

Nuclear Emergency Preparedness and Response in Japan following Fukushima Accident

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1. New Nuclear Regulatory Organization

New Nuclear Regulatory Organization

Independence:

- To resolved the problem caused by having both “promotion of utilization” and “safety regulations” under the same organization, the safety regulation division was separated from the Ministry of Economy, Trade and Industry.
- The “**Nuclear Regulation Authority (NRA)**”, was established as an external organization of the Ministry of Environment.

Integration:

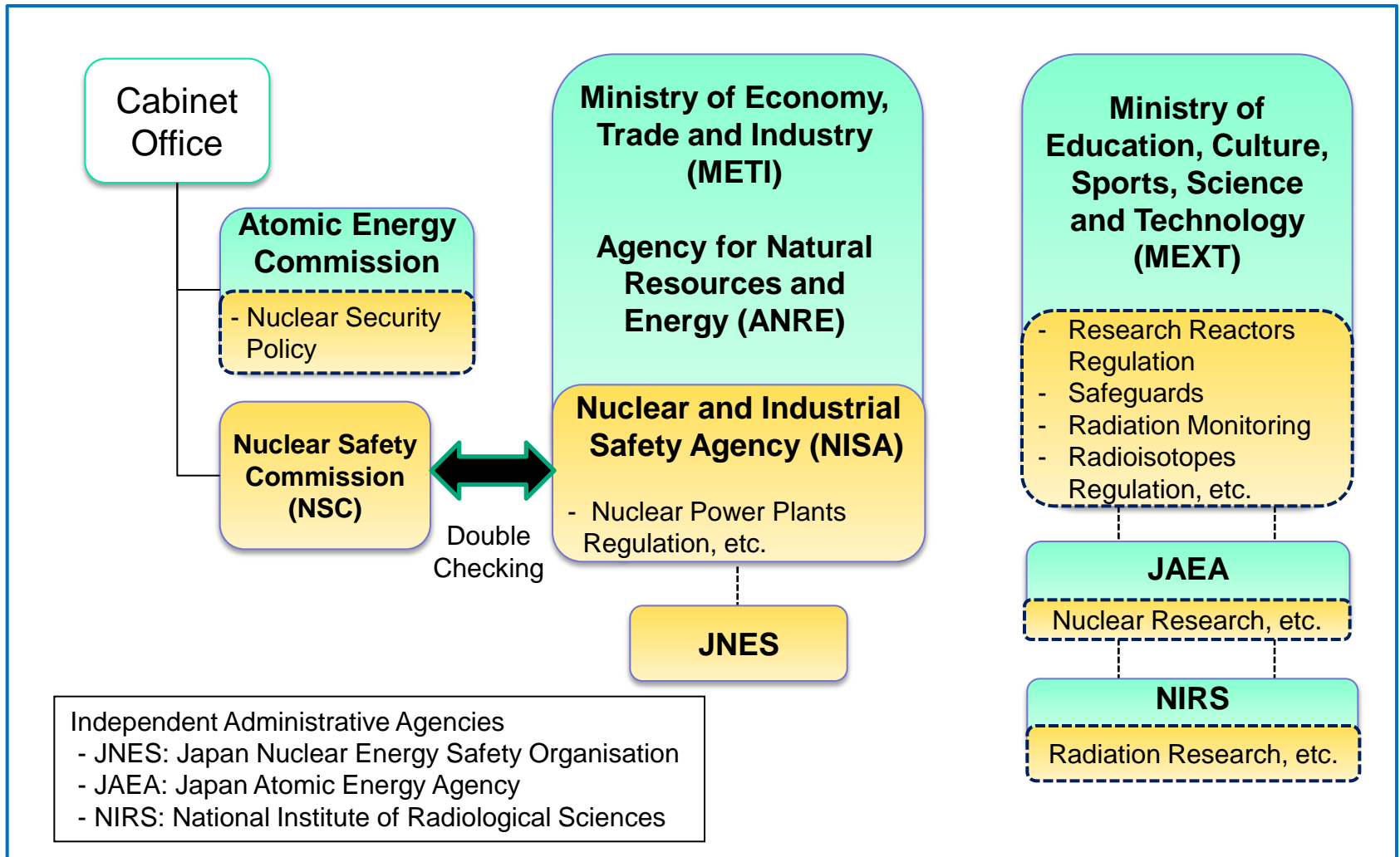
- Integrate nuclear regulation functions, namely, nuclear safety, security, safeguards, radiation monitoring and radioisotopes regulation, into the NRA.

Crisis Management:

- Establish “Nuclear Emergency Preparedness Commission” in a cabinet
- Implement nuclear emergency prevention measures in close cooperation with relevant organisations.

