

# Study on How to Build Nuclear Emergency Response Systems in East Asia

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- 1 Introduction
- 2 International Emergency Response Systems
- 3 Present Situation and Approach in East Asia
- 4 Conclusion

# 1 Introduction

This report refers to a study implemented between 2013 and 2015 under a contract with the Economic Research Institute for ASEAN and East Asia.

- The Fukushima accident has prompted people to reaffirm the need for correct communications in Japan and the international community in a nuclear emergency.
- A large number of nuclear power stations exist in East Asia. China and Southeast Asia are constructing new nuclear power stations.
- In East Asia, **a nuclear emergency could affect multiple countries.**



The Fangchenggang Nuclear Power Station, planned to start commercial operation in 2015, is about 60 kilometers from China's border with Vietnam.

## 1-1 Introduction - Background (2/4)

### ○ The Fukushima accident affected foreign countries as well.

- The U.S. government recommended American residents in Japan on March 16 to evacuate from a 50-mile (80-kilometer) radius of the Fukushima **Daiichi nuclear** power station. The radius differed from the Japanese government-designated 20-kilometer radius, confusing foreign governments.
- The European Union issued European Commission Implementing Regulation No. 297/2011 on March 26, toughening restrictions on food and feed imports from Japan by requiring them to be accompanied by certificates issued by Japanese authorities. (The regulation was applied to the member countries of the European Free Trade Area.)
- Even as of 2015, South Korea is still restricting farm and fishery product imports from Japan, prompting Japan to file a petition against the restrictions with the World Trade Organization.



Photo source: TEPCO website



Photo source: Kantei website



# 1-1 Introduction - Background (3/4)

○ The 2011 Fukushima accident prompted people to reaffirm **the need for preparations for a severe accident.**

⇒ Japan and other countries are enhancing emergency response facilities and offsite support systems at power stations.



○ But no system similar to the nuclear emergency response system built in Europe has yet been created in East Asia.



**Attempting to make recommendations on how to create emergency response systems in East Asia based on research achievements by the Nuclear Energy Working Group of the Economic Research Institute for ASEAN and East Asia (ERIA)**

# 1-1 Introduction - Background (4/4)

## OERIA Nuclear Energy WG operations

The WG discussed “nuclear emergency response systems” from FY2013 to FY2014.

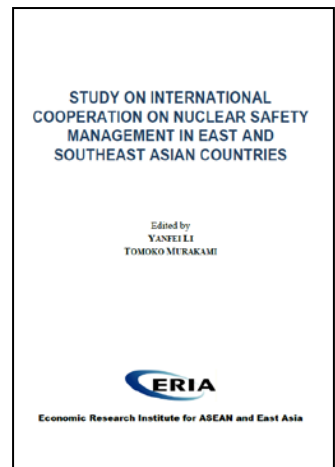
### • Participants

- Japan: IEEJ (Institute of Energy Economics, Japan)
  - China: CNPRI (China Nuclear Power Technology Research Institute)
  - Indonesia: BATAN (Indonesian National Nuclear Energy Agency)
  - Malaysia: MKN (Malaysian National Security Council)
  - Philippines: DOE (Philippine Department of Energy)
  - South Korea: KINS (Korea Institute of Nuclear Safety)
  - Singapore: NUS (National University of Singapore)
  - Thailand: MOEN (Thai Ministry of Energy)
  - Vietnam: VARANS (Vietnam Agency for Radiation and Nuclear Safety)
- etc.

Studying desirable cooperation in nuclear emergency and preparing draft guidelines



ERIA Nuclear Energy WG (2014@Malaysia)



ERIA Nuclear Energy WG (FY2013) Report

# 1-2 Introduction - Nuclear Power Stations in East Asia

- In East Asia, **100 nuclear reactors are in operation**. In the future, **Southeast Asian countries are expected to introduce nuclear reactors**.



