Current Status of Fukushima Daiichi and Activities of NDF

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Tokyo

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Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF)

1. Current Status of Fukushima Daiichi

2. Activities of NDF

Strengthened organizational and institutional settings

2011 2012 2013 2014 2015 2016

GOJ Headquarters

Nuclear Emergency Response Headquarters March 11, 2011

Inter-Ministerial Council for Contaminated Water and Decommissioning Issues Sep 3, 2013

Local nuclear emergency response headquarters March 11, 2011

Team for Countermeasures for Decommissioning and Contaminated Water Treatment Sep 10, 2013

Committee on Countermeasures for Contaminated Water Treatment Apr 19, 2013

Decommissioning Roadmap

Roadmap
Dec 26, 2011

Roadmap, rev1
July 30, 2012

Roadmap, rev2
June 27, 2013

Roadmap, rev3
June 12, 2015

Mar 11, 2011

Cold shutdown
Dec 16, 2011

Support Organizations

NDF
Aug 18, 2014

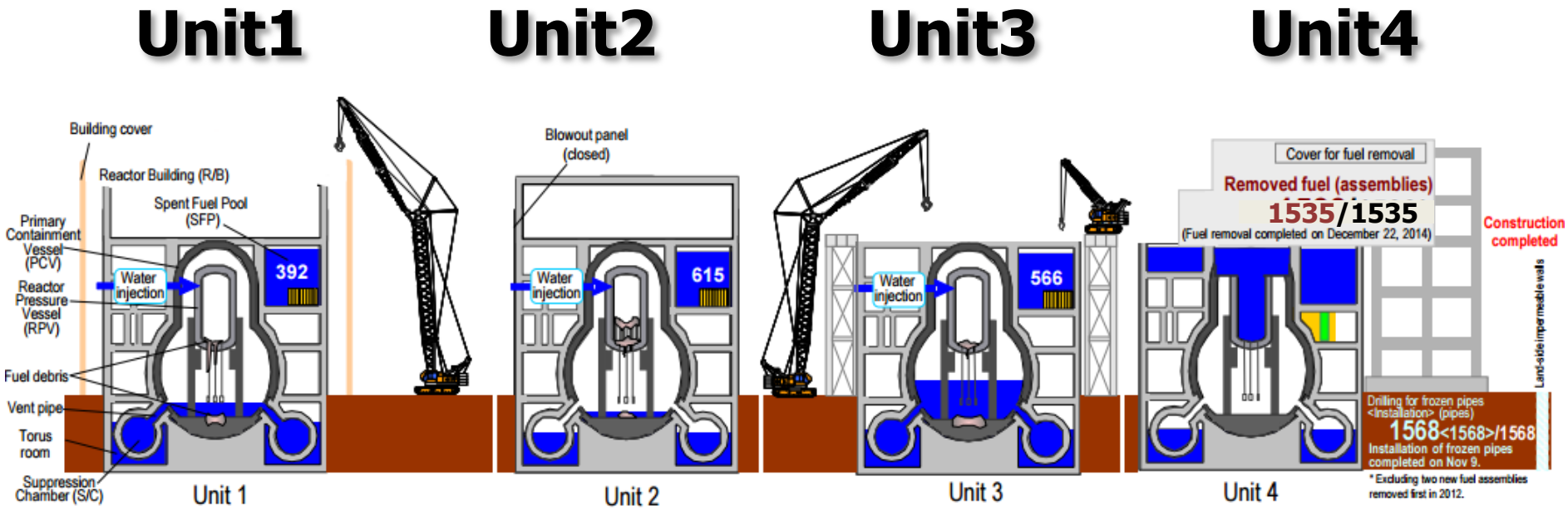
IRID
Aug 1, 2013

TEPCO D&D Co.
Apr 1, 2014

Technical Strategic Plan

Strategic Plan 2015
Apr 30. 2015

Update of Units 1-4



Removal of last one roof panel

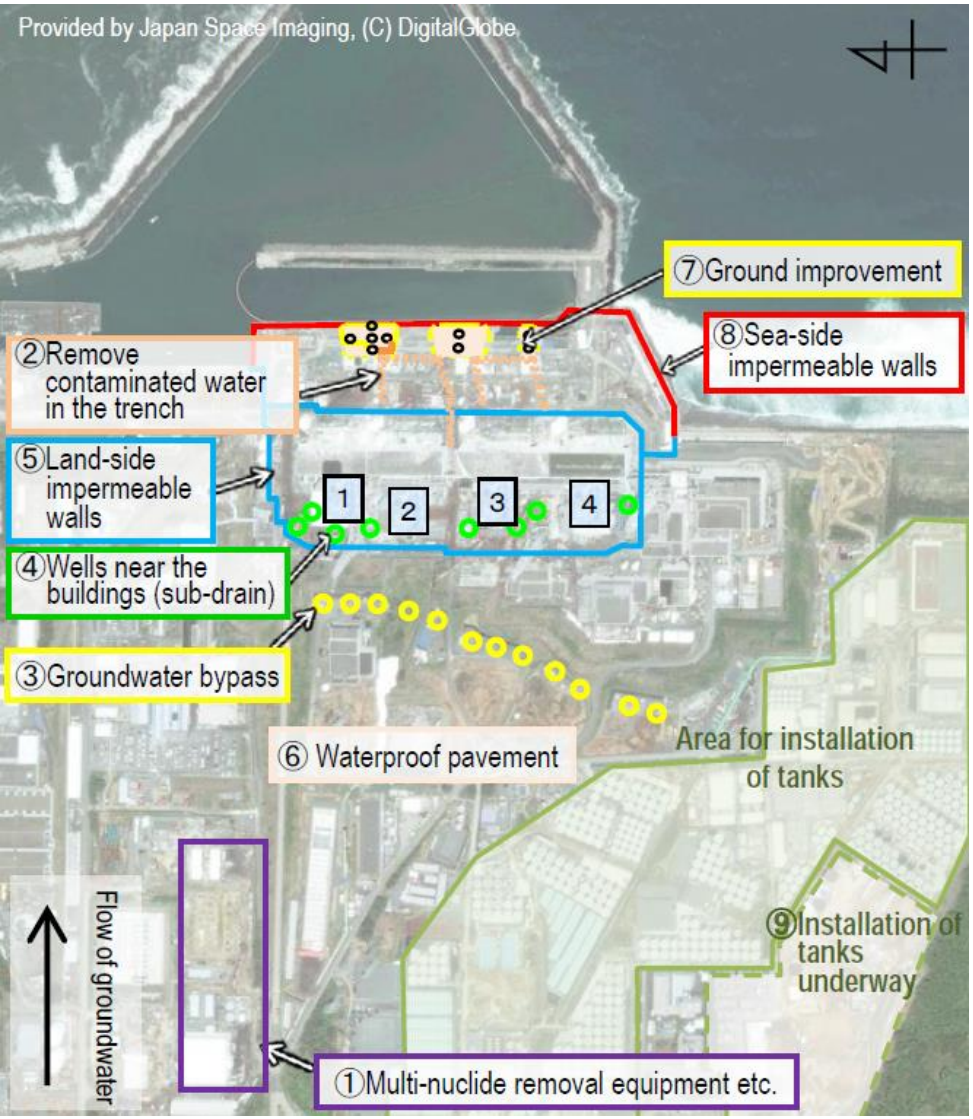
Policy decision for the overall disassembly of storage shed

During preparation of retrieval/decontamination

Completion of spent fuel

Source :Meeting material from Team for Countermeasures for Decommissioning and Contaminated Water Treatment

Three principles behind contaminated water countermeasures



1. Eliminate contamination sources

① Multi-nuclide removal equipment, etc.

