

International Forum "Chornobyl's Legacy for the Nuclear Safety of the World"

30<sup>th</sup> anniversary of the Chernobyl NPP accident

5<sup>th</sup> anniversary of the Fukushima Daiichi NPS accident

International Community  
in Search for International Guarantees of the  
World Nuclear Safety



Japan Atomic Energy Agency  
Special Advisor to the President

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National Technical University of Ukraine KPI, Kyiv, Ukraine, 21-23 April, 2016.

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  - Decommissioning of the Fukushima Daiichi NPS and related R&D activities
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  - Activities for enhanced safety regulation and nuclear safety
  - Global situation and future prospects of nuclear energy
4. Ukraine-Japan cooperation to advance aftermath response to accidents at NPS and contribute to the enhancement of world nuclear safety

# 1. Support/cooperation for the Chernobyl NPP Accident

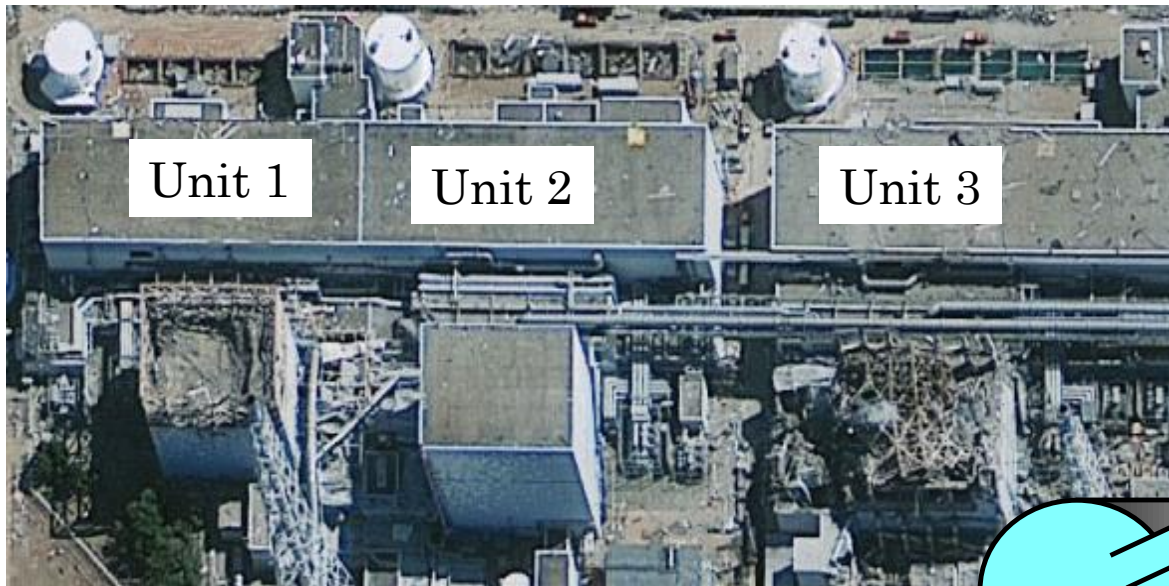
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- Two international conventions on nuclear accidents: came into effect in 1987 following negotiation at the IAEA
  - Convention on Early Notification of a Nuclear Accident
  - Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency
- <== Special statement on the Chernobyl Nuclear Accident at Tokyo G7 summit (May 4-5, 1986):
- Various types of support
  - Nuclear safety assistance: Assistance to Nuclear Safety Account and Chernobyl Sarcophagus Fund
  - Humanitarian aid: Provision of medical supplies, Contribution through the WHO
  - Assistance for denuclearization (completed in May, 2015): Support for establishment of a nuclear material control system, provision of medical equipment and materials for personnel for disposition of nuclear weapons, etc.