- : Operating nuclear reactors
- : Constructing nuclear reactors
- : Planning to introduce nuclear power generation

Country	Status	Number of reactors	Capacity (MW)	Number of reactors under construction
Japan	◎	43	40,480	2
China	◎	27	24,196	24
(Taiwan)	◎	6	4,927	2
South Korea	◎	24	21,677	4
Vietnam	○	-	-	2*
Malaysia	△	-	-	-
Thailand	△	-	-	-
Indonesia	×	-	-	-
Philippines	×	-	-	-
Singapore	×	-	-	-

\* Construction starting in or after 2015

◎: Operating nuclear reactors  
 △: Planning to introduce nuclear power generation

○: Constructing nuclear reactors  
 ×: No plan to introduce nuclear power generation

- How frequently would severe accidents occur in East Asia?

Data used at Power Generation Cost Verification WG in 2015: 1 accident per 4,000 reactor-years

⇒ 1 accident per about 40 years in East Asia

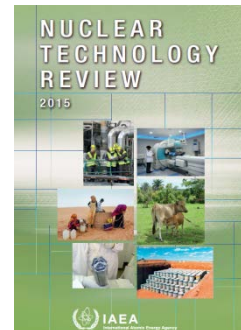
3 commercial reactor accidents in past 16,000 reactor-years (1 accident per 5,300 reactor-years)

⇒ 1 accident per about 50 years in East Asia

NRC's PRA (probabilistic risk assessment) performance target:

Core damage frequency  $< 1 \times 10^{-4}$ /reactor-year (1 per 10,000 reactor-years)

⇒ 1 accident per about 100 years in East Asia





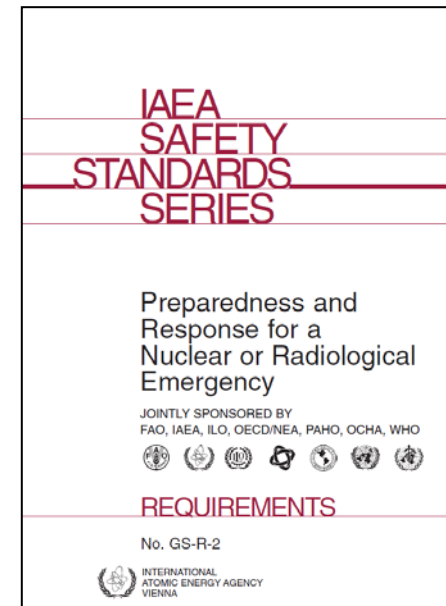
# 1-3 Introduction - What Is Response for a Nuclear Emergency?

○ What is response for a nuclear (or radiological) emergency?

Minimizing consequences of any nuclear or radiological emergency on people, property and the environment.