②Remove contaminated water in the trench

2. **Isolate** water from contamination

③ Pump up groundwater for bypassing

④ Pump up groundwater near buildings

⑤ Land-side impermeable walls

⑥ Waterproof pavement

3. **Prevent leakage** of contaminated water

⑦ Soil improvement by sodium silicate

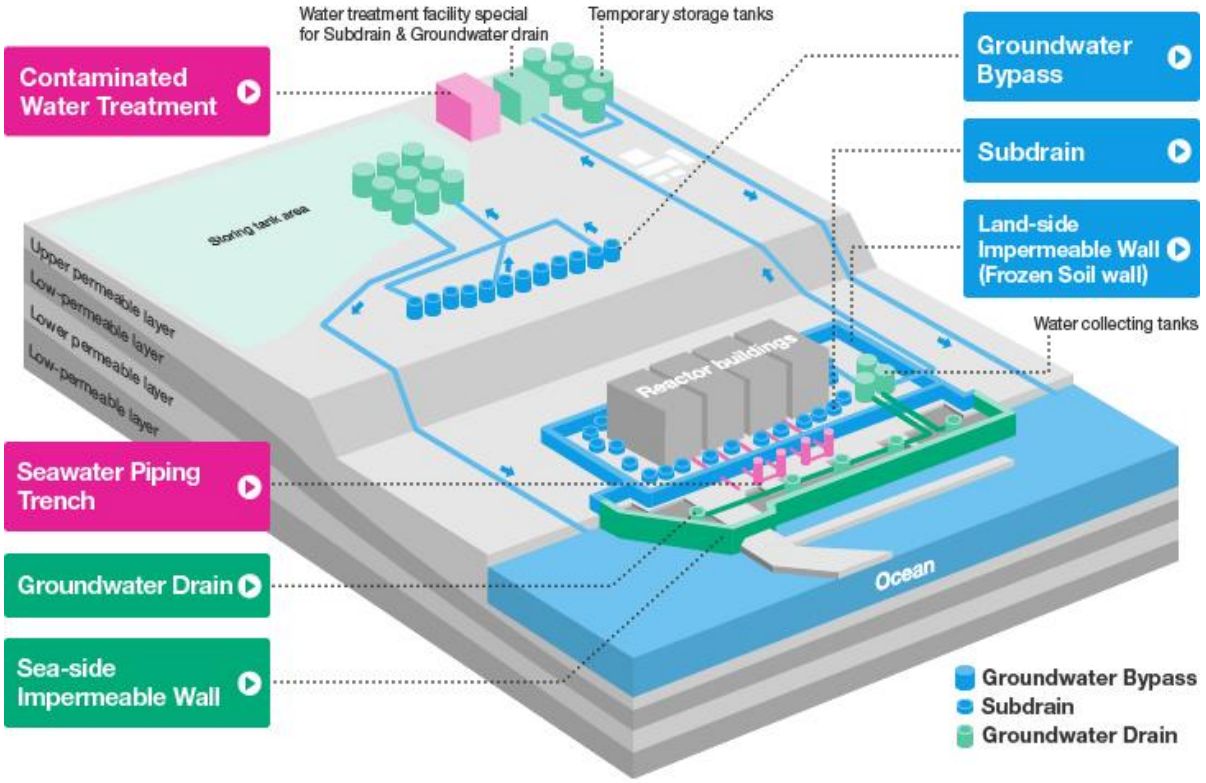
⑧ Sea-side impermeable walls

⑨ Increase tanks (welded-joint tanks)

Source:TEPCO

Addressing the contaminated water challenges

Operation to complete Frozen Soil Wall is ongoing.