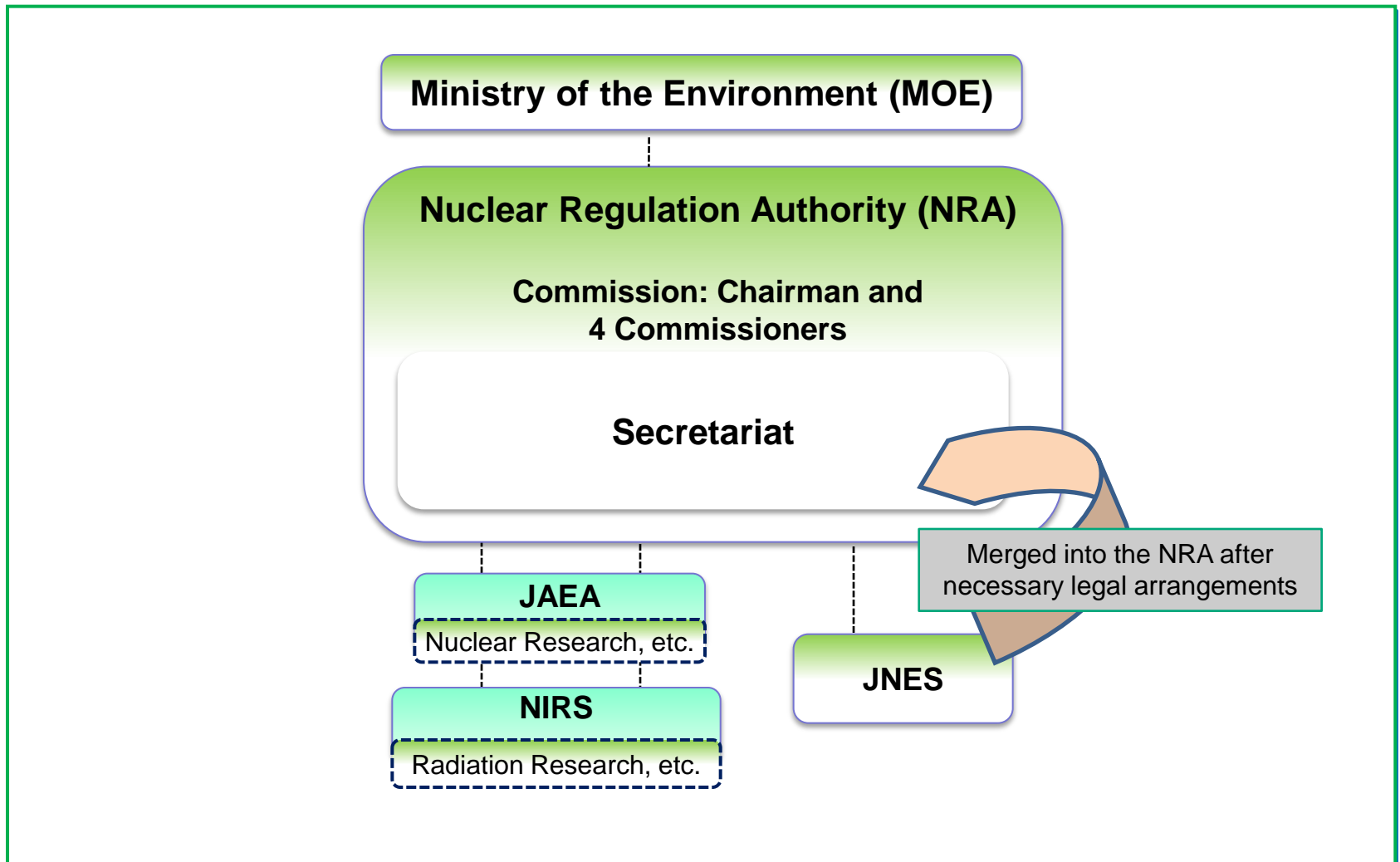
New Nuclear Regulatory Organization

Previous Organizations (till 9/19/2012)



New Nuclear Regulatory Organization

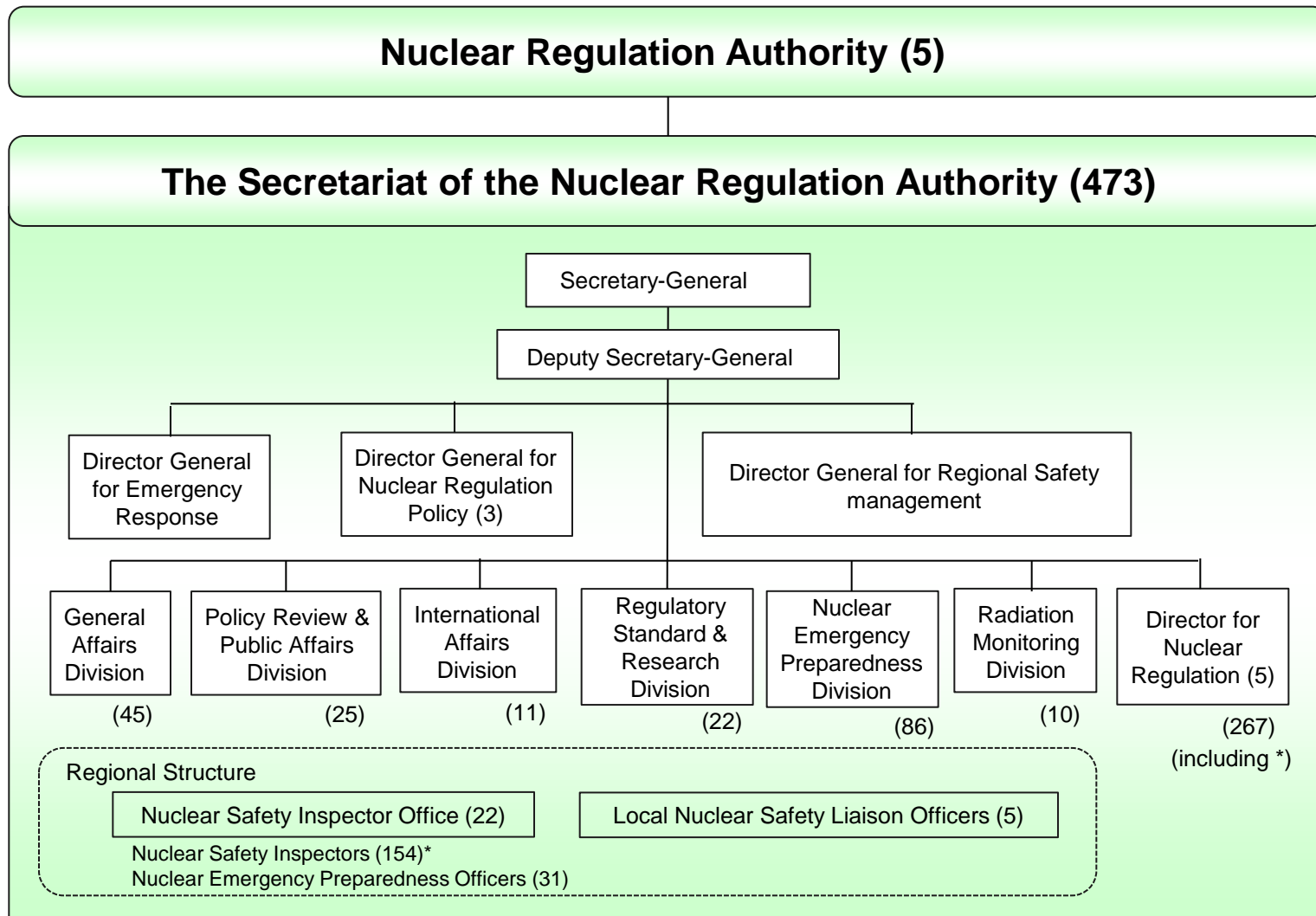
New Organizations (from 9/19/2012)