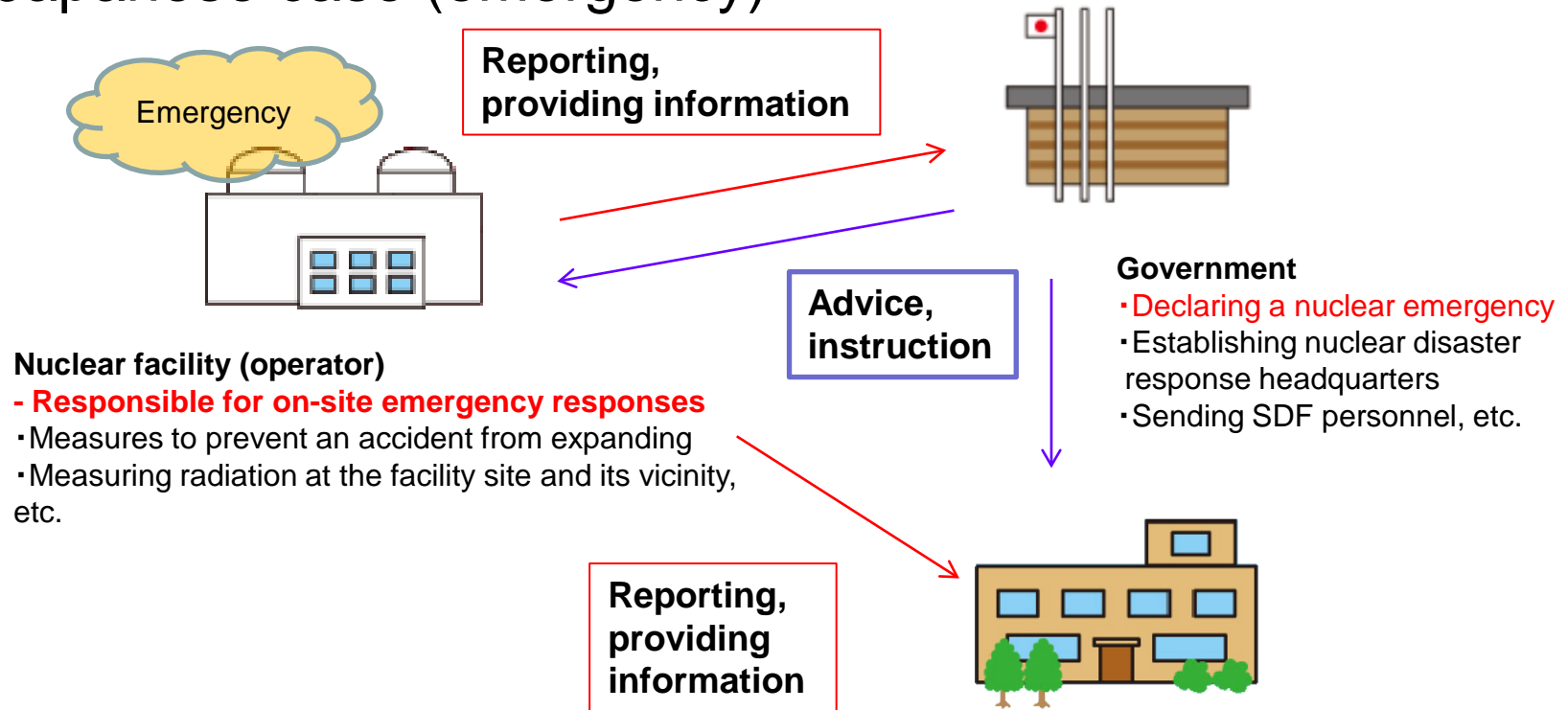


Given that inappropriate acts in a nuclear emergency could lead to health damage through radiation exposure, **it is very important to prepare contingency plans for emergency response in advance.**



# 1-4 Introduction - Japan's Nuclear Emergency Response System

## ○ Japanese case (emergency)



### In normal times,

**Government:** Making basic disaster prevention plans and guidelines for nuclear disaster measures, implementing nuclear disaster prevention exercises (once a year)

**Local governments:** Making local disaster prevention plans (including evacuation plans)

**Operators:** Making disaster prevention plans for nuclear business operators, etc.

### Local governments

- **Responsible for off-site emergency responses**

• Establishing nuclear disaster response headquarters

• **Issuing evacuation instructions for residents**

## 2 International Emergency Response Systems

## 2-1 International Emergency Response Systems - IAEA

○ IAEA (International Atomic Energy Agency: an autonomous United Nations agency)

- “Convention on Early Notification of a Nuclear Accident (adopted in September 1986)”
  - An IAEA member country is **required to promptly report details of an accident (facts, time, venue, etc.) to the IAEA.**
  - The IAEA is set to **promptly provide the report and information received from a member to the others, etc. (update its website).**



Source: IAEA-HP

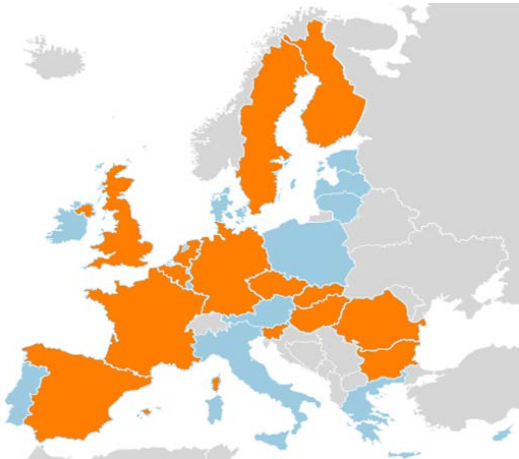
- “Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (adopted in September 1986)”
  - An IAEA member country is allowed to request assistance from other members or international organizations. The IAEA may meet the request and mediate and coordinate between members.
- The IAEA headquarters has established the Incident and Emergency Center (IEC) to receive accident reports around the clock.

