EPR of Korea and International Assistance

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Korea Institute of Nuclear Safety (KINS)
I. Nuclear Emergency Preparedness and Response of Korea
Status of Nuclear Power Plant Operation in Korea

(As of May 2016)

Operation
- 24 units
  - 20 PWR
  - 4 CANDU

Under construction
- 4 units

1 Research reactor

- In Operation
- Under Construction
National Radiological Emergency Management Scheme

- **Nuclear Safety and Security Commission (NSSC)**
  - nuclear regulatory authority
  - national coordination authority of emergency management
  - national emergency management committee (NEMC)
  - chairperson of OEMC (decision making for off-site)

- **Local Government**
  - local emergency management center (LEMC)
  - implement countermeasure on off-site

- **Korea Institute of Nuclear Safety (KINS)**
  - regulation on nuclear installations
  - Radiological Emergency Technical Advisory Center (RETAC)
  - dispatch technical advisory team to OEMC
  - run emergency technical advisory system

- **Korea Institute of Radiological and Medical Science (KIRAMS)**
  - national radiation emergency medical center (REMC)
Nuclear Emergency Response Steps in Korea

EOF (Licensee)
Emergency Operation Facility

LEMC
(Local Government)

Protective Action Implementation

EMerency
MCR/TSC/OSC
(Licensee)

President

Prime Minister

NEMC (NSSC)
National Emergency Management Committee

• Other Ministries Coordination
• Disaster Declaration/Cancellation

OEMC (NSSC)
Off-site Emergency Management Center

Site-area Emergency & General Emergency Management
Decision of Protective Action

OEMCAC
Advisory Committee

JPIC
Joint Public Information Center

JRMC
(Civil, Official, Military)
Environ. Monitoring Center

JREMSC
Medical Service Center

• Technical Advice
• Experts Dispatch
• Run AtomCARE system

RETAC
(KINS)

• Dispatch

REMCE (KIRAMS)

• Medical Team Dispatch
Off-Site Emergency Center (OEMC)
Radiological Emergency Technical Advisory Center (KINS–RETAC)

- Technical Advice on Emergency Management
- Off-Site Radiological Monitoring and Evaluation Support
- Makes recommendation for emergency response measures
- Operates the Nuclear Emergency Management System (AtomCARE)
II. Reflection of the Lessons Learned from Fukushima
New Strategy of Emergency Management in Korea

- Set up the Goal of Emergency Management
  - To prevent occurrence of deterministic effects, to reduce occurrence of stochastic effects in emergency situation
- Establish Precautionary Action Zone (PAZ, 3~5km)
- Establish Urgent Protective action planning Zone (UPZ, 20~30km)

**EMERGENCY PLANNING ZONE**

- **EPZ**: Emergency Planning Zone (8~10km)
- **PAZ**: Precautionary Action Zone (3~5km)
- **UPZ**: Urgent Protective Action Planning Zone (20~30km)
1. Establish **precautionary action zone (PAZ)** in advance and do precautionary urgent protective actions (**EAL, General Emergency**)
   - to prevent the deterministic effects

2. From (projected) dose assessment result, to perform protective actions in accordance with **GIL (Generic Intervention Level)**
   - to reduce stochastic effect
   - before radiological materials release

3. Based on environmental monitoring (sampling and analysis) results, to perform protective actions applying **OIL (Operational Intervention Level)**
   - to reduce stochastic effect
   - after radiological materials release
Response stage

1. Evacuation on General Emergency
2. Public Protective Action by Dose prediction Results
3. Public Protective Action by Environmental Monitoring Results

Off-Site Environmental Monitoring

OEMC

LEMC

Evacuation center

Assembly Place

PAZ (3~5km)

New Emergency Planning Zone (May, 2015)

National Environmental Monitoring (IERNNet)
http://iernet.kins.re.kr/
New Emergency Planning Zone (May 2015)

<table>
<thead>
<tr>
<th>Old</th>
<th>New Area</th>
<th>Old Population</th>
<th>New Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metropolitan 7, Local 8</td>
<td>Metropolitan 8, Local 21</td>
<td>105,874</td>
<td>2,091,541</td>
</tr>
</tbody>
</table>

- Kori
- Wolsong
- Uljin
- Yeounggwang
Strengthen Emergency Exercise

- **Unified Emergency Exercise**
  - National level radiological emergency exercise leading by NSSC and involving the central administrative agencies conduct once a year (1/5yr → 1/1yr)

- **Integrated Emergency Exercise**
  - The metropolitan and local government conduct a radiological emergency exercise every two years (1/4yr → 1/2yr)
  - (New) Each local government conducts the public protective exercise once a year

- **On-site Emergency Exercise**
  - Two units perform once every year

- **Drill**: Participation of each on-site emergency organization
  - One unit or Two units perform once every quarter
Establish On-site Emergency Response Center

- Establishment of on-site ERC at all sites by 2020
- Design to withstand earthquakes (earthquake resistant building)
- Response for complex disaster and multi-units accidents

