The 13th Meeting on the Framework for Revised Nuclear Energy Policy

Information materials No. 1 - 3

Efforts for Safety Improvement

February 7, 2012

Federation of Electric Power Companies

1. Analysis of the Fukushima Accident

Impacts of earthquake

○All the reactors successfully shut down automatically immediately after the earthquake
●Offsite power supply was lost because power transmission towers collapsed by a landslide etc.
○All emergency diesel generators successfully started up
○Systems required for cooling the reactors successfully functioned

Impacts of tsunami

●Important equipment such as emergency diesel generators, switchboard, and batteries were submerged
●Seawater cooling function was lost due to failure of seawater pumps
●Loss of all AC power sources (loss of offsite power + emergency diesel generators)

Extensive loss of power sources, loss of seawater cooling function and resultant significant damage to the cores and containment vessels led to the release of radioactive materials to the outside and the long-term evacuation of local residents due to soil contamination.

2. Safety Improvement Efforts of Electric Power Companies

Improvement already undertaken
~Safety assurance by emergency safety measures~

Perspective of the measures

"Fukushima Accident" must never be repeated

"Multiplication" and "Diversification"

- **Assurance of power supplies**
  - Assurance of power supplies at the main control room by deploying emergency power supply cars, etc.
- **Assurance of cooling**
  - Assurance of water supplied to reactors and steam generators by deploying fire pumps, etc.
- **Measures against submersion**
  - Measures against submersion of switchboards, batteries and pumps

Assess and confirm by stress tests

Further improvement
~Aiming to achieve the world's highest safety level~

Goals

Achieving the world's highest safety level

① Organizational efforts

- **A new organization to be established to continuously promote safety improvement measures**

② Continuous system improvement

- **Measures to prevent core damage**
- **Measures to prevent containment vessel damage**
- **Measures to minimize long-term evacuation areas due to soil contamination**

3. Establishment of New Organization (Organizational Efforts)

A new organization is to be established by the end of FY2012 to continuously promote safety improvement measures.

Outline of the new organization

◆ Promote state-of-the-art safety systems including the newest measures in foreign countries

- ➢ Work closely with overseas organizations (INPO*1, WANO*2, etc.)
- ➢ Collect and analyze information of foreign countries and use the latest findings to improve the safety of each power plant

◆ Establish a system based on commitments by the top management of each electric utility

- ➢ Provide proposals, instructions and recommendations to the electric power companies based on an independent viewpoint and strong authority

◆ Secure human resources with highly advanced, professional skills

- ➢ Mobilize the technical strengths of Japanese industries

*1 INPO: Institute of Nuclear Power Operations
*2 WANO: World Association of Nuclear Operators