NRA's Core Values and Principles

- ◆ Learn and absorb lessons from Fukushima and never allow such accidents again
- ◆ Restore public trust of utmost importance
- ◆ Foster a genuine safety culture; Highest priority on public safety
- ◆ Independent decision-making based on scientific and technological information, free from any outside pressure or bias
- ◆ Achieve genuinely effective regulations rather than formalities
- ◆ Open and transparent organization: avoid self-isolation, self-righteousness
- ◆ High ethical standards, sense of mission, rightful pride
- ◆ Swift and effective response readiness to all emergencies

NRA Organization (as of March 2013)



2. Enhancement of the Nuclear Emergency Preparedness System

National Government

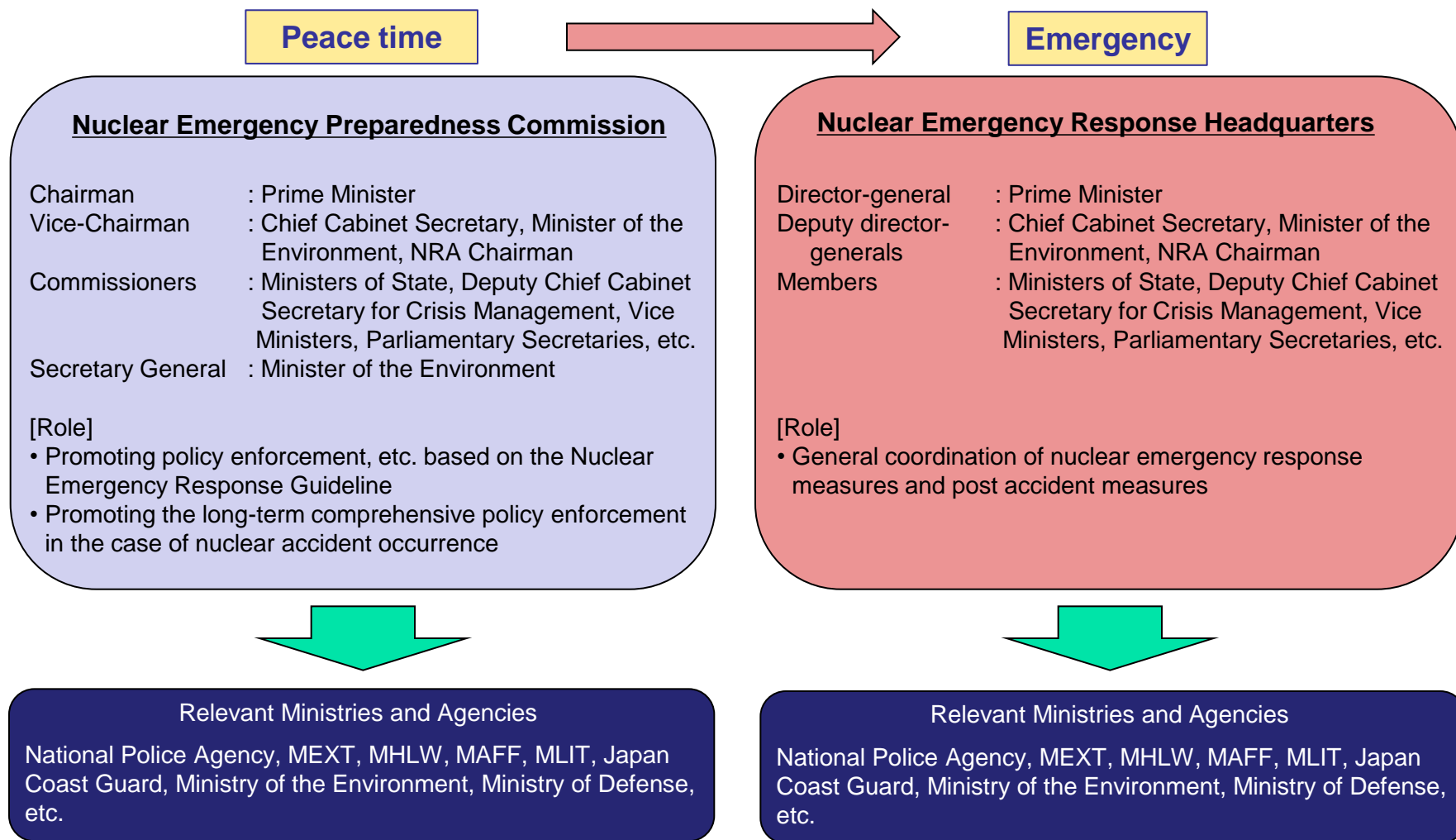
- **Peace Time**

As a precaution against emergencies, a new **Nuclear Emergency Preparedness Commission (NEPC)** is permanently established under the Cabinet to promote nuclear emergency preparedness measures throughout the government from normal times.

- **Emergency**

Nuclear Emergency Response Headquarters is temporarily installed under the Cabinet Office at the time of Declaration of the State of Nuclear Emergency.