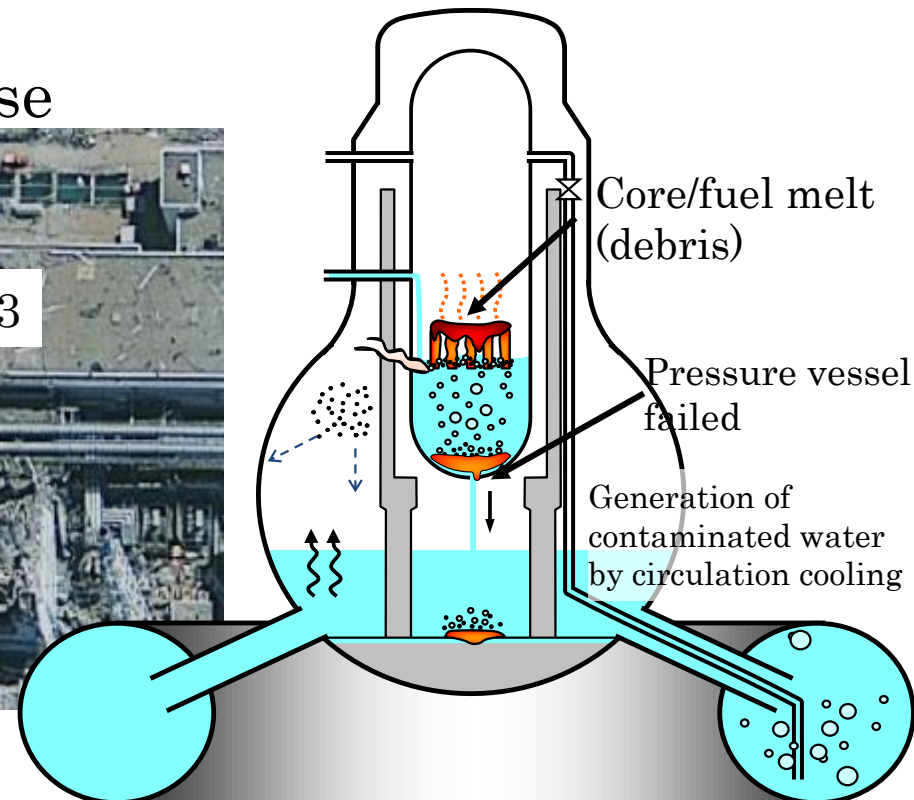


# 2-1 Overview of the Fukushima Daiichi NPS Accident (March 11, 2011)

- Reactors were safely shut down by earthquake.
- Station blackout: off-site power (by earthquake), emergency power (by tsunami)
- Loss of core cooling functions -> Core damage/melt -> Hydrogen explosion, Radioactive material release



Appearance of Units 1-3 immediately after the accident



Schematic of core cooling condition

## 2-2 Response to the Fukushima Daiichi NPS Accident and Efforts toward Reconstruction/Revitalization of Fukushima

### [Emergency response measures]

For 1 month from immediately after the accident

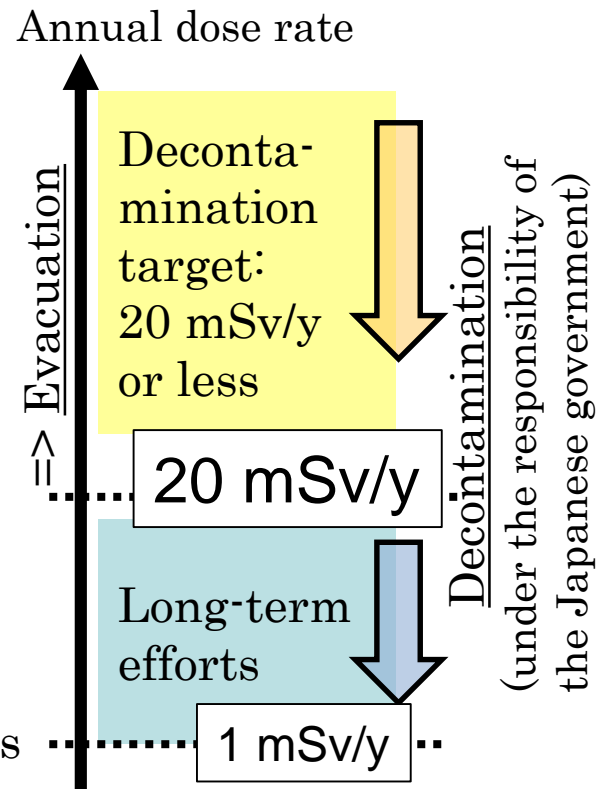
- Measures to stabilize the reactor
- Measures to minimize radiation exposure: Setting up of evacuation zones (20km radius), Restriction on ingestion of food and drink