4.1 Further Safety Improvements reflecting Fukushima Accident
(Continuous system improvement)

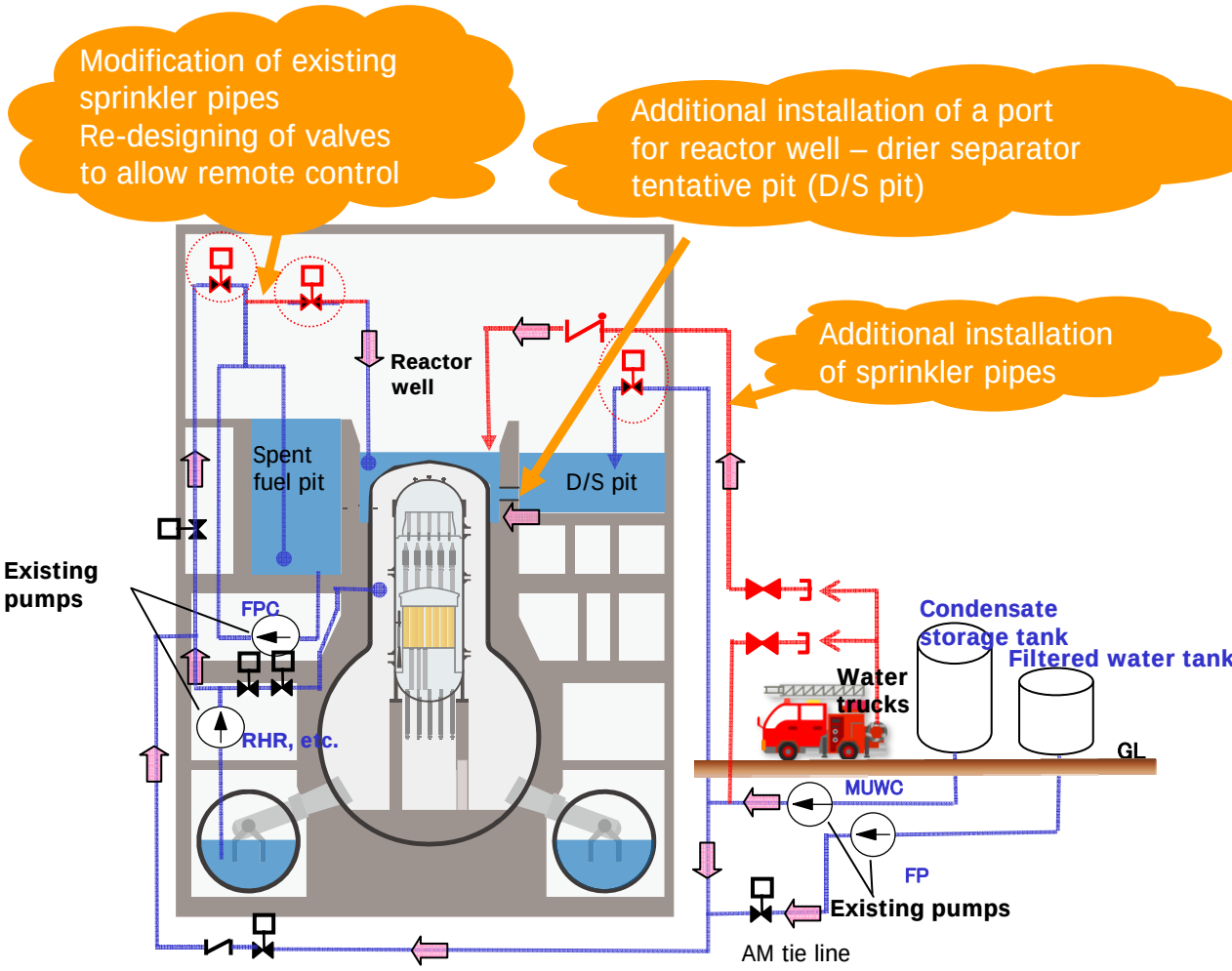
Goals	Specific measures for safety improvement
Prevention of core damage **Prevention of containment vessel damage**	Achieve further multiplication and diversification of systems so that a plant can reliably respond in case of blackout or loss of seawater cooling function, at least for a certain period of time, without outer assistance from official bodies.
Minimization of long-term evacuation areas	Install a special system to drastically reduce the amount of radioactive materials released even in an emergency.

- Prevention of core damage
  - Provide sufficient protection against tsunami by construction and reinforcement of tidal embankments, breakwater walls, water-tight doors, etc.
  - Diversify, distribute and increase the number/capacity of power supply and cooling systems
- Prevention of containment vessel damage
  - Provide cooling of the top head flange of the containment vessel (BWR)
  - Diversify means of cooling the containment vessel (PWR)
- Minimization of long-term evacuation areas
  - Install filtered ventilation system

4.2 Example of Cooling of Containment Vessel Top Head Flange (BWR)

◆ Measure to fill a reactor well with water

Inject water into the reactor well by existing pumps or from water trucks, and cool the containment vessel top head flange to prevent leakage due to excessive heating of the flange.