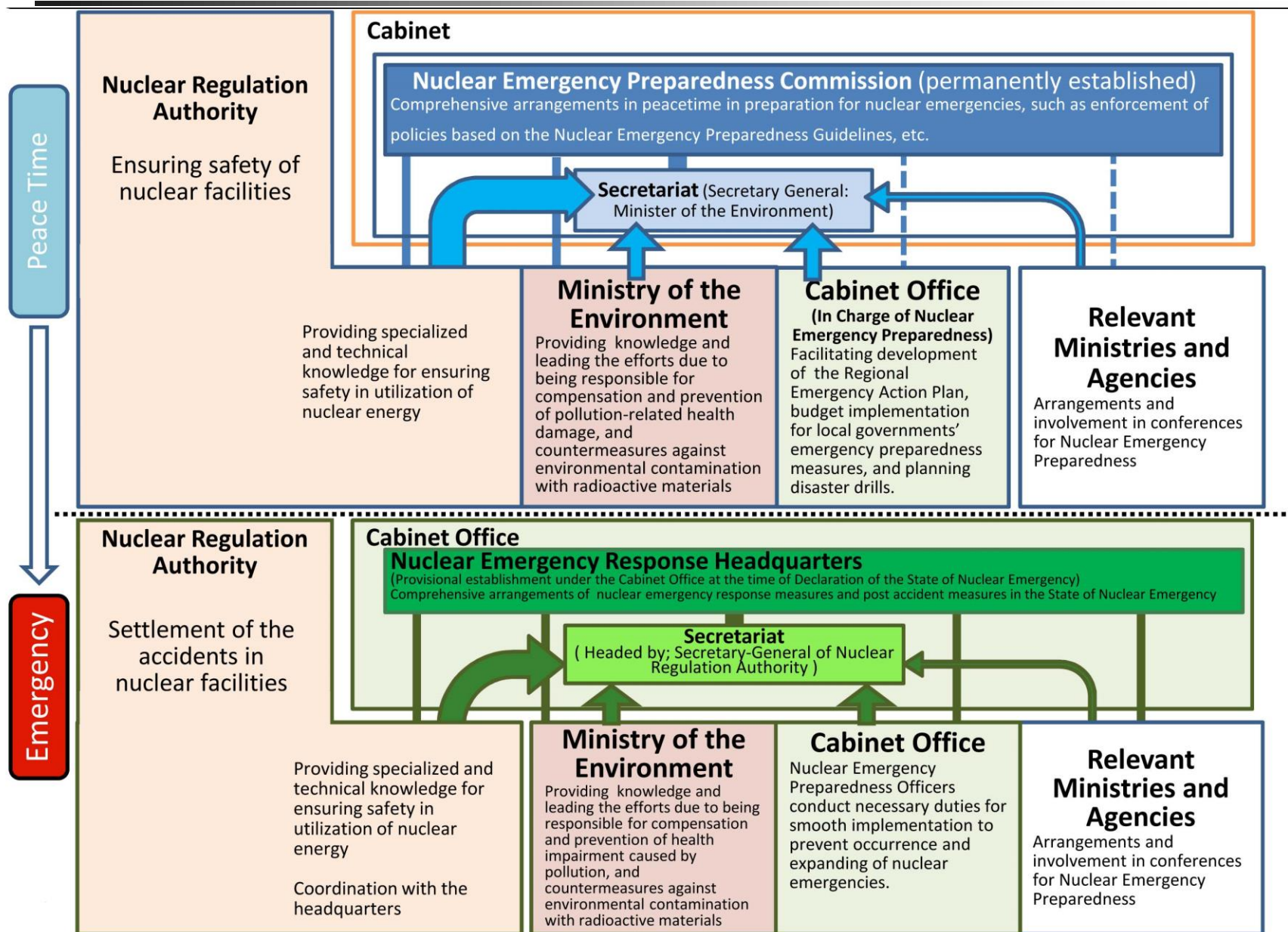
Nuclear Emergency Preparedness Commission



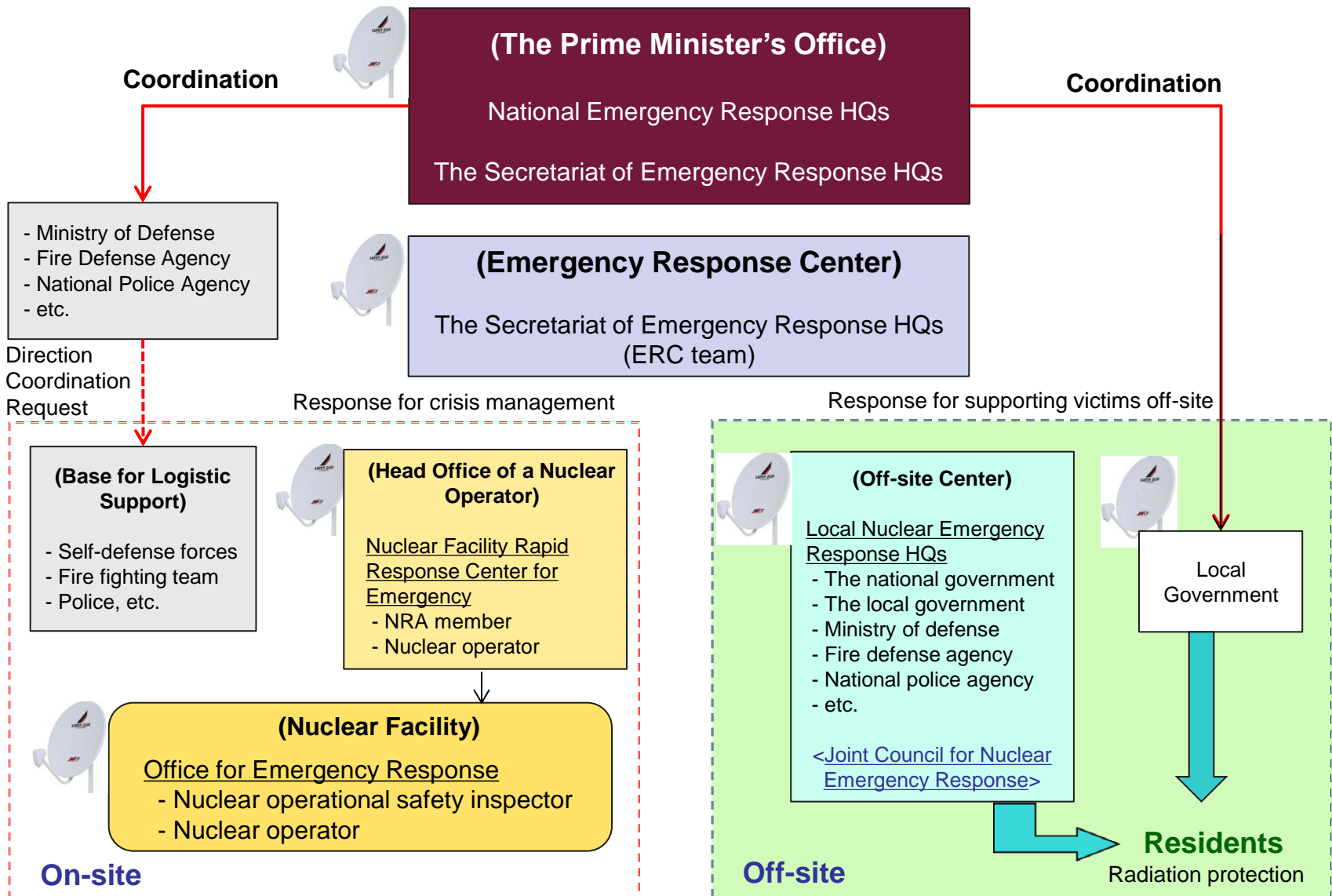
NRA: Nuclear Regulation Authority
 MEXT: Ministry of Education, Culture, Sports, Science and Technology
 MLIT: Ministry of Land, Infrastructure, Transport and Tourism