### [Aimed at environmental restoration, the lifting of evacuation order, and the return of residents]

For 1 year from after the accident

- Start of decontamination, temporary access of evacuees to home, etc.
- Monitoring and measurement of radiation

=>Lifting and successive update of evacuation order zones

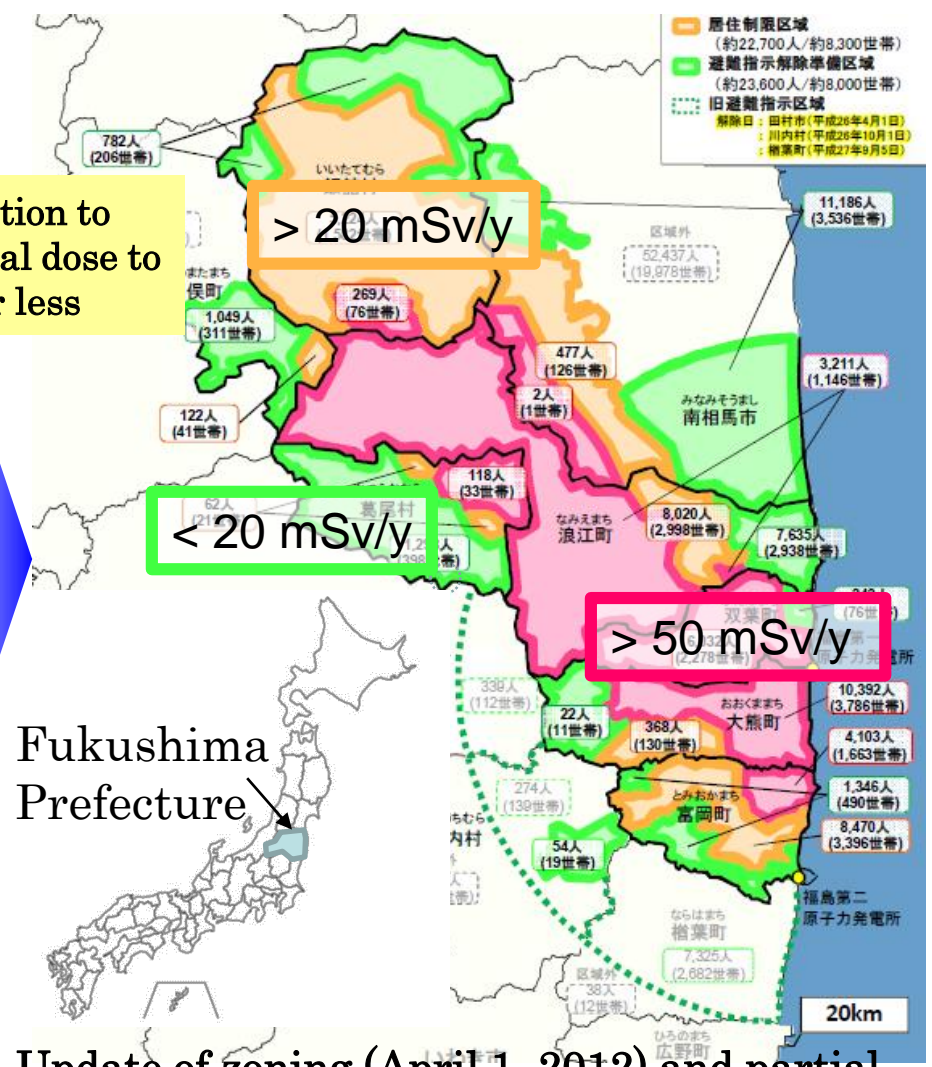


### [Toward Reconstruction/Revitalization of Fukushima] Target annual doses

Beyond 1 year or more after the accident

- Measures for early returnees: Continued decontamination, Infrastructure reconstruction, etc.
- Measures for long-term evacuees: Establishment of evacuee housing
- Support for new lives: Preparation for new living environment, Creation of new industry.