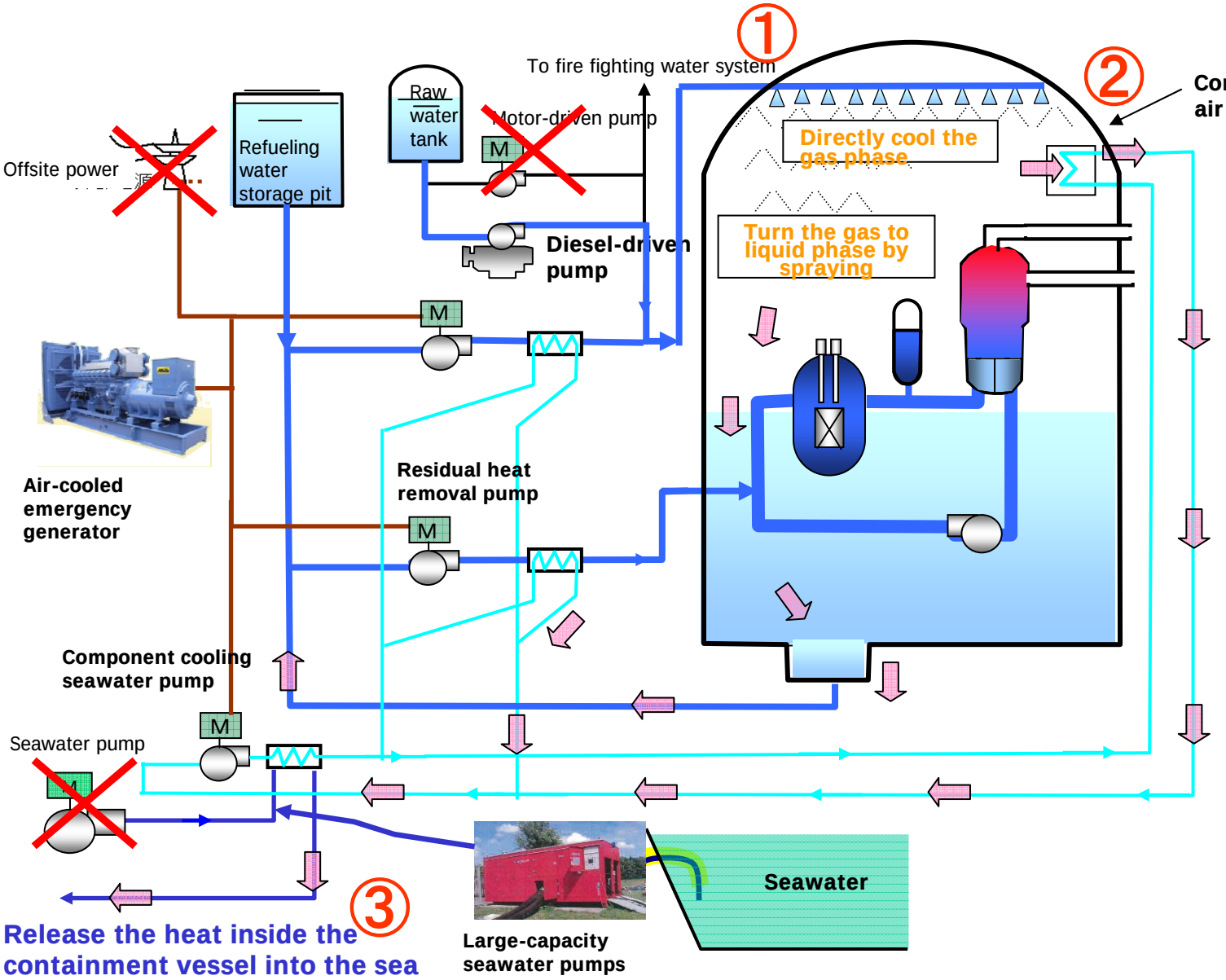


Examples of water injection routes

Drier separator tentative pit
↓
Port (additional installation)
↓
Reactor well

Reactor well sprinkler pipes (modification of existing pipes and additional installation of pipes)
↓
Reactor well