Minimum requirements for an emergency


## 2-2 International Emergency Response Systems - Europe (1/3)


### ○ European nuclear power generation

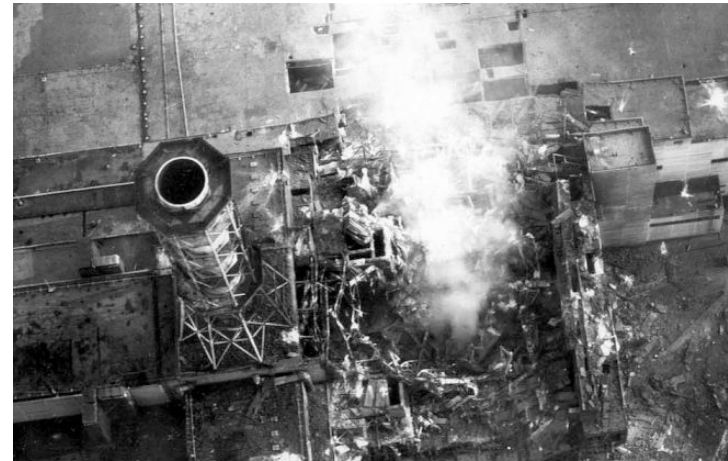
- Fourteen EU members and Switzerland outside the EU are using nuclear power generation.
- When an accident occurred at Unit 4 of the Chernobyl nuclear power station in 1986, Europe experienced information shortages and a fallout of radioactive materials.



European Union member states:

 with nuclear power

 without nuclear power



Source: Asahi Shimbun

Europe has experienced the Chernobyl accident and is **highly interested in cross-border cooperation.**

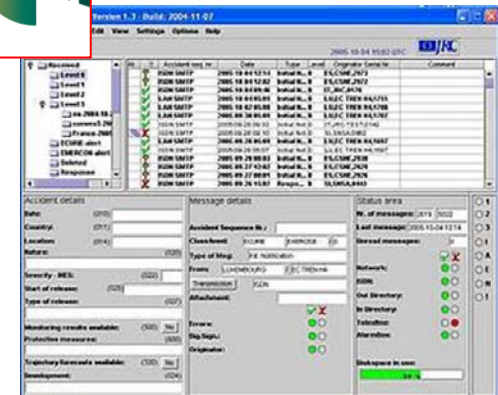
## 2-2 International Emergency Response Systems - Europe (2/3)

- EURATOM (European Atomic Energy Community: An EU-operated international organization)
  - “Decision on Community arrangements for the early exchange of information in the event of a radiological emergency 87/600”
    - Establishing a framework for notification and provision of information



### ECURIE (European Community Urgent Radiological Information Exchange)

- The ECURIE system is **a platform** built under the abovementioned decision **for European countries to make initial response and share information.**
- In a nuclear emergency, information may be provided to member countries through the EURIE system
- The EU may also receive information on necessary measures from member countries.
- The ECURIE system covers all the EU members, Switzerland and Croatia.