NPP Site

- Current EOF will be available for environmental monitoring and support the onsite emergency response, etc.
III. AtomCARE System for Emergency Management
Functions of Emergency Response System

- Assess status of safety functions of the nuclear power reactors on a real-time basis
- Provide recommendations for the public protective measures to the government

Monitoring and Detection
- Safety Information Display System
- Environmental Monitoring - Domestic

Emergency Characterization
- Accident Characterization and Source Term Evaluation
- Meteorological Data Acquisition

Emergency Management
- Dose Assessment - Domestic
- Dose Assessment - Global
- Protective Action Advice

Consequence Management
- Cooperative Consequence Management
- Commands and Control

IAEA early Notification convention

IEEA International Atomic Energy Agency
● Collects Environmental Radiation Levels (National Wide & Marine)
  - Real time monitoring of nationwide environmental radiation levels
  - 1 Central Monitoring Station / 14 Regional Monitoring Stations (CAMSNet)
  - Total 134 Monitoring Posts (by Dec. 2015)
  - 3 Xenon Monitoring Station
    (meteorological monitoring posts, remote islands, army bases)

● Detects any Abnormal Variations in Environmental Radiation Levels

● Open to public using web & mobile phone application

http://IERNet.kins.re.kr/
Environmental Radiation Monitoring

- Environmental monitoring information open to mobile phone application
- eRAD@NOW2
Joint Radiological Environmental Monitoring

Aerial Survey

Radioactive Airborne Dust Sampling

Marine Survey

Car-borne Survey

Mobile Monitoring Post

SIREN
System for Identifying Radiation in Environments Nationwide

In Situ Gamma Spectroscopy

National Wide Systems (IRENet)
**SIDS/POMS & STES**

- **SIDS/POMS:** Collects & Analyzes Operational Information
  - Displays real time safety parameter values of NPP & RR

- **STES:** Estimates the Radiation Source Term of an accident
  - Assesses the degree of reactor core damage
  - Estimates the reduction factor & pathways of radioactive materials
  - Estimates the amount of released radioactive materials
Plant Operation Monitoring System (POMS)

- Restructure of the NPP’s information transmission system
  - singles transmission through dual channel, redundancy, supply by mobile-power
- Development of plant operation monitoring system using real-time parameters (POMS)
  - alarm on abnormal signal, understanding situation, diagnosis, and aid mitigation action
- Collecting signals: primary system, SG, emergency core coolant system, containment, spent fuel pool, radiation monitoring, power system, significant alarm, meteorological data, engineering safety feature actuation signal, major equipment signal, feed-water flow, etc.
**AINS (Automatic Information Notification System)**

**Automatically provides the warnings and/or alerts**

1. Transmits automatic alarm signals to emergency response personnel:
   - A rapid change in power output, a reactor trip,
     a station black out, or abnormal radiation levels

2. Notifies information about individual abnormal events to emergency response personnel
● **Collects Meteorological Information**
- Automatic weather stations in each NPP site
- AWS weather information every 10 minutes from KMA (about 600 site)
- Numerical Weather Prediction data every 6 hours from KMA (horizontal res. 25, 12, 1.5km)

● **Generates 3-D Wind Fields**
- Altitudinal Range: 50 ~ 1500 m
- Numerical Weather Prediction Data from KMA
New Dose Assessment System (ADAMO) uses massive amount of weather information (REMDAS + FADAS)

- Numerical Weather Prediction data every 6 hours from KMA (horizontal res. 25, 12, 1.5km)
- The result covers the Korean peninsula and Northeast Asia

**Receiving Data**
- KMA numerical prediction data
  - LADAP: 1.5km
  - RDAPS: 12km
- KMA ASOS data
  - Synoptic observation date
  - AWS
- NPP sites weather data
- Source term estimation data

**Develop Weather Information and Data Assimilation**
- Prediction data interface
- Observation interface
- 1km grid data formation
- Atmospheric dispersion model interface

**Atmospheric dispersion model**
- Lagrangian PUFF model
- Lagrangian PARTICLE model
Public Protective Action using Dose Evaluation
ADAMO-GR (Global Region)

- Dose assessment in global region
- Meteorological data
  - East Asia region: horizontal res. 12km
  - Global region : horizontal res. 100km
- Source term data
  - NPP source term data of oversea
● Web-based Interactive Emergency Response Information Sharing System

- ERIX system
- Exclusive access with an authentication process
- On-line information sharing with relevant organizations
- Electronic document management function
- Multi-user bulletin board function
- Multi-message injection function

● Communication by Video Conference
Radiological Emergency Mobile Command & Control Center
IV. International Assistance and Cooperation
Joint RANET : April 2015

- The Competent Authorities : NSSC
- NAC Coordinator : KINS
- Assistance (FAT, EBS) organization in Korea : NSSC, KINS, KAERI, KIRAM
  - NSSC (Nuclear Safety and Security Commission)
  - KINS (Korea Institute of Nuclear Safety)
  - KAERI (Korea Atomic Energy Research Institute)
  - KIRAMS (Korea Institute of Radiological & Medical Science)
International Assistance and Cooperation

