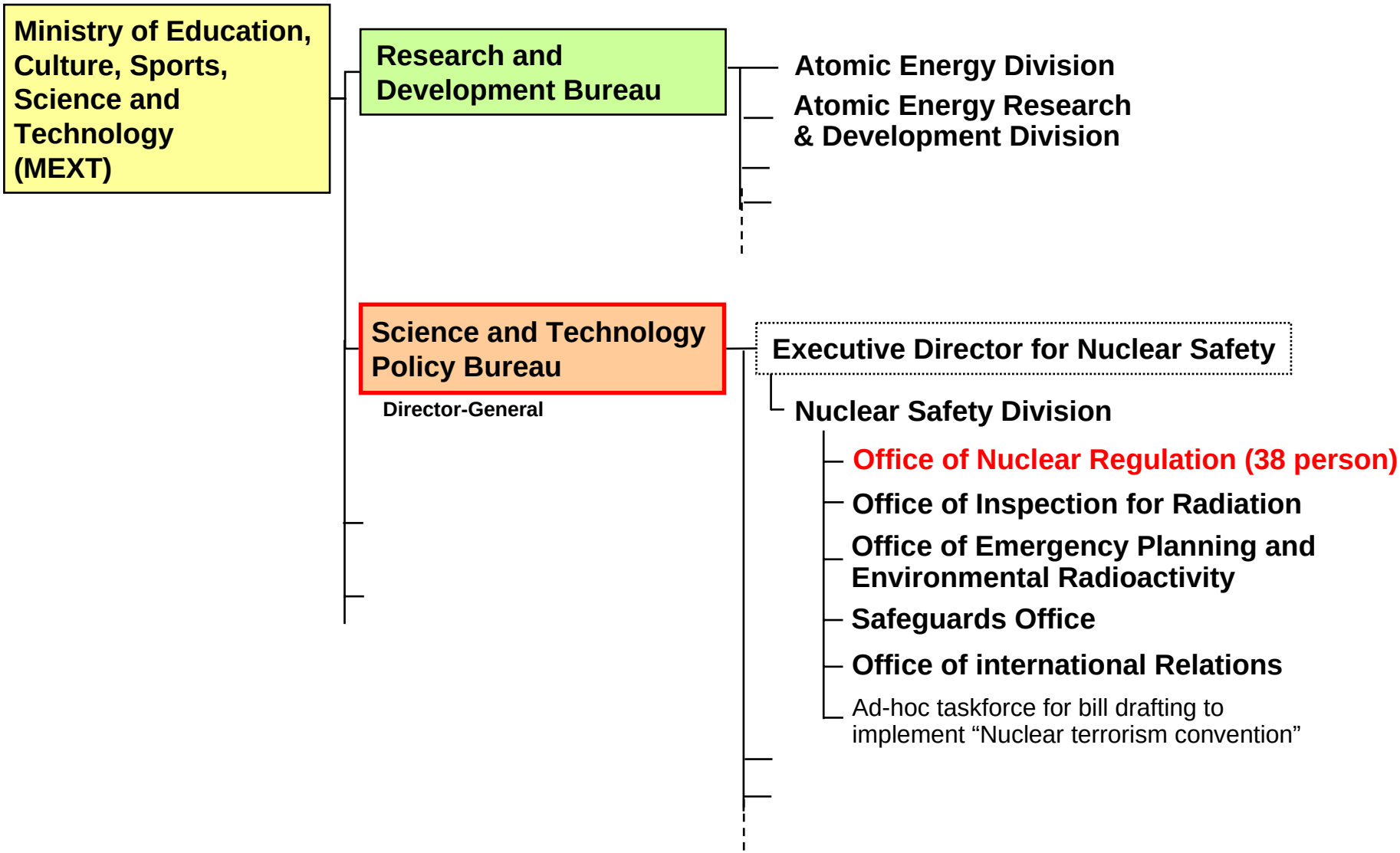
- Approval for the plan of decommissioning
- Confirmation of completion of decommissioning