4.3 Examples of Diverse Means of Containment Vessel Cooling (PWR)



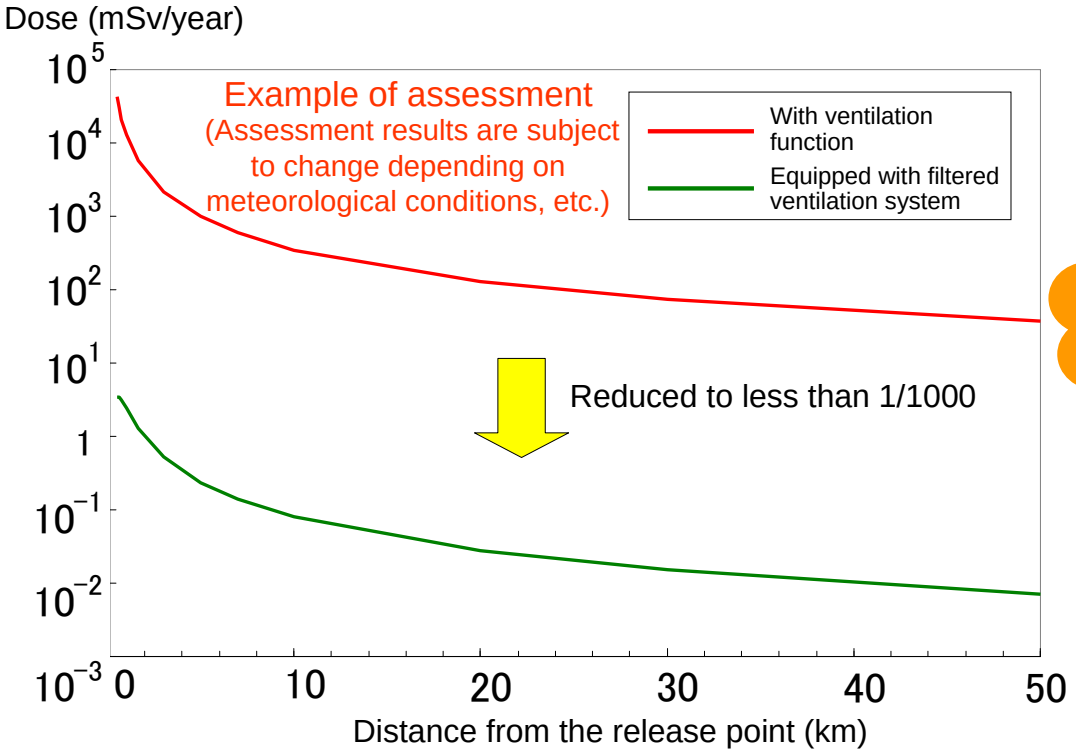
① Suppress pressure by condensing the vapor by spraying. **Cool the liquid phase** by a low-pressure injection system.
② **Cool the gas phase** by a containment recirculation air handling system.