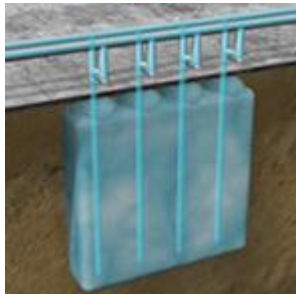
2014/5
Discharge started

2015/9
Pumping-up started

2015/3
Operation started

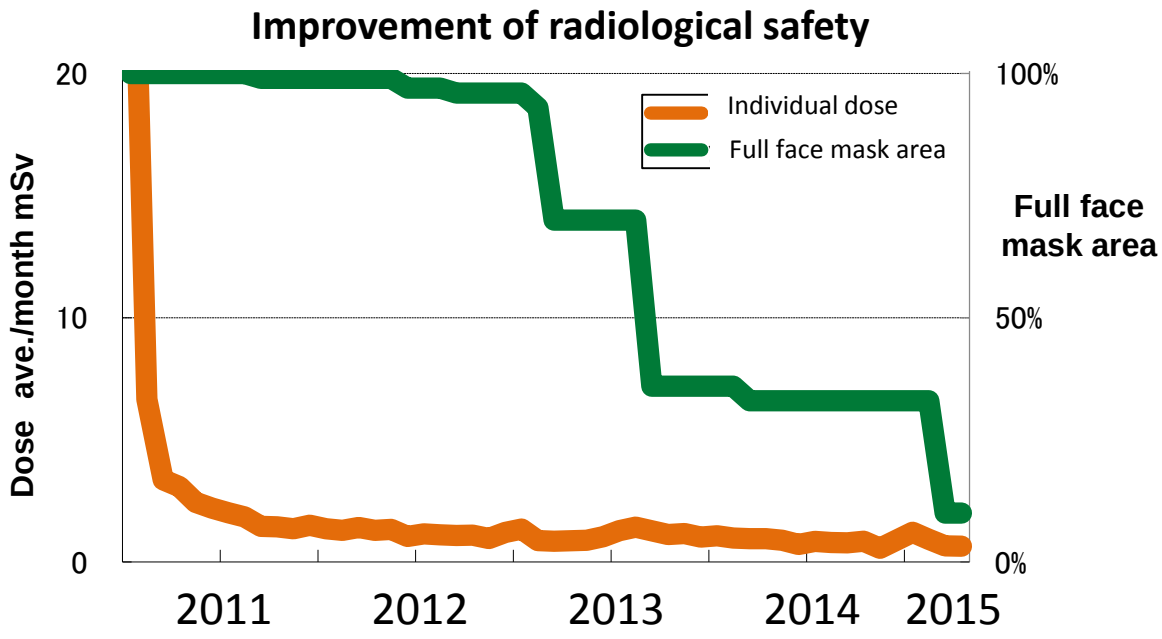
2015/7
Water removal completed

2016/2
Closing completed