# Regulatory authority (Code paragraph 10,11)

## Governmental Organization for Nuclear Safety Regulation in Japan



# *Organization of MEXT*



# Governmental Emergency Response (Code paragraph 14)

## Nuclear Emergency Preparedness

**Special Law for Nuclear Emergency** (2000)

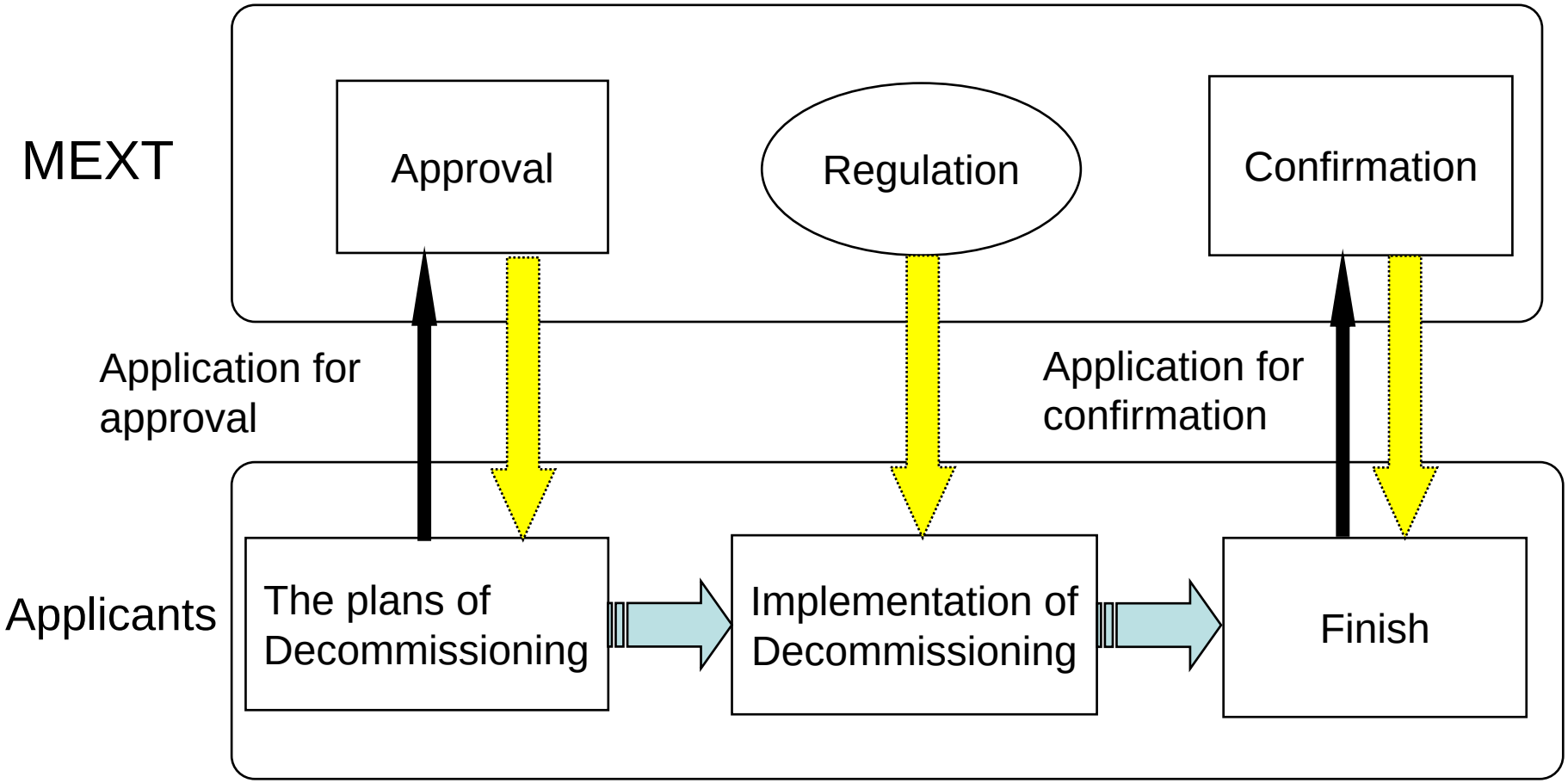
⇐ Lesson learned from JCO criticality accident in Tokai (1999)