Source: REM-Website

**An information-sharing system for emergencies has been built, with exercises conducted regularly.**

## 2-2 International Emergency Response Systems - Europe (3/3)



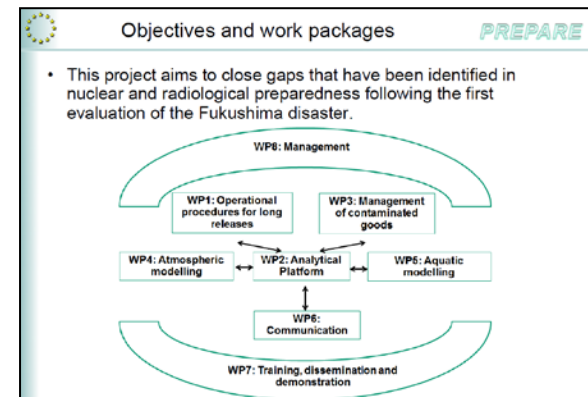
### OEURATOM (continued)

NERIS (National Energy Referral Information System, a European platform on preparedness for nuclear and radiological emergency response and recovery)

- NERIS has been established for European countries to **share their measures taken in response to the Chernobyl nuclear plant accident and improve knowledge on nuclear emergency response measures and subsequent recovery.**
- Regular workshops and training courses have been established. Research has been implemented on methods for protection from radiation and surveillance.

### PREPARE (NERIS project)

- A total of 20 European and former Soviet Union countries participate in the project.
- **Clarifying measures each country should take against prolonged radioactive pollution**
- Standardizing measures to handle radiation-contaminated materials in a life environment



Source: NERIS -Website

Sharing and improving knowledge among member countries



## 2-3 International Emergency Response Systems - North America

### ○ North America

- North America has 99 U.S. and 19 Canadian nuclear reactors in operation.
- The U.S. Nuclear Regulatory Commission (NRC) (and the Federal Emergency Management Agency, or FEMA) and the Canadian Nuclear Safety Commission (CNSC) have made their respective nuclear emergency response plans, while falling short of establishing any common nuclear emergency response system.
- These regulatory organizations **hold an annual regulatory information conference (RIC)**, focusing on how to share on-site measures in an emergency.



Canadian nuclear disaster prevention exercise in 2014  
Source: RIC-HP

Nuclear regulatory agencies regularly exchange information



RIC 2015  
March 10-12  
27<sup>th</sup> ANNUAL REGULATORY INFORMATION CONFERENCE  
Bethesda North Marriott Hotel & Conference Center

**What If?**  
Implementation of Lessons Learned From the Fukushima Daiichi Accident – Canadian Experience

US NRC 27<sup>th</sup> Annual Regulatory Information Conference  
North Bethesda, Maryland, USA  
March 11, 2015

Ramzi Jammal  
Executive Vice-President and  
Chief Regulatory Operations Officer

US NRC 27<sup>th</sup> Annual RIC, March 11, 2015  
nuclearsafety.gc.ca

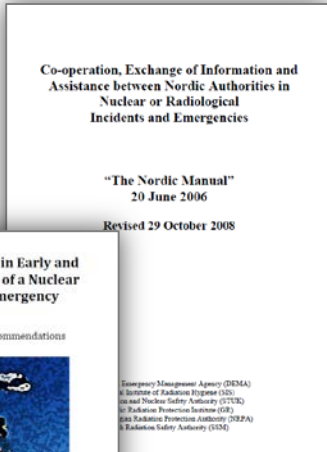
CNSC document given at RIC 2015  
Source: RIC-HP



# 2-4 International Emergency Response Systems - Northern Europe

ONEP (Northern Europe working group regarding emergency response systems)

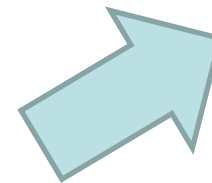
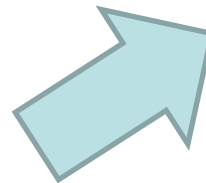
- Northern European countries meet to discuss cooperation and information-sharing in a nuclear emergency.
- Participating countries: Denmark, Finland, Iceland, Norway, Sweden
- **Their Nordic Manual agreement provides for the objective and outline of NEP activities.**
- The NEP **prepares the Nordic Guidelines** for securing public safety in the event of a radiation accident.
  - Voluntary activities based on EU activities
  - (Participating countries are not required to implement the Manual or Guidelines)**



Neighboring countries jointly prepare documents to improve effectiveness of emergency response

# 2-5 International Emergency Response Systems - Conclusion

- The IAEA imposes minimum requirements regarding a nuclear emergency.
- The EU imposes a mandatory information-sharing requirement, has an information-sharing system and shares knowledge among member countries.
- In North America, nuclear regulatory agencies regularly exchange information.
- Northern European countries jointly prepare documents on a voluntary basis to improve the effectiveness of emergency response.