Source: GOJ and TEPCO website and photo archive

Improvement of site condition



Source: Courtesy by TEPCO

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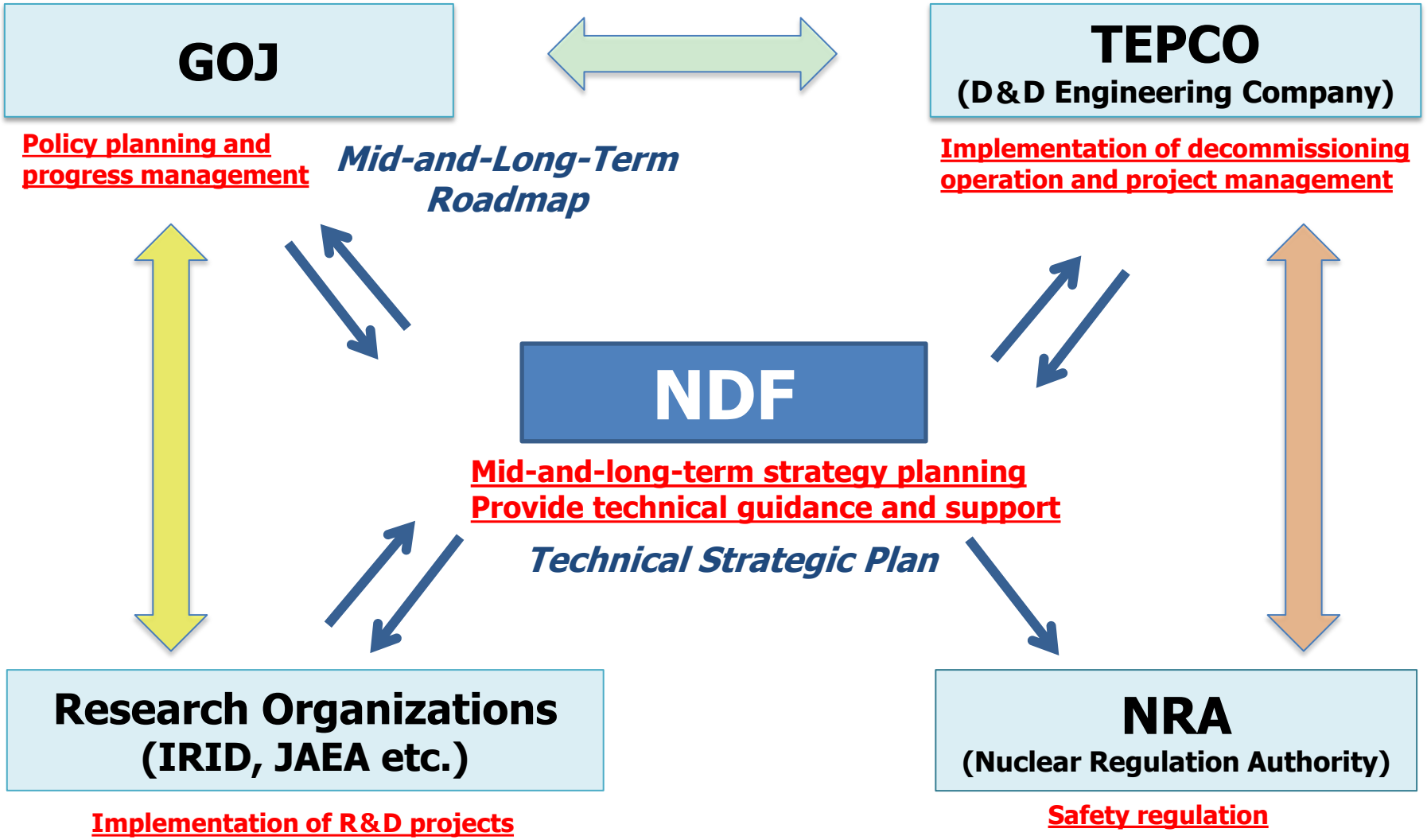
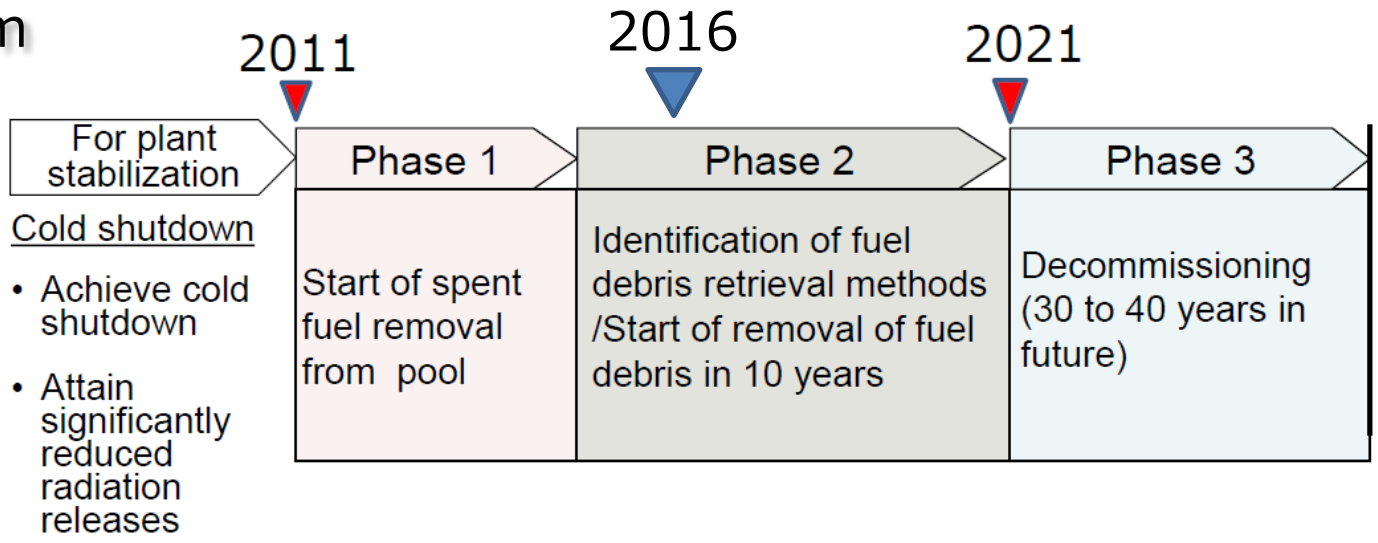
2. Activities of NDF