- **Ensuring swift initial activation**
  - Clarification of the notification criteria
  - Clarification of the decision criteria for nuclear emergency
- **Ensuring close cooperation with the central government and local government (prefecture & municipality)**
- **Enhancement of emergency response system of central government**
  - Establishment of Off-site Center
  - Residence of national senior specialist for nuclear emergency preparedness at the sites
  - System development for monitoring, medical treatment, dispatch of specialist etc.
  - Nuclear emergency drill
- **Clarification of the responsibility of Licensee for emergency preparedness & response**

# Legal and Infrastructure arrangements for Decommissioning (Code paragraph 15)

***About Regulation of Decommissioning***

Based on Nuclear Regulation Law



# Role of the Regulatory Body

- ***Implementation of the Regulatory Process (Code paragraph 19)***
- ***Requirement for safety management (Code paragraph 20 a)***
- ***Assessment and verification of Safety (Code paragraph 20 b,c)***
- ***Requirement for Training of Personnel (Code paragraph 20e)***
- ***Requirement for a quality assurance program (Code paragraph 20f)***
- ***Requirement to take human factors into account (Code paragraph 20g)***
- ***Requirement for a radiation protection (Code paragraph 20h, i)***
- ***Criteria for sitting research reactor (Code paragraph 20 k)***
- ***Requirements related to design, construction and commissioning (Code paragraph 20 l, m, n)***
- ***Requirements related to operations, maintenance, modifications and utilization (Code paragraph 20o,p,q,r,s)***
- ***Criteria for release from regulatory control of decommissioned reactor (Code paragraph 20 u)***

# ***Implementation of the Regulatory Process (Code paragraph 19)***

## Planning & design phase

- **Licensing for the reactor installation** (double check by NSC)
- Approval for the design and method of construction
- Approval for the method of welding

## Construction phase

- Welding inspection *1
- Pre-service inspection

*1 The inspection is delegated to an independent administrative organization (JNES)