MAFF: Ministry of Agriculture, Forestry and Fisheries
 MHLW: Ministry of Health, Labour and Welfare

Nuclear Emergency Preparedness System of the National Government



The National Crisis Management System in Case of Emergency



3. Nuclear Emergency Response Guideline

Nuclear Emergency Response Guideline

- 1979.3 Three Mile Island Nuclear Power Plant Accident
- 1980.6 “Disaster Measure around Nuclear Power Plant (Nuclear Emergency Response Guideline)” by Nuclear Safety Committee (NSC)
- 1999.9 JCO Critical Accident
- 2000.5 Revision of “Nuclear Emergency Response Guideline”
 - ☞ to rename “Disaster measure around Nuclear Facility”
 - ☞ to add and revise the content due to Special Law of Nuclear Emergency Preparedness” established on 1999.12
- 2011.3 Fukushima Daiichi Nuclear Power Plant Accident of Tokyo Electric Company
- 2012.3 “Intermediate Summary about the revision of Nuclear Emergency Preparedness Guideline” reported by NSC
- 2012.10 “Nuclear Emergency Response Guideline” formulated by Nuclear Regulation Authority (NRA)
(http://www.nsr.go.jp/activity/bousai/data/saitai_shishin.pdf)
- 2013.6 “Nuclear Emergency Response Guideline” implemented by NRA

Concept on the Implementation of Urgent Protective Actions in case of Emergency

Judge the situation based on the plant condition
(Emergency Action Level (EAL))

- Protective measures (Avoiding deterministic effects)
 - Evacuation
 - Providing dose of stable iodine tablets...

Judge the situation based on the air radiation dose rate
(Operational Intervention Level (OIL))

- Protective measures in an emergency
(Reducing stochastic effects)
 - Evacuation
 - Temporary relocation
 - Restriction of food and drink intake



Emergency



EAL

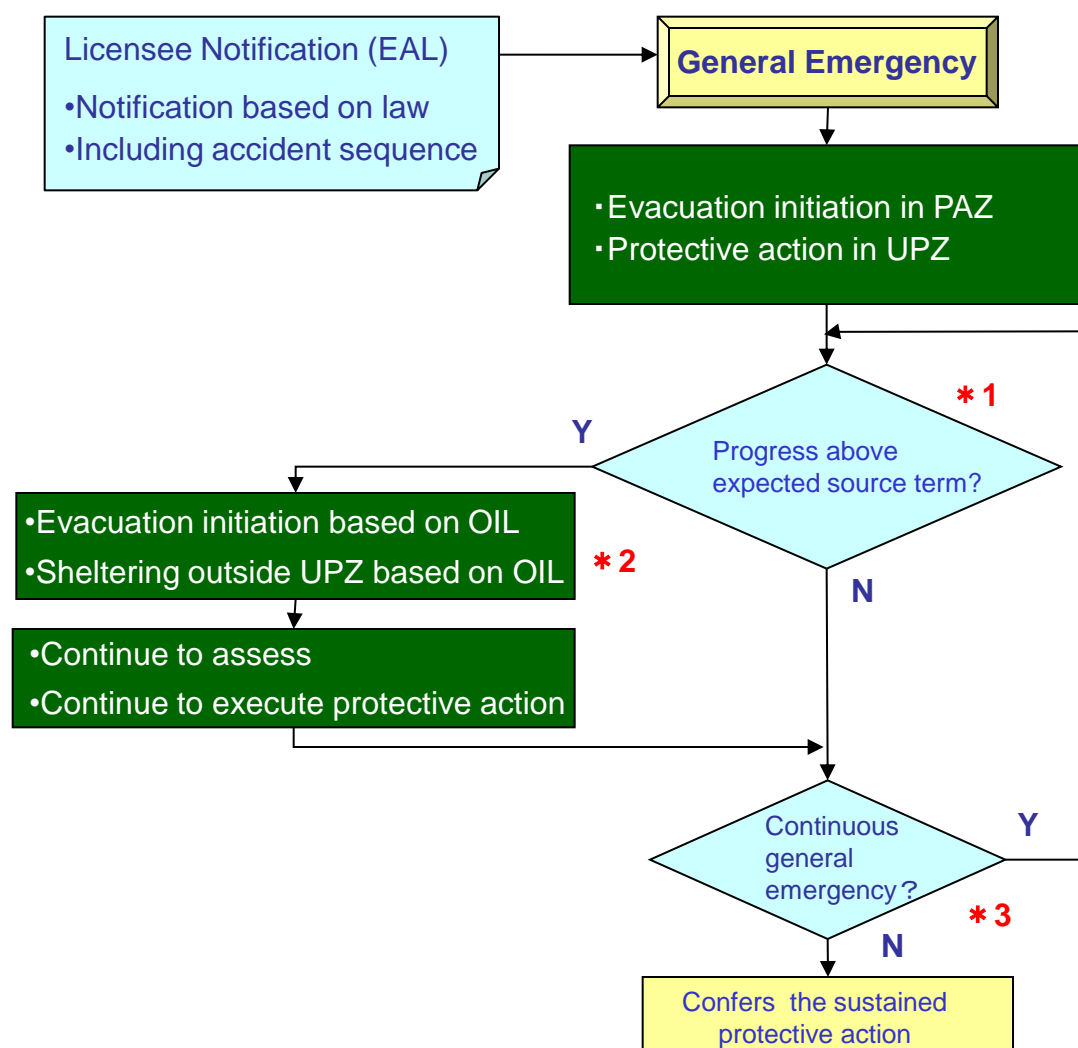
Release of
radioactive
materials



OIL

Progression of the situation

Basic Ideas for Emergency Classification



Scheme:

- PAZ is determined the immediate evacuation zone including multi reactors accident
- UPZ is determined the protective action zone in stage if necessary
(If the sequence is above the expected source term, the evacuation zone is expanded in stage.)
- In PAZ and UPZ, each protective action is done by EAL.