Organizational relationship



Mid-and-Long-Term Roadmap & Technical Strategic Plan

Mid-and-Long-term Roadmap (GOJ)



Technical Strategic Plan (NDF)

Strategic Plan 2015: Issued on Apr. 30, 2015

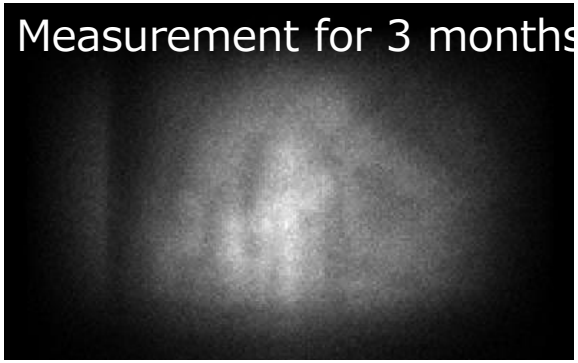
Strategic Plan 2016: Scheduled for this summer

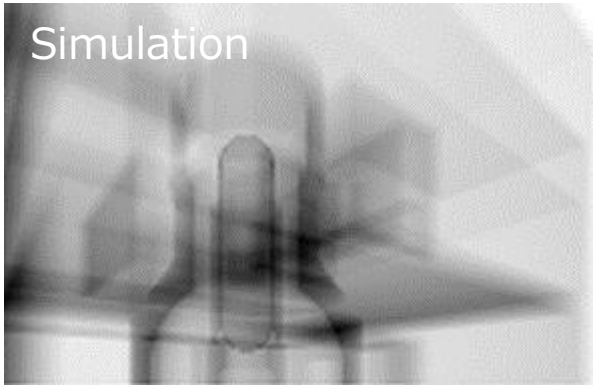
- ◆Discussion through the close dialogue and exchange of information between the Government and TEPCO.
- ◆Study mid-term technical strategy through the discussion with the experts from various technical fields while receiving the advise from Decommissioning Strategy Board, Expert Committee from multiple fields, International Special Advisors.
- ◆"Risk reduction strategy" regarding mid- and long-term decommissioning
- ◆In vessel inspection and study of the technical strategy for the fuel debris retrieval method.
- ◆Develop an optimum technical strategy based on the Five Guiding Principles. " Safe, Proven, Efficient, Timely and Field-oriented"

Internal inspection for reactor containment vessel

Internal inspection for reactor containment vessel using robots and other remote techniques are the keys to determine the fuel debris retrieval method.

Muon-tomography adopted to Unit-1



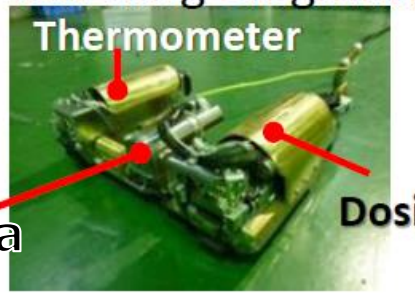


Shape-changing crawler robot

Traveling through piping

Transformation

Traveling on grating



Camera

Source: Published materials by TEPCO and IRID

About fuel debris

What are "Fuel debris“ ?

“Solidified melted fuel distributed among fuel assemblies, control rods and some other reactor materials”