# 2-3 Update of Evacuation Order Zones with the Progress of Decontamination



Update of zoning (April 1, 2012) and partial lifting of evacuation order zones (step by step since April, 2014)

Zone determination after the accident

## 2-4 Nuclear Liability Scheme

### Act on Compensation for Nuclear Damage (1962)

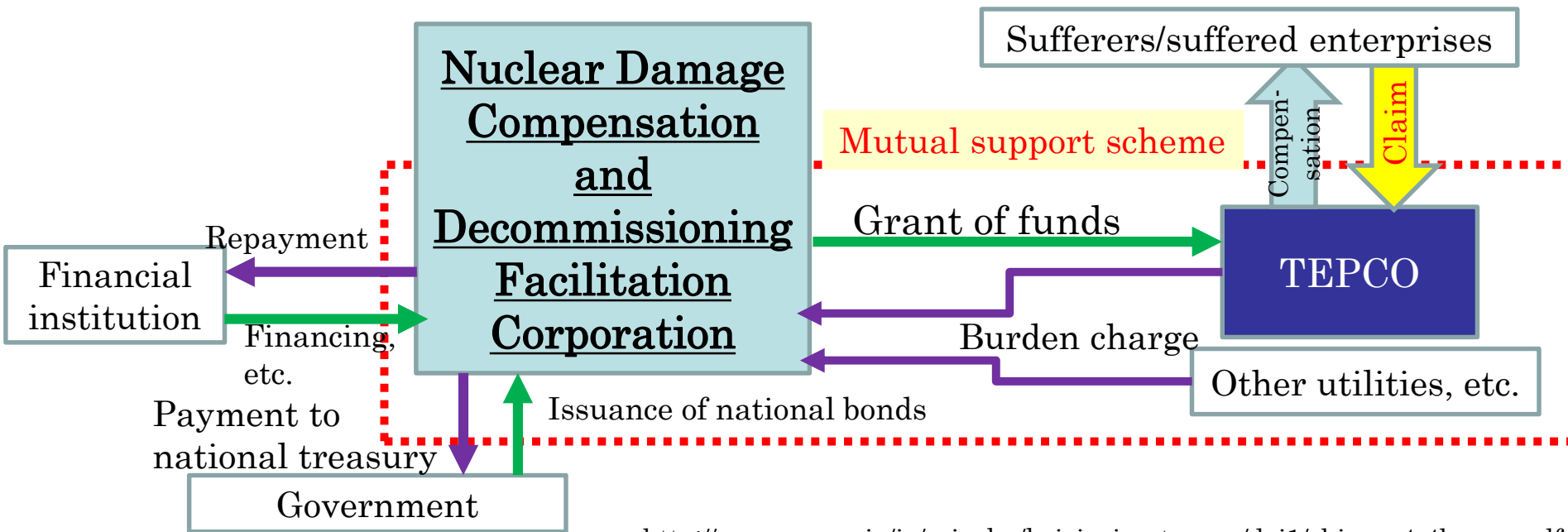


New mechanism centered on the Nuclear Damage Compensation Facilitation Corporation (established in Sept. 2011)

- Concept of mutual support among nuclear operators
- To ensure rapid and adequate compensation for sufferers

Re-organization to Nuclear Damage Compensation and Decommissioning Facilitation Corporation (August, 2014)