- **NAC (FAT & EBS) area of organizations in Korea**
  - NSSC : arrangement for assistance
  - KINS : Radiation Survey, Source Search and Recovery, Radiological Assessment and Advice, Dose assessment
  - KAERI : Decontamination
  - KIRAMS : Medical Support

- **NAC (FAT & EBS) Installation : PWR, PHWR**
  - Advice on NPP Reactor Design, Operation, Accident Analysis, Assessment
  - Advice on Fuel Fabrication Facility Assessment, Spent Fuel Storage Assessment, Operation of Specialized Technology
V. Korea, China, Japan Emergency Cooperation
Three countries conduct Joint Emergency Drill in Korea on Nov. 19. ~ Nov. 20. 2014

<table>
<thead>
<tr>
<th>Date</th>
<th>Details</th>
<th>Location</th>
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</table>
| Wednesday, 19 November 2014 | 15:00 ~ 16:00 Briefing (Off-site Emergency Management Center or OEMC)  
|                           | 16:00 ~ 16:30 Facility tour at OEMC  
|                           | 17:00 ~ 17:50 NPP tour (Shin-Kori Unit 2)       | <Busan> Kori OEMC /Shin-Kori Unit 2 (observers, liaison officials) |
| Thursday, 20 November 2014 | 09:00 ~ 15:00 Execution of the Drill  
|                           | 15:00 ~ 16:00 Evaluation of the Drill           | <Busan> Kori OEMC (liaison officials) |

- **Type of participants**
  - Liaison officers: Participation in the drill
  - Observers: facility tour and observation trip to the drill (MCR, TSC, EOF, OEMC, etc.)

- **Target of the drill**: Kori NPP (Shin-Kori unit 2 and Kori unit 4)
  - Multi units accident scenario caused natural disaster
Participants in the TRM Drill

- **Korea (10)**: NSSC(3), KINS(3), KORSAFe(2), interpreters(2)
- **China (2)**: NSC(2) - liaison official(1) and observer(1)
- **Japan (5)**: NRA(5) - liaison officials(2) and observers(3)

Respective message regarding measures by stage (Event scenario)

<table>
<thead>
<tr>
<th>Time</th>
<th>Details</th>
<th>Stage</th>
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<tr>
<td>09:58</td>
<td>IAEA receiving early notification message 1</td>
<td>Blue(Site) Emergency</td>
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<tr>
<td>10:31</td>
<td>IAEA receiving early notification message 2</td>
<td>Blue(Site) Emergency</td>
</tr>
<tr>
<td>11:23</td>
<td>IAEA receiving early notification message 3</td>
<td>Red(General) Emergency</td>
</tr>
<tr>
<td>11:23</td>
<td>IAEA receiving early notification message 4</td>
<td>Public Protection Measure</td>
</tr>
<tr>
<td>11:55</td>
<td>IAEA receiving early notification message 5</td>
<td>Red(General) Emergency</td>
</tr>
<tr>
<td>12:25</td>
<td>IAEA receiving early notification message 6</td>
<td>Environmental Monitoring</td>
</tr>
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Organizational Structure (Roles & Responsibilities)

Leading Body
(Korea NSSC)
- Responsible for JED exercise
- Planning & final Report

- NSSC - Nuclear Emergency Division
  - Seating arrangements for Chinese and Japanese liaison officials conducting TTX during a TRM drill
  - Responsible for emergency preparedness drill of Korea in general

- NSSC - Kori Site Office
  - On-site arrangements including seating arrangements for Chinese and Japanese liaison officials conducting TTX during a TRM drill

- KINS – Dept. of Nuclear Emergency Preparedness
  - Exercise scenario development
  - Responsible for leading and briefing observers and supporting liaison officers with exercises

- KINS – Dept. of International Cooperation
  - Responsible for liaison officials in general

- KORSafe – Dept. of International Cooperation
  - Responsible for observers in general

- KHNP – Function of Emergency Preparedness Drill
  - Support the entry into KHNP facilities including NPPs
2015 Unified Emergency Exercise

- 201510.06. unified emergency exercise at Hanbit NPPs and around 30 km
2015 Unified Emergency Exercise

- Participate government org (18), local government org (8), KINS, KHNP, KIRAM, etc.
- Complex disaster scenario (earthquake, tsunami and NPP accident)
- INEX-5 (International Nuclear Emergency Exercise) scenario reflect
- Inform the message and information of exercise to IAEA, Japan, and China based on the TRM JED
Korea Emergency Drill based on Japan’s Drill

- Japan IKATA NPP Drill (8~9 Nov. 2015) - Korea conducted 2nd TRM Drill

(Off-site center on Ehime)

(Japanese Prime Minister & cabinet meeting)

(Evacuation using warship)

(Evacuation Center)
Thank you for your attention!