### 3 Present Situation and Approach in East Asia



# 3-1 Present Situation and Approach in East Asia

## - Cooperation in East Asia (1/3)

### ○ Japan-China-South Korea Top Regulatory Meeting (TRM)

- Japan, China and South Korea created the TRM in 2008 for senior officials of their nuclear regulatory agencies to promote their exchange of information, improve nuclear safety in Northeast Asia and enhance regional cooperation. (Participants: MEP/NNSA, NSSC, NRA)



- At the sixth meeting in 2013, an agreement came on the establishment of an information exchange framework (IEF) for normal and emergency times.

#### Outline of IEF (Information Exchange Framework)

- Subject to information exchange are policies, examinations, inspection and audit, assessment, nuclear events and accidents, and disaster prevention measures.
- **In an emergency (when public interest is expected in an INES Level-1 event or an INES Level-2 or more serious event comes), an initial email (exclusive account) shall be sent and an emergency call shall be made.**
- In order to contribute to quick communications, information shall be exchanged in the original language (Chinese, Japanese or Korean) for translation by recipients.
- The three shall alternately host an annual emergency response exercise.

Japanese, Chinese and South Korean regulatory agencies in Northeast Asia are cooperating.

# 3-1 Present Situation and Approach in East Asia

## - Cooperation in East Asia (2/3)

### ○ The Forum for Nuclear Cooperation in Asia: FNCA

- An international cooperation framework for peaceful use of nuclear technology in Asia and its vicinity

(Participants: Australia, Bangladesh, China, Japan, Kazakhstan, South Korea, Malaysia, Mongolia, Indonesia, Philippines, Thailand, Vietnam)

#### The FNCA Framework



#### Details of 5th meeting in 2013

- An emergency preparedness and response (EPR) session was held to introduce lessons learned in Japan from the Fukushima accident and relevant changes in laws, institutions and **zoning**, etc.
- **Participants discussed fields for regional cooperation (including reporting, unification of zones for emergency contingency plans, sharing of resources, regional training and exercises, and existing wide-area disaster management systems for synergy effects)**

Sharing technical information with many countries in Asia regarding nuclear disaster prevention

# 3-1 Present Situation and Approach in East Asia

## - Cooperation in East Asia (3/3)

### ○ Asian Nuclear Safety Network: ANSN

• The ANSN is a project for participating countries' sharing of nuclear safety information under the IAEA's Extra-budgetary Program on the Safety of Nuclear Installations in South East Asia, Pacific and Far East Countries.

(Participants: Bangladesh, China, Indonesia, Japan, Kazakhstan, South Korea, Malaysia, Philippines, Singapore, Thailand, Vietnam)



ANSN regional workshop “On Observing a Nuclear Emergency Response Exercise of the Local Government” held in Japan (Hokkaido)

- **Japan introduced experiences with the Fukushima accident** (explaining about off-site operations and improvements)
- Participants **observed Hokkaido's nuclear disaster prevention exercise** at the Kutchan alternative operation center (observing decision-making processes in each phase and surveys on evacuees).
- At a study meeting, participants resolved questions that they had during the exercise. They **put in order and shared knowledge applicable to their respective countries.**

The IAEA program allows East Asian countries to share practical information regarding disaster prevention.