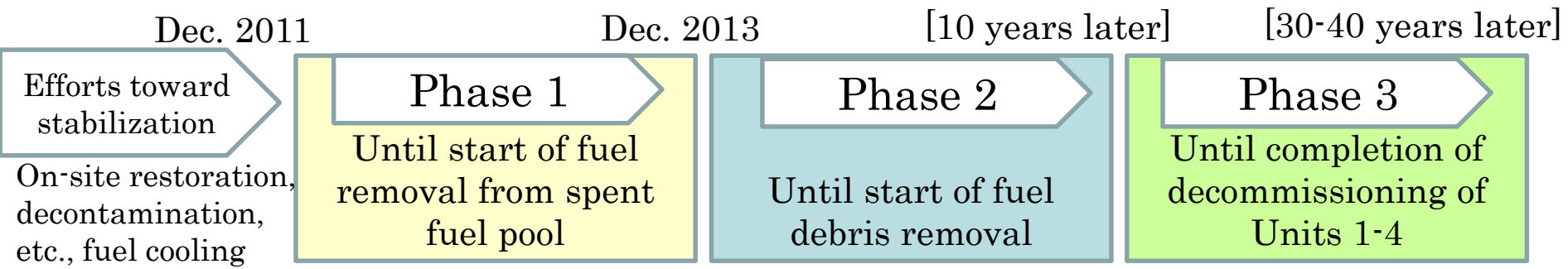
- Smooth decommissioning of the Fukushima Daiichi NPS



# 2-5 Decommissioning of Fukushima Daiichi NPS

## Mid-and-long-Term Roadmap towards the Decommissioning of TEPCO's Fukushima Daiichi NPS (revised in June 2015)

1. Removal of fuel from spent fuel pool
2. Treatment of contaminated water
3. Removal and disposition of fuel debris
4. Treatment of solid waste



- Focus on risk reduction
- Clarification of milestones
- Enhancement of relationship of trust with local communities through thorough information disclosure
- Further reduction in worker exposure/ Enhanced occupational safety and health management system



# 2-6 R&D Efforts for Decommissioning Centered on the JAEA

Ministry of Education, Culture, Sports, Science and Technology has initiated Acceleration Plan of Reactor Decommissioning R&D for the Fukushima Daiichi NPS

- Arrangement to bring together the wisdom of key figures from home and abroad
- Enhancement of decommissioning research from home and abroad
- Enhancement of middle & long-term human resource development functions
- Development of information supply functions

## ➤ TEPCO

(Tokyo Electric Power Company)

## ➤ IRID

(International Research Institute for Nuclear Decommissioning)

## Fukushima Pref.

Fukushima Prefectural Centre for Environmental Creation



Technology Centre



## (1) CLADS (Tomioka)

Collaborative Laboratories for Advanced Decommissioning Science

Mar., 2017~  
100-150 staff



IBARAKI site (Hot lab., 50 staffs)  
April, 2015-



Collaborative Laboratories for Advanced Decommissioning Science

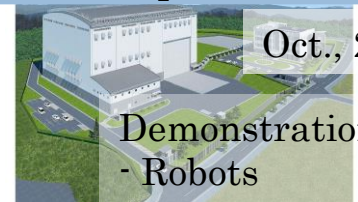
## (2) Okuma Analysis and Research Center

2017~  
Analyzing hard-to-measure nuclides, etc.



## (3) Naraha Remote Technology Development Center

Oct., 2015~  
Demonstration tests  
- Robots  
- Debris Removal Devices etc.