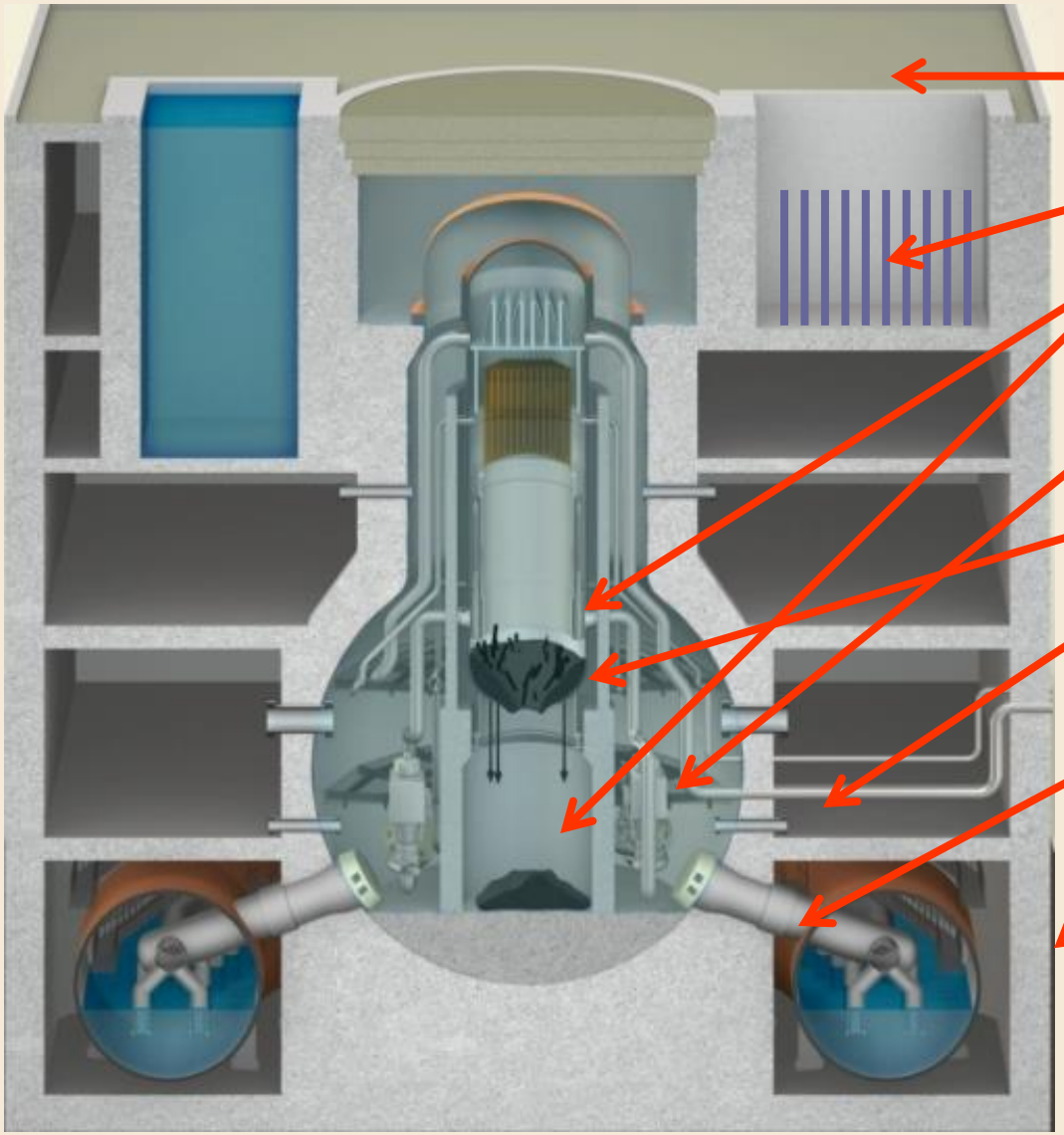
Fuel debris of TMI-2

Fuel debris of Chernobyl

Fuel debris of Windscale

- Features
  Mixed with other materials not contained in the cladding such as nuclear fuel materials.
- Risks to be considered with the plant status.
  - Criticality, decay heat, containment, radiation, hydrogen explosion, support structure
- Difficulties in risk management for the fuel debris
  - Uncertainty: Lack of information on in-vessel conditions
  - Instability: Fuel melted and facilities damaged by the accident
  - Lack of risk management: Difficulty in accessing due to severe radiological environment
- Institutional requirements and the rules