# 3-2 Present Situation and Approach in East Asia

## - Comparison between World and East Asia (1/3)

- The IAEA imposes minimum requirements regarding a nuclear emergency
  - Many East Asian countries have joined the IAEA.
- The EU imposes a mandatory information-sharing requirement and has an information-sharing system
  - **Northeast Asian nuclear regulatory agencies have agreed to share information in an emergency.**  
(Information sharing tools are limited to email and telephone networks. **No information-sharing system has yet been developed**)
- In North America, nuclear regulatory agencies regularly exchange information.
  - Countries with nuclear regulatory agencies are sharing information with each other.
- In Northern Europe, countries including those using nuclear energy and others are sharing information and preparing emergency response documents on a voluntary basis to improve the effectiveness of emergency response.
  - In Asia, each country has prepared **only its own standards** based on the IAEA standards.
  - Nuclear-using countries are sharing information with others through **initiatives led by the IAEA and Japan.**

The Fukushima accident has prompted Asian countries to recognize the importance of emergency response and proceed with their respective measures. But they have fallen behind European countries **in developing an information-sharing system and drafting common standards voluntarily.**

## 3-2 Present Situation and Approach in East Asia

### - Comparison between World and East Asia (2/3)

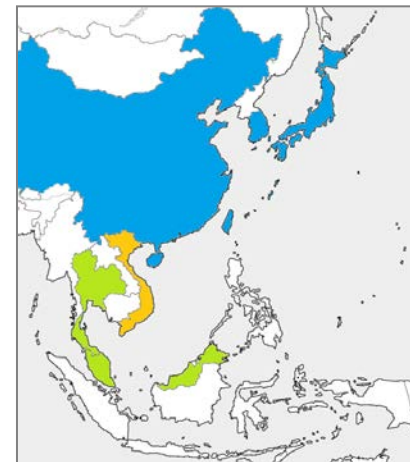
#### ○ East Asia's unique conditions

- Countries that use nuclear energy, plan to introduce the energy and have no such plan are mixed.
- Languages and cultures are more diversified than in Europe.
- There are complex geopolitical risks.

etc....



Based on the abovementioned conditions, a framework suitable for East Asia should be developed.



Tianjin explosion site  
Source: Asahi Shimbun



# 3-2 Present Situation and Approach in East Asia

## - Comparison between World and East Asia (3/3)

### ○ Desirable points of emergency response systems in East Asia

(Given comparison between the world and East Asia:)

- The IAEA framework should cover minimum requirements.
- **Develop information-sharing tools and put in order information to be shared in normal and emergency times**
- Improve the effectiveness of emergency response through voluntary operations rather than mandatory operations
- **Develop emergency response manuals** based on unique regional conditions

(Given Asia's unique conditions:)

- A framework in which each country can voluntarily participate irrespective of its unique conditions is required.
  - **The framework should be beneficial for countries that use nuclear energy, plan to introduce nuclear energy and have no such plan.**
- Unify languages for communications
  - Use **English**

## 3-3 Present Situation and Approach in East Asia - How to Proceed (1/4)

### ○ How to build emergency response systems

1. Launching a panel to study emergency response systems



2. Studying tools required to build emergency response systems



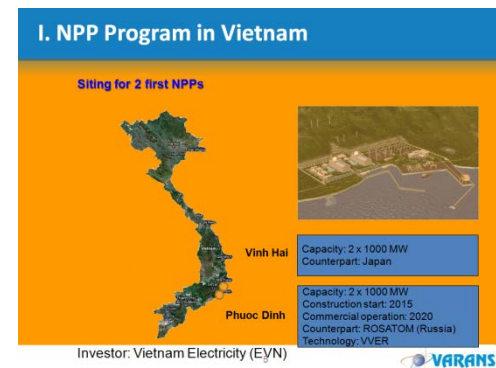
3. Using tools to secure effectiveness  
(Securing strategists, implementing  
exercises, etc.)