# 2-7 R&D Facilities in Fukushima Prefecture

## Fukushima Pref.

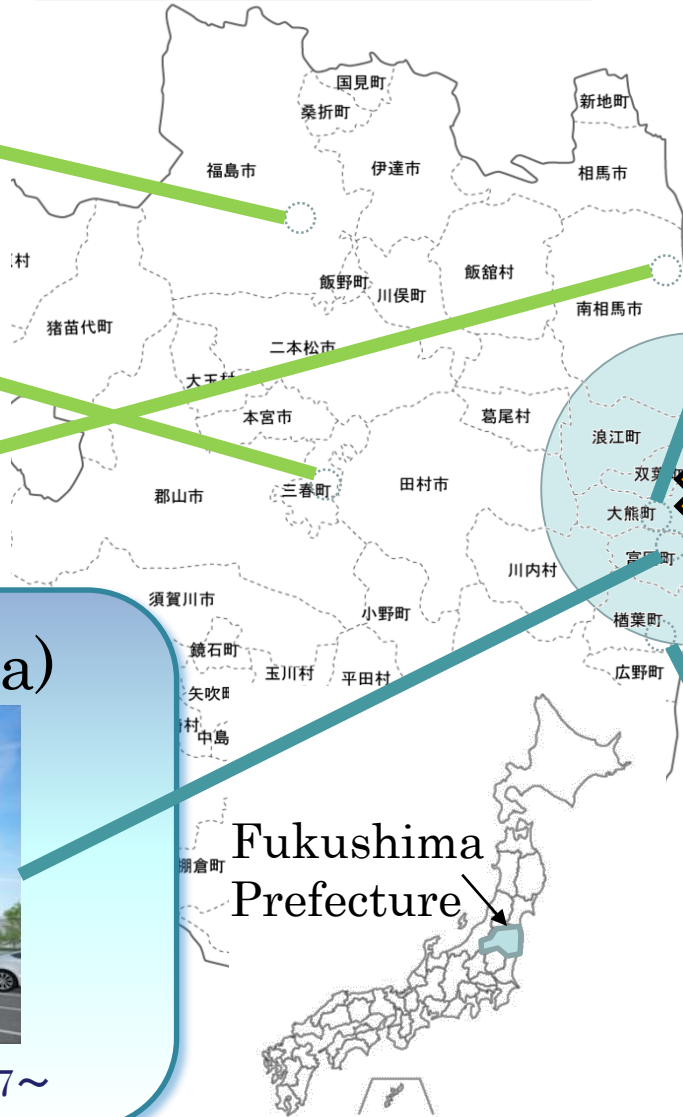
Technology Centre




Fukushima Prefectural Centre for Environmental Creation




## Fukushima Prefecture



(2) Okuma Analysis and Research Center



2017~

(1) CLADS (Tomioka)



Mar., 2017~

(3) Naraha Remote Technology Development Center



Oct., 2015~

## 2-8 Promotion of International R&D at JAEA-CLADS

### 1<sup>st</sup> CLADS International Workshop

- Held Nov. 2015, at Tokai, Japan
- 130 participants, 6 overseas countries



1<sup>st</sup> CLADS Workshop  
"Advanced science toward  
Decommissioning of FDNPP"

November 10, 2015

Organized by  
Collaborative Laboratories for Advanced Decommissioning Science (CLADS)  
JAPAN ATOMIC ENERGY AGENCY (JAEA)

### Possible Collaboration Items between Ukraine - Japan

1. Collaborative research: Institute for Safety Problem of NPP of the National Academy of Sciences of Ukraine and JAEA have started an information exchange on technology regarding the fuel containing material of Chernobyl and debris of Fukushima NPS.
2. Collaborative work in the frame of OECD/NEA: e.g. Databasing for severe accident-related materials (debris, fission products, etc.)
3. Researcher invitation: Invitation to the 2<sup>nd</sup> CLADS international workshop (next autumn)

# 2-9 Responses to the Fukushima Daiichi NPS Accident (Summary)

## IAEA report (published on August 31, 2015)

Prepared by approximately 180 experts from 42 countries in an international advisory committee organized with the participation of OECD/NEA, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and other institutions.

Foreword written by Yukiya Amano, Director General, IAEA:

- Since nuclear safety in Japan was based on a "myth about the safety," preparation for major nuclear accidents was not sufficient.
- Distributed regulatory responsibilities among a number of organizations/ Lack of measures against the coincidence of large natural disasters and nuclear accident  
=> improved after the Fukushima Accident

Chapter 1: Introduction: Significance and configuration of the report

Chapter 2: Description and evaluation of the accident (consideration of nuclear safety):

Several important aspects did not sufficiently follow international practice. Consideration of tsunami and other external events was insufficient.

Chapter 3: Emergency preparedness and response: Lack of a system to respond to the coincidence of nuclear emergency and natural disasters

Chapter 4: Radiation effects: consistent with the conclusion of the UNSCEAR report

Chapter 5: Restoration after the accident: External exposure from cesium deposited on the ground surface is dominant (focused on decontamination work)/ Need for sustainable solutions for contaminated water

### 3. Development of Basic Energy Plan

#### -Significance of Nuclear Energy-

Developed in June 2014 by the Japanese Government based on the Basic Act on Energy Policy

(Significance of Nuclear Energy)