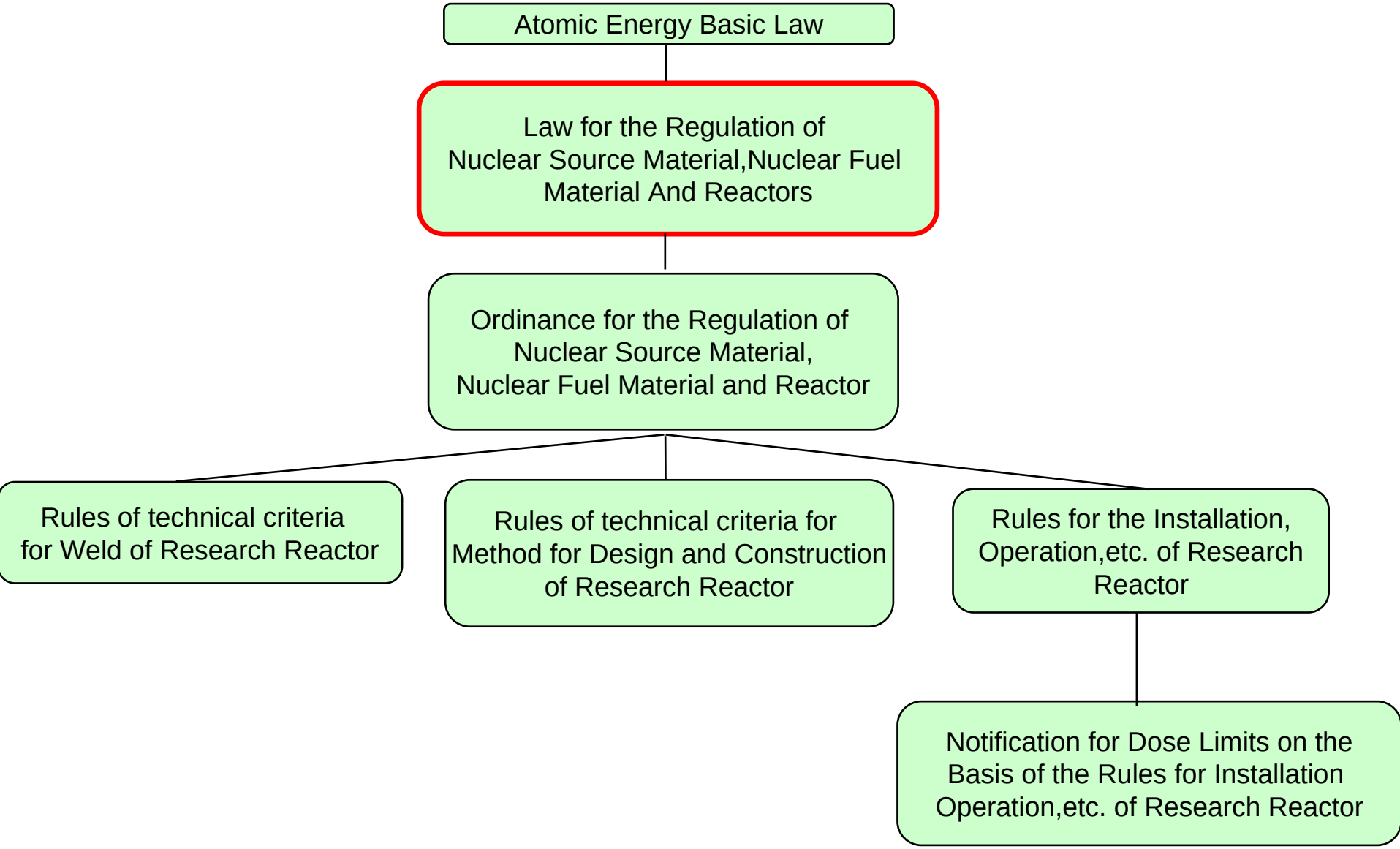
## Operation phase

- Approval for the safety manual
- Approval for the physical protection manual
- Designation of the chief technician of reactors
- Periodical safety inspection (once a quarter)
- Periodical hardware inspection (once a year)  etc.

## Decommissioning phase

- Approval for the plan of decommissioning
- Confirmation of completion of decommissioning

# Legislations for research reactor



## ***Requirement for safety management (Code paragraph 20 a)***

*The development and utilization of the nuclear energy have been promoted giving due priority to safety in accordance with the Atomic Energy Basic Law.*

*The JCO criticality accident in 1999, etc. showed importance of moral and safety culture in the organization, and resulted in the introduction of the Nuclear Safety Inspection and the Allegation System.*

# ***Assessment and verification of Safety (Code paragraph 20 b,c)***

*MEXT and licence holders perform and record the assessment and verification of the safety of nuclear installations in accordance with the legislative framework, at each stage of sitting, commissioning, construction, and operation. Necessary regulatory guides are enacted and utilized for assessment and verification of each stage.*

- **Assessment and Verification of Safety prior to Construction**

  An application for establishing a commercial power reactor consists of a main text and attached documents detailing safety design, safety analysis, sitting assessment, etc. in accordance with the provisions of the Reactor Regulation Law and the related legislation. The application document describes basic design with sufficient information for examining the safety.

## ○ Assessment and Verification of Safety Prior to the Commissioning

The licence holder of reactor establishment shall develop a construction plan for establishment of structures, and shall obtain the approval of MEXT before starting construction in accordance with the Nuclear Reactor Law.

After obtaining the approval of construction plan, he shall undergo the pre-service inspection by MEXT at the every process and at the completion of construction.

## ○Assessment and Verification of Safety during Operating Life Time

The license holder obtains the approval of Operational Safety Manual before commissioning, and perform the periodical safety assessment, and investigation of an accident or a failure and measures to prevent the recurrence, and undergoes the spot entry inspection conducted by MEXT at any time in addition to the Nuclear Safety Inspection, the Periodic Inspection, during the operating lifetime, so that the comprehensive confirmation of the safety of research reactors is performed.