- * 1 : Judgment of conditions by accident sequence (including complex disaster)
- * 2 : Air radiation levels are taken in UPZ. Evacuation initiation and other protective action are implemented based on OIL. Graded evacuation distance is tentative.
- * 3 : Strengthen of emergency support system such as tracking the atmospheric diffusion after radioactive materials release

Flowchart for Decision of Initial Response in General Emergency

The Status of Emergency Classification in Application of EAL

NRA and JNES develop the EAL guideline.

- Referred to IAEA requirement and U.S. EAL guideline (NUREG-0654, NEI 99-01)
- The guideline provides EAL for standard scenarios.
- Operators prepare each EAL and report to NRA.
- NRA reviews the EAL.

Emergency Class	NUREG0654 NEI 99-01	IAEA classification
General Emergency (Article 15)	General Emergency	General Emergency
Site Area Emergency (Article 10)	Site Area Emergency	Site Area Emergency
		Facility Emergency
Alert	Alert	Alert
Events written in Reactor Regulation Act	Unusual Event	—

Emergency Classification Level and Evaluation Criteria

	Class 1	Class 2	Class 3
Emergency Class	Alert : Prepare for implementation within and without the facilities	Site Emergency: Implement protective action on the site and prepare for protective actions off the site	General Emergency: Start evacuation within PAZ and implement protective actions in UPZ
Emergency Action Level (EAL)	Establishment of criteria to be used when plant safety level is decreased or when an event which is possible to cause such a situation is occurred. (EAL1)	Establishment of criteria to be used when plant function required to protect public safety is lost or when an event which is possible to cause such a situation is occurred. (EAL2)	Establishment of criteria to be used when a core damage or fuel melting is generated or when an event which is possible to cause such a situation is occurred, and, when an event which is possible to cause a loss of containment integrity is occurred. (EAL3)

Emergency Classification : Alert

- ***Special Alarm Phenomenon***

- 1) If, in prefectures where nuclear facilities are located, more than intensity 6 earthquake occurred.
- 2) If, in prefectures where nuclear facilities are located, large tsunami warning was issued.
- 3) When the Tokai Earthquake Advisory was issued
- 4) Others, such as when the chairman of the Nuclear Regulation Authority the establishment of a headquarters warning is deemed necessary.

Emergency Classification : Site Area Emergency

- ***Article 10 on Special Law of Emergency Preparedness for Nuclear Disaster***
 - 1) Leakage of reactor coolant
 - 2) A breakdown of residual heat removal capabilities in addition to the breakdown of heat removal capabilities from the reactor via the main condenser
 - 3) Loss of all of the alternating-current power supply (for more than 5 minutes)
 - 4) The power source that supplies electricity to emergency direct-current generating lines was reduced to one, with the number of emergency direct-current generating lines also being reduced to one (for more than 5 minutes)
 - 5) A state in which a nuclear reactor's operations are suspended and the level of water in the reactor vessel lowers to the point at which the emergency core cooling system becomes activated
 - 6) All nuclear reactor cooling functions break down while the reactor is an inactive state, etc.

Emergency Classification : General Emergency

● *Article 15 on Special Law of Emergency Preparedness for Nuclear Disaster*

- 1-1) When the nuclear reactor needs to be shutdown urgently, it cannot be done so by using a normal neutron absorber
- 1-2) When the nuclear reactor needs to be shutdown urgently, all functions designed to stop the reactor break down.
- 2) Unable to inject water into the nuclear reactor by any of the emergency core cooling system
- 3) The depressurizing function of the nuclear reactor vessel breaks down when the residual heat removing function from the reactor has broken down.
- 4) All functions that cool the nuclear reactor break down.
- 5) All of emergency direct-current power supplies break down (for more than 5 minutes).
- 6) Detection of radiation doses or temperatures that indicate melting of the reactor
- 7) Lowering of water levels to the point at which the residual heat removal function breaks down (for more than 1 hour)
- 8) Lowering of liquid levels in the storage tank containing fuel assemblies which have been irradiated to the point at which the fuel assembly is exposed above the liquid surface.
- 9) A dose rate measured at the nuclear facility site boundary of 5 $\mu\text{Sv/h}$, etc.

Future Plans for Japan's Emergency Classification

- **Examined to determinate the plant status for emergency classification submitted by the nuclear operator.**

The Setting of Operational Intervention Level (OIL)

With reference to international standard and lessons learned from the accident at the Fukushima Daiichi Nuclear Power Plant.



- **Determination of the range may extend the influence of radiation.**
- **Preparation for prompt implementation of protective actions.**
- **Reduction of the stochastic effect along the international standards.**

The Setting of OIL (1)

- **Determination of the range may extend the influence of radiation**
 - Area based on the EAL classification, where the evacuation is immediately done before the release of radioactive materials.