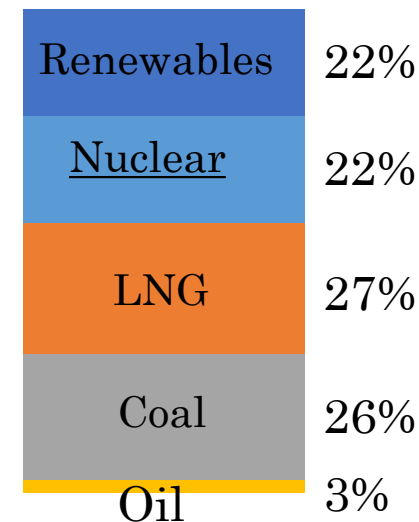
- Important baseload power source (based on ensured safety)
- Less dependence on nuclear power
- Restart of nuclear power plants based on compliance with the Nuclear Regulation Authority's standards

Nuclear Regulation Authority (NRA)  
(established in Sept. 2012)

- Independence
- Centralized regulation

Enhanced: measures against natural phenomena and fire, safety equipment reliability, anti-seismic/tsunami performance

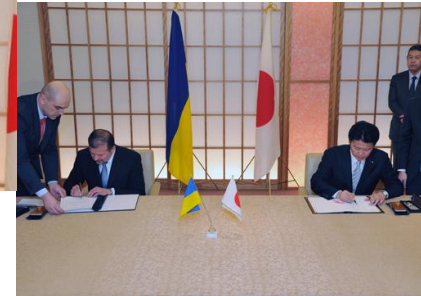
Newly established: severe accident measures



Best-mixed power generation systems in 2030

# 4-1 Ukraine-Japan Cooperation to Advance Aftermath Response to Accidents at Nuclear Power Stations

- Ukraine-Japan cooperation:
  - "Agreement concerning Cooperation to Advance Aftermath Response to Accidents at Nuclear Power Stations": concluded in April 2012, and came into effect in May 2012
- Meeting of the intergovernmental cooperation joint committee based on this Agreement:
  - ✓ 1st Mtg. (July 2012), 2nd Mtg. (July 2013): Support for responses to the Fukushima NPS accident, possible cooperation for addressing NPS accidents
  - ✓ 3rd. Mtg. (Nov. 2015): Further promotion of information sharing between two countries, etc.
- Cooperation results:
  - ✓ 6 Japanese ultra-small earth observation satellites were launched by Ukrainian rockets to observe regions surrounding the both Chernobyl and Fukushima NPSs (June and Nov. 2014).
  - ✓ Nearly 80 Chernobyl NPS accident investigation teams from Japan visited the Chernobyl site.
  - ✓ Many exchanges between experts of both countries.



## 4-2 Conclusion (1):

### Contribution to the Enhancement of the World Nuclear Safety (1/2)

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#### Contribution to international community by Ukraine and Japan

It is a responsibility of Ukraine and Japan as countries that have experienced severe nuclear reactor accidents to contribute to enhancement of world nuclear safety in a positive and leading way.

- Systematization and sharing among countries concerned of lessons, findings and technologies obtained from the responses to Chernobyl and Fukushima NPS accidents
  - Accident cause investigation; Reflection of the results into severe accident management technology and regulation
  - Environmental restoration technology
  - Damage liability scheme for nuclear accidents
  - Various responses and measures against nuclear accidents (development of emergency evacuation plans, emergency support, life reconstruction, etc.)
  - Technology to decommission a reactor that caused accident

## 4-2 Conclusion (2):

### Contribution to the Enhancement of the World Nuclear Safety (2/2)

- My personal idea for nuclear emergency response measures
  - Establishment of an international nuclear emergency support team:
    - ✓ Establishment of national nuclear emergency support teams
    - ✓ International cooperation among national teams for nuclear accidents in any countries  
(cooperation for the team of the country with an accident, or for establishment, training and guidance of teams for countries that newly introduce nuclear reactors)
    - ✓ Coordination of the roles of respective countries' teams by the IAEA, if needed
  - Succession of lessons and findings of nuclear accidents, human resource development for nuclear emergency response



Japanese Emergency Countermeasure Support Team



FARN (Force d'Action Rapide Nucleaire): French nuclear emergency response force





**Thank you for your kind attention.**