## ***Requirement for Training of Personnel (Code paragraph 20e)***

The Reactor Regulation Law provides that the license holder prepare the Operational Safety Manual, obtain approval of MEXT on it and comply with it.

The program includes preparation of operation management system, education program on safety, operational procedures etc.

MEXT confirms and approves the Operational Safety Manual, and the Nuclear Safety Inspectors confirm the compliance with it by the license holder in the Nuclear Safety Inspection.

# ***Requirement for a quality assurance program (Code paragraph 20f)***

MEXT requires applicant for license, or license holder, of a nuclear installation to submit appropriate QA program, and confirms implementation of QA program as follows:

○Examination of Basic Policy for QA activities at Reactor Establishment

MEXT requires the applicant to submit the “Policy for Quality Assurance” attached to the application document at safety examination for establishment license of a nuclear installation,

○Confirmation of QA Activities throughout Operating Life

MEXT confirms QA activities of license holders throughout the operating life of nuclear installations as follows:

－ Description of QA activities in the Operational Safety Manual

－ Confirmation of compliance of the Operational Safety Manual in the Nuclear Safety Inspection

## ***Requirement to take human factors into account (Code paragraph 20g)***

The license holder takes human factors into consideration at the design stage of nuclear installation. The regulatory body also takes various steps for prevention and remediation of human errors at design stage.

## ***Requirement for a radiation protection (Code paragraph 20h, i)***

The standards of radiation protection for the general public and personnel engaged in radiation work in Japan are prescribed in the laws and legislations, such as the Reactor Regulation Law, the Industrial Safety and Health Law, etc.

The recommendations of the ICRP 1990 are incorporated into their provisions of radiation protection with due considerations.

Consequently, licence holders have kept the radiation exposure doses of personnel engaged in radiation work below the dose limit, as a matter of course, and have attempted to reduce the exposure based on the ALARA policy.

# Allowable Dose Limits

## 1) Allowable Dose Limits for Controlled Areas

The Rules for Commercial Power Reactors and the Dose Limits Notification requires license holders to establish radiation controlled area including reactor room, and spent fuel storage facilities and radioactive waste disposal facilities, where the dose of external radiation may exceed 1.3mSv for three months, or where the concentration of radioactive materials in the air or the surface density of radioactive materials may exceed the values specified in the notification, respectively, and to establish necessary measures to be taken in these areas.

## 2) Allowable Dose Limits for Occupational Exposure

The allowable dose limits for personnel engaged in radiation works are specified in the Dose Limits Notification as listed in following Table.

# Dose limits for personnel engaged in radiation work

| Items | Limit |
|---|---|
| 1. Effective dose limits | |
| a) Personnel engaged in radiation works | 100 mSv / 5 year, but do not exceed 50 mSv for any year |
| b) Female personnel | 100 mSv / 5 year, but do not exceed 5 mSv for any 3 months |
| c) Pregnant Female personnel | 100 mSv / 5 year, but do not exceed 1 mSv from internal exposure during pregnancy |
| 2. Equivalent dose limits | |
| a) Eye lens | 150 mSv/ year |
| b) Skin | 500 mSv/ year |
| c) Female abdominal region | 2 mSv from notification of pregnancy to delivery |
| 3. Dose limits for the personnel engaged in emergency radiation works | |
| a) Effective dose | 100 mSv/ incident |
| b) Equivalent dose for eye lens | 300mSv/ incident |
| c) Equivalent dose for skin | 1Sv/ incident |

## 3) Dose Limits for the Public

The dose limits for the public are also given in the Dose Limit Notification as follows;

Dose limits outside the peripheral monitoring area

Effective dose 1 mSv/ year

Equivalent dose for eye lens 15 mSv/year

Equivalent dose for skin 50 mSv/ year

# ***Criteria for sitting research reactor (Code paragraph 20 k)***

- The Nuclear Regulation Law requires that location of a research reactor must be selected and its structures and components must be designed so that the radiological hazards can be prevented.

- The adequacy of siting is examined in accordance with the Regulatory Guide for Reviewing Nuclear Reactor Siting Evaluation and Application Criteria (hereinafter called, the Guide for Reactor Sitting) etc. as part of safety examination of establishment license.