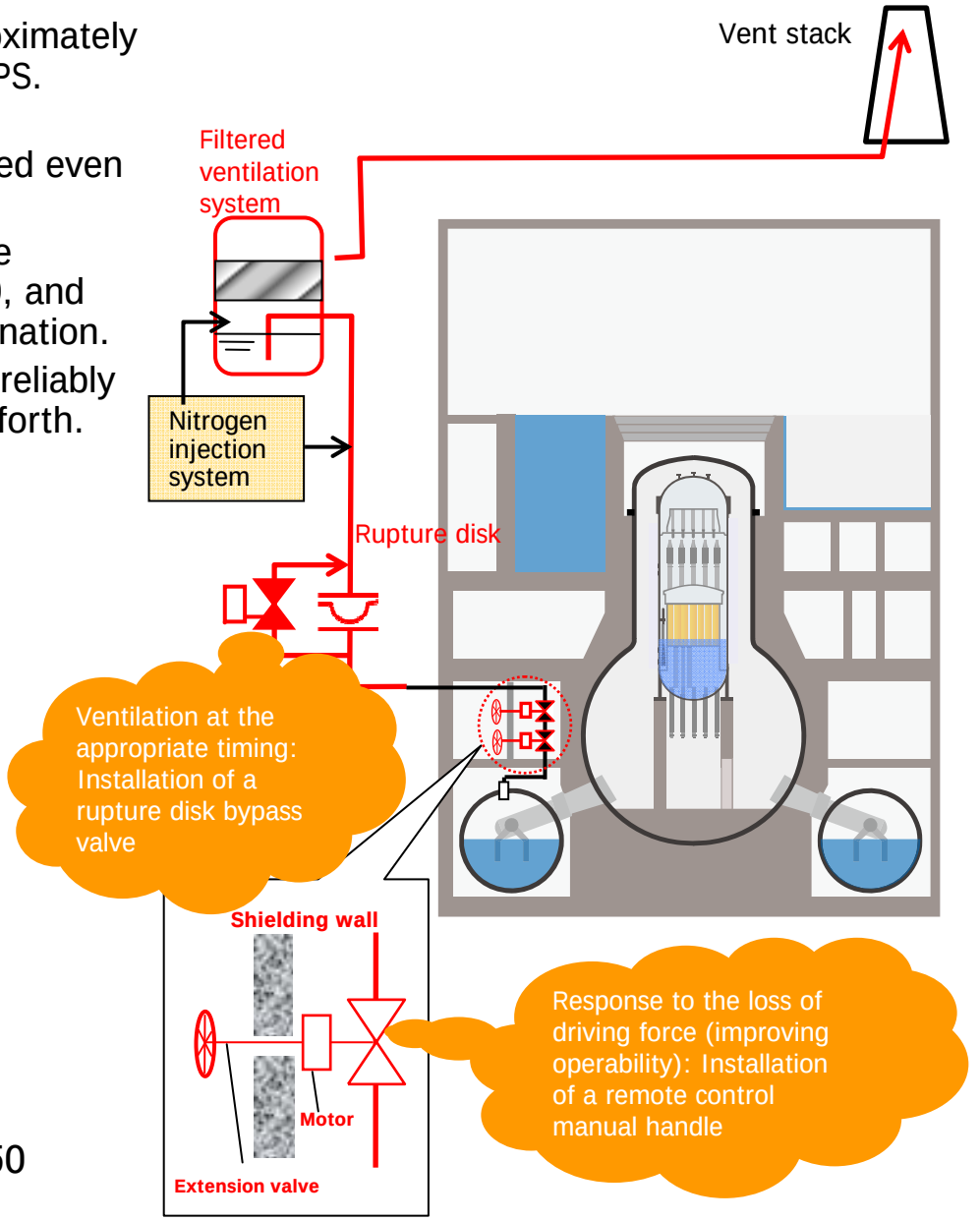
③ Release the heat inside the containment vessel into the sea
Although it is possible to release heat from a steam generator to the atmosphere, alternative means are provided to release heat into the sea.

Heat flow

5. Installation of Filtered Ventilation System

- In the Fukushima accident, soil was contaminated to approximately 20 mSv/year in places within the area 50 km radius from NPS.
- A filtered ventilation system was newly installed in order to drastically reduce the amount of radioactive material released even in an emergency.
- Installation of the filtered ventilation system can reduce the amount of radioactive material released to less than 1/1000, and minimize the long-term evacuation area due to soil contamination.
- Consideration is given to ensure the ventilation system can reliably actuate under various conditions including a loss of driving forth.





Conclusions

◆**Implementation of emergency safety measures**

Safety assurance by taking measures to ensure the Fukushima Accident is never repeated

◆**Further efforts will be made to achieve the world's highest safety level**

➢Establishment of new organization

- Work closely with overseas organizations and collect and analyze information of foreign countries etc.
- Provide proposals, instructions and recommendations to the electric power companies based on an independent viewpoint and strong authority
- Mobilize the technical strengths of Japanese industries and secure human resources with highly advanced, professional skills

➢Continuous improvement of systems

- Continuous improvement toward preventing damage to core and containment vessel
- Install a filtered ventilation system to minimize the long-term evacuation areas