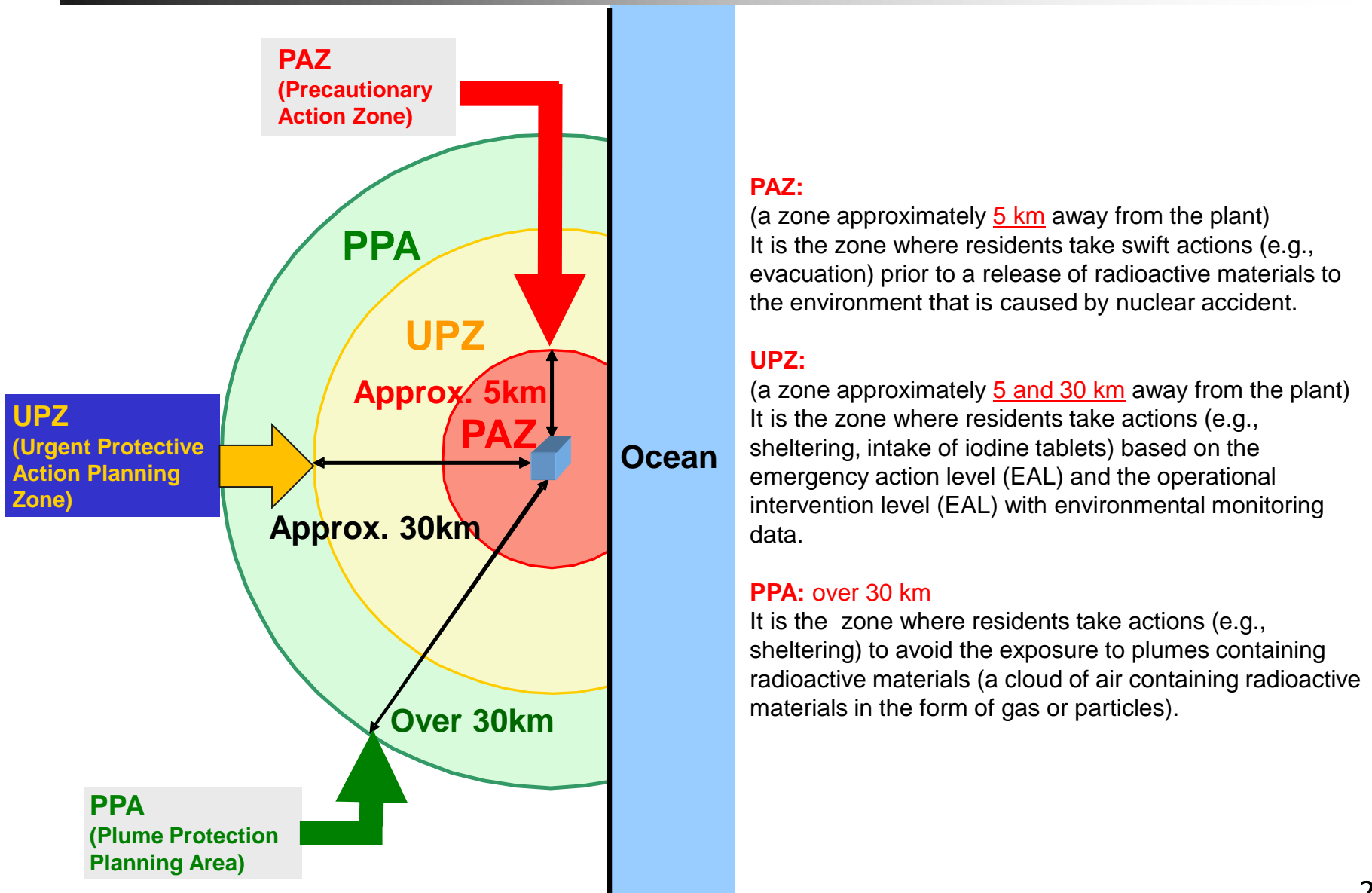
Setting of PAZ (approx. 5 km)

- Area where the evacuation or the sheltering is conducted based on measured value with OIL reference.



Setting of UPZ (approx. 5-30 km)

Concept of Zones for Nuclear Emergency Preparedness and Response



The Setting of OIL (2)

- **Preparation for prompt implementation of protective actions**

<Measures performed by national & local governments and the nuclear operators>

- Development of monitoring system in an emergency
- Centralized information management from monitoring posts
- Wide-area monitoring using aircraft
- Securement of the information transmission to local residents during peacetime.

The Setting of OIL (3)

- **Reduction of the stochastic effect along the international standards**

<Standard protective measures as defined in reference generic criteria (GC) by the IAEA>

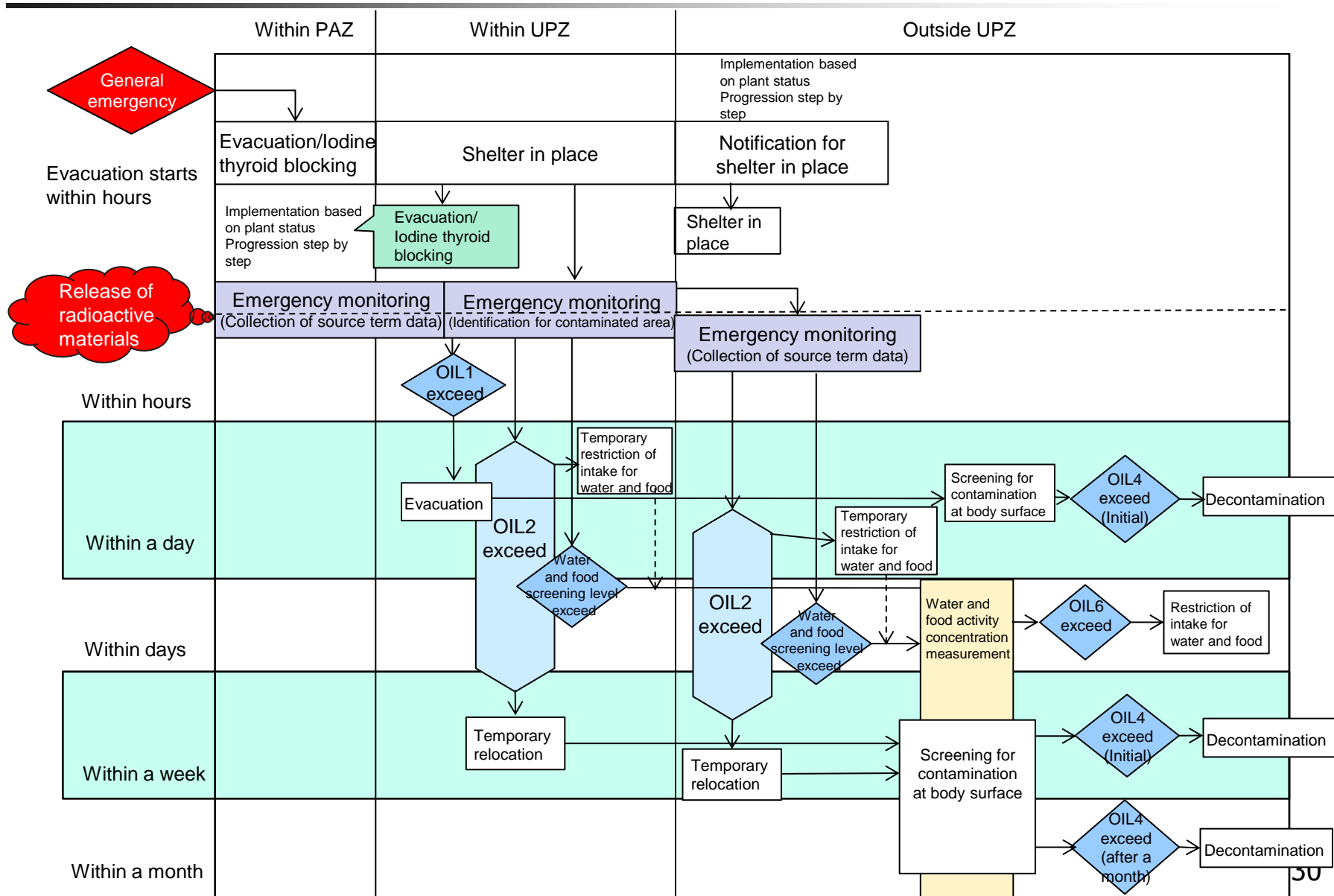
- **OIL1: 500 $\mu\text{Sv/h}$** Evacuation or sheltering indoors (for several hours)
- **OIL2: 20 $\mu\text{Sv/h}$** Temporary relocation (for 1 week maximum)
- **OIL3: 0.5 $\mu\text{Sv/h}$** Restriction of food and drink intake (until details are confirmed)
- **OIL4: 40,000 cpm** Decontamination of the body (act promptly)
- **OIL5: No value assigned** (screening of food and drink)
- **OIL6: Restriction of food and drink intake may be recommended** depending on the results of nuclide analysis (for 1 week maximum)