- The Regulatory Guide for Reactor Siting requires that no such event that might induce serious accidents has occurred in the past or could be expected to occur in the future at the proposed site and furthermore, there should not be events that may aggravate accidents, and that reactors are isolated at a sufficient distance from the public in consideration of engineered safety features.

# ***Requirements related to design, construction and commissioning (Code paragraph 20 l, m, n)***

## ○Design phase

In the safety examination conducted by MEXT, it is verified that basic design or design concept of the research reactor applied conforms to Regulatory Guide for Reviewing Safety Design of Research Reactor Facilities (hereinafter called, the Guide for Safety Design), and the safety is discussed and evaluated as a whole in accordance with the provisions of Regulatory Guide for Reviewing Safety Assessment of Research Reactor Facilities (hereinafter called, the Guide for Safety Assessment.).

The Regulatory Guide for Safety Design requires that the basic policy of the safety design for research reactors should be established, and structures, systems and components of nuclear reactor facilities should perform the required functions not only in the normal operation condition but also in the assumed abnormal situation to ensure the safety.

Specifically, two postulated event categories of "anticipated transients during operation" and "accidents" are defined and the safety during these events is evaluated based on the Guide for Safety Assessment.

Applicants to install nuclear reactors perform safety analysis on these postulated events and proves the adequacy of the safety design of the plant referring the results to the acceptance criteria.

## ○Construction Phase

MEXT will review to confirm that the detailed design of nuclear structures is not contradictory in the basic design or fundamental design policies of the establishment licensing stage, and is not nonconforming with the technical standards in accordance with the Rules of technical criteria for Method for Design and Construction of Research Reactor for the approval of construction plan concerned.

## ○Commissioning Phase

Licence holders, after receiving the Approval of Construction Plan, undergoes Pre-Service Inspection by NISA at each construction stage and at the completion of all construction works, to verify that the construction is completed in accordance with the Approval of Construction Plan and is not nonconforming with the technical standards.

The Pre-Service Inspections includes those inspections on structure, strength or leak-tightness of each component and these inspections on function and performance of overall system of commercial power reactor.

## ***Requirements related to operations, maintenance, modifications and utilization (Code paragraph 20o,p,q,r,s)***

# Limiting Conditions for Operation

- Operation and maintenance of research reactors are carried out in accordance with the Operational Safety Manual approved by MEXT.
- Operational Safety Program are included in the Limiting Conditions for Operation such as shutdown margin and reactor thermal limits, etc.
- If the LCO should not be complied, MEXT could order the licence holder to suspend the operation of the nuclear facility and so forth by the Reactor Regulation Law.

## Reporting of Incidents

- Reactor Regulation Law and require licence holders to report the situation and measures taken to the incidents or failures occurred in research reactors to MEXT.
- The example of reporting criteria is as follows;

  -When a reactor was shut down by failure of a reactor facility or when it became necessary to shut down a reactor during operation.

# ***Criteria for release from regulatory control of decommissioned reactor (Code paragraph 20 u)***

- Release from regulatory control of decommissioned reactor carried out the approval of application for confirmation by MEXT in accordance with the Rules for the Installation, Operation, etc. of Research Reactor.

## ***Application for confirmation***

- result of decommissioning
- result of nuclear fuel transfer
- result of decontamination
- result of disposal of contaminant

## ***Standard of Approval***

- Nuclear fuel transfer is done.
- Measure for preventing from radioactive disaster is not required of Facility left after decommissioning and land.
- Disposal of contaminant is done.

# Topics

## ***Reassessment of seismic safety in line with the new guideline***

### Background

NSC decided to revising the Regulatory Guide for Seismic Design Review of Nuclear Power Reactor Facilities in Sep. 2006, which established in 1981.The new guideline is innovated a latest methodology and technology for seismic design.

### Revision summary

–Optimize the evaluation method for ground motion waveform.

–Review the seismic safety importance classification.

–Utilization of PSA findings for seismic safety.

***→MEXT recommended all the licensees to report the result of reassessment the seismic safety for their research reactor in line with the new guideline.***

***Thank you for your attention***