## 1. Launching a panel to study emergency response systems

### Activities at ERIA Nuclear Energy WG in FY2013-2014 (Details of activities)

- Introducing and sharing information on each country's emergency response systems and nuclear facilities
- Collecting information on European emergency response systems, summarizing initiatives to become references for East Asia
- **Studying draft guidelines**

The ERIA Nuclear Energy WG has studied how to share information subject to sharing and draft guidelines



Document on Vietnam's construction plan, provided at ERIA Nuclear Energy WG



ERIA Secretary General Nishimura explains about draft guidelines at an international symposium on nuclear energy (in Tokyo in 2015)

## 2. Studying tools required to build emergency response systems

### ○ Draft guidelines

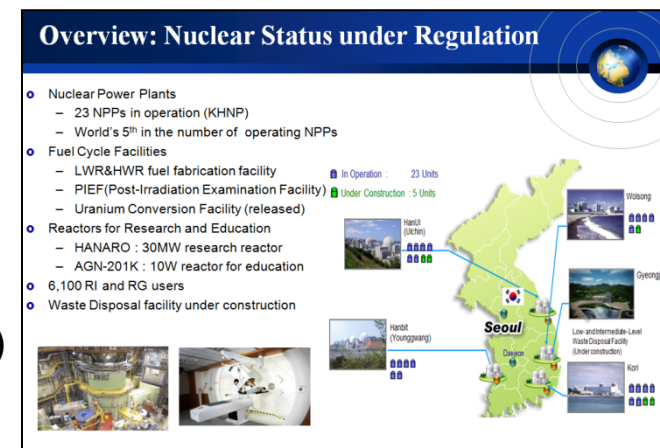
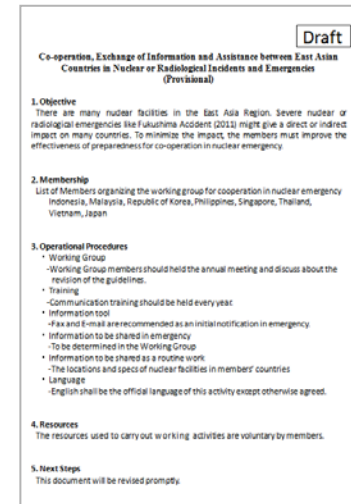
#### (Details)

- Objective: Cooperating in minimizing impacts of a nuclear emergency
- Participating countries: Participants in ERIA Nuclear Energy WG
- Operation
  - WG activities → Once a year
  - Emergency communications tools → Using FAX and email
  - Information for sharing in normal times
    - Sharing basic information on nuclear facilities of participating countries
    - Working language → English in principle
- Upgrading guidelines: as necessary (annually)

### ○ Information-sharing tools

#### (Information that should be shared)

- Basic nuclear facility information (venues, types, etc.)
- Nuclear regulatory systems
- Emergency response systems (each organization's roles)
- Existing monitoring posts
- Evacuation standards (disaster prevention zone concepts, etc.) etc.



South Korea's basic information on nuclear power plants

# 3-3 Present Situation and Approach in East Asia - How to Proceed (4/4)

## ○ Future challenges

### 1. Continuing discussions

⇒ Expecting future activities at ASEANTOM

(ASEAN Network of Regulatory Bodies on Atomic Energy)



### 2. Expanding tools

- Setting up each country's counterpart
- Setting up reporting rules (subjecting INES Level-2 or more serious events to reporting?)
- Developing information-sharing tools (putting in order information for sharing)
- Considering whether any headquarters organization (like a fund) would be required to manage information
- Developing 24/7 systems
- Cooperating with existing projects including the FNCA and ANSN etc....

### 3. Cooperating with ASEAN, the IAEA and other **international organizations having influence on national governments and regulatory agencies** in exploring cooperation with each country's disaster prevention systems



## 4 Conclusion



## 4 Conclusion

- In Europe, the Chernobyl accident has prompted countries to develop emergency response systems. In East Asia, the Fukushima accident has led countries to share a consciousness of developing such systems.
- The ERIA Nuclear Energy WG has considered desirable emergency response systems in East Asia in view of Western cases, developed draft guidelines and studied information for sharing.
- Many challenges are left to be solved before East Asia builds emergency response systems and develops them into such systems as seen in Northern Europe. So, relevant activities must be continued.
- In order to lead emergency response systems and manuals to practically function, we should cooperate with ASEAN, the IAEA and other international organizations having influence on national governments and regulatory agencies in exploring cooperation with each country's disaster prevention systems.

I thank you for your kind attention.