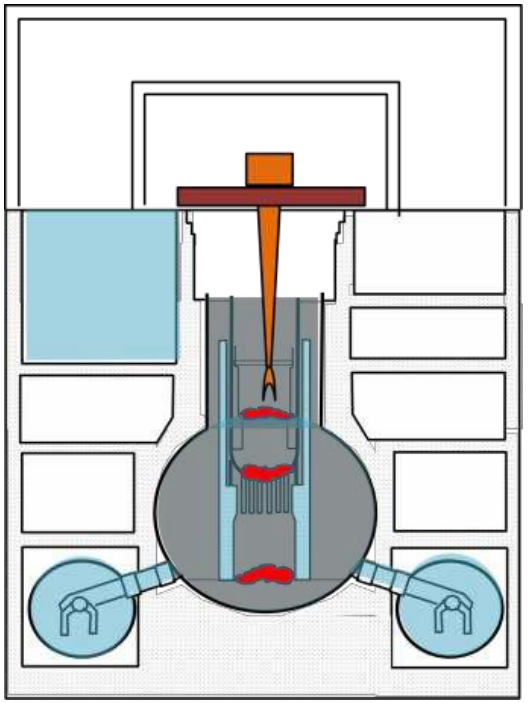
Fuel debris retrieval



- Operation floor largely damaged.
  High dose rate
- Spent fuels stored in Unit1, 2 and 3
- Fuel debris dispersed in both RPV and PCV
  Properties unknown
- High radiation inside PCV
  Inside PCV gradually known.
- Cooldown by water injection required.
- Building highly contaminated with high radiation (battle with decontamination)
- Leakage from PCV.
  Generation of contaminated water.
- Leakage from the building.
  Penetration of groundwater.
  Needs of contaminated water leakage prevention

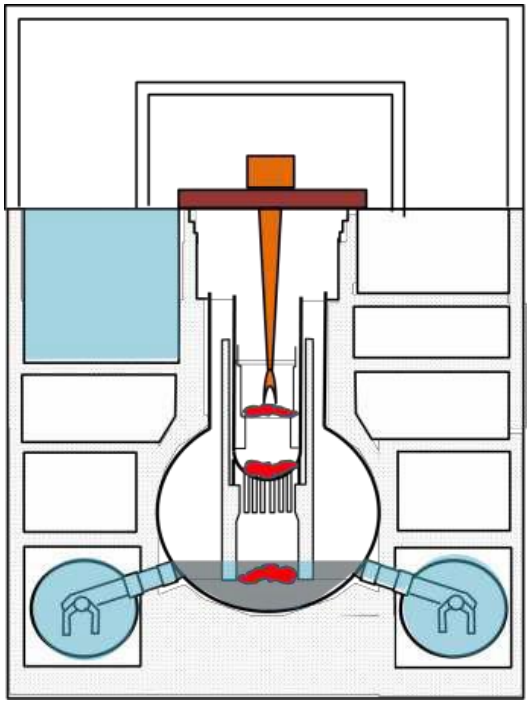
Source: Courtesy of IRID

Fuel debris retrieval method



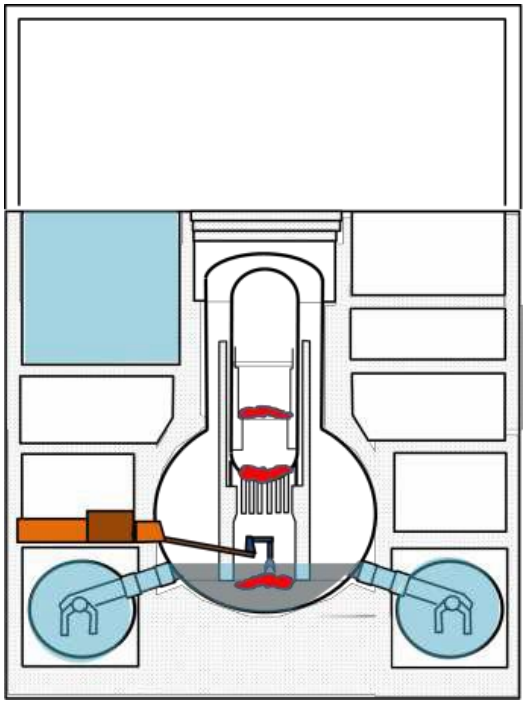
Submersion - Top entry method

Assuming the in-core structures above the fuel debris are removed



Partial submersion - Top entry method

Assuming that the in-core structures above the fuel debris are removed



Partial submersion - Side entry method