The Setting of OIL (4)

<Japan's own Modifications>

- GM survey meter of Japan has a large diameter more than the criteria of IAEA.
- OIL2, which is the criterion for the judgment of temporary relocation, is set to reflect the lessons of the accident at Fukushima Daiichi nuclear power plant.
- In Japan, it is easily to measure nuclide analysis in environmental samples. Japan does not set OIL5 which IAEA shows.

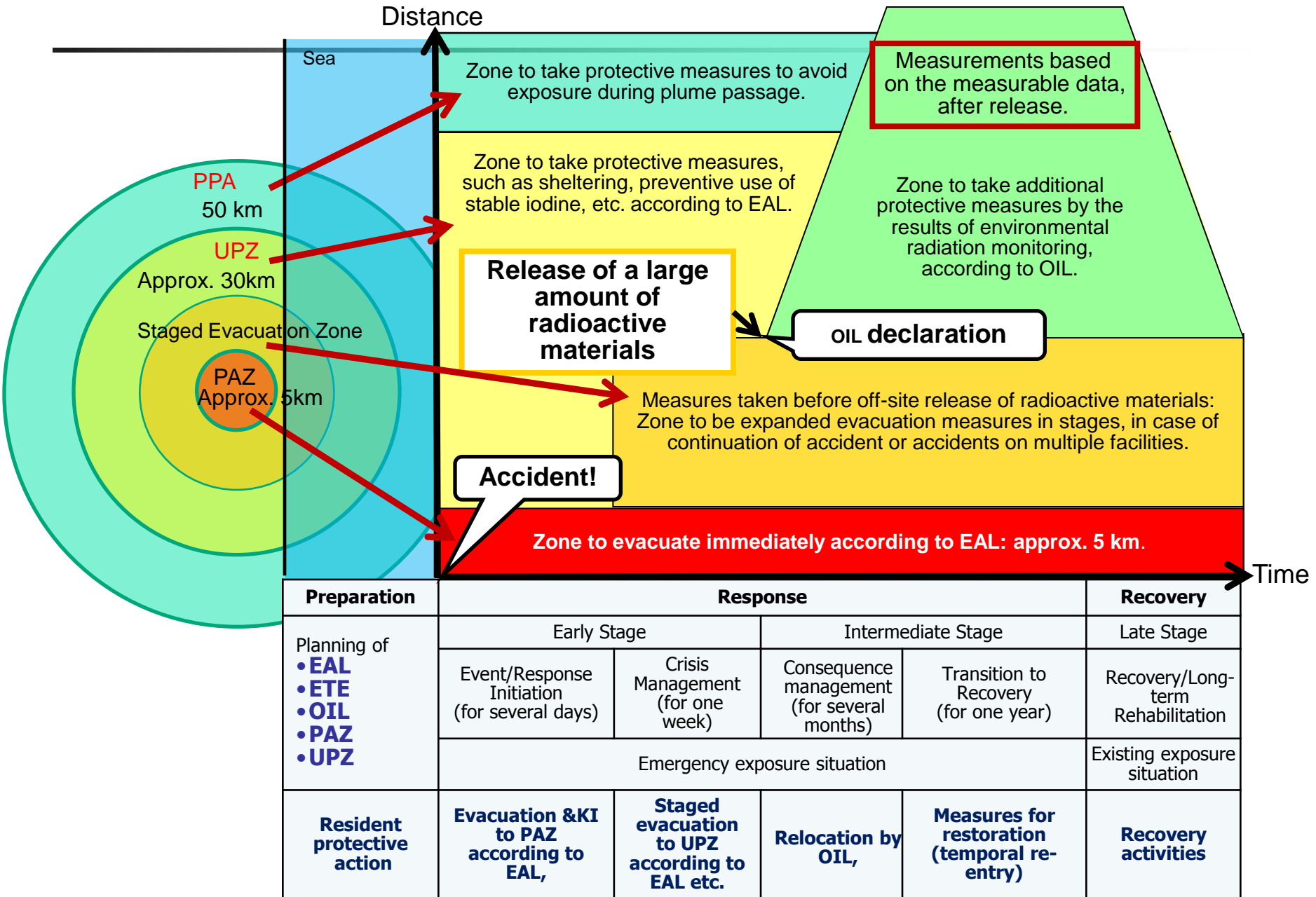
Concept of Operation for Protective Action



Summary

- **The new regulatory system is established and separated from the promotion organization.**
- **The new protective action process is to take lessons in the international criteria such as EAL and OIL.**

Concluding Remarks: Framework View



Any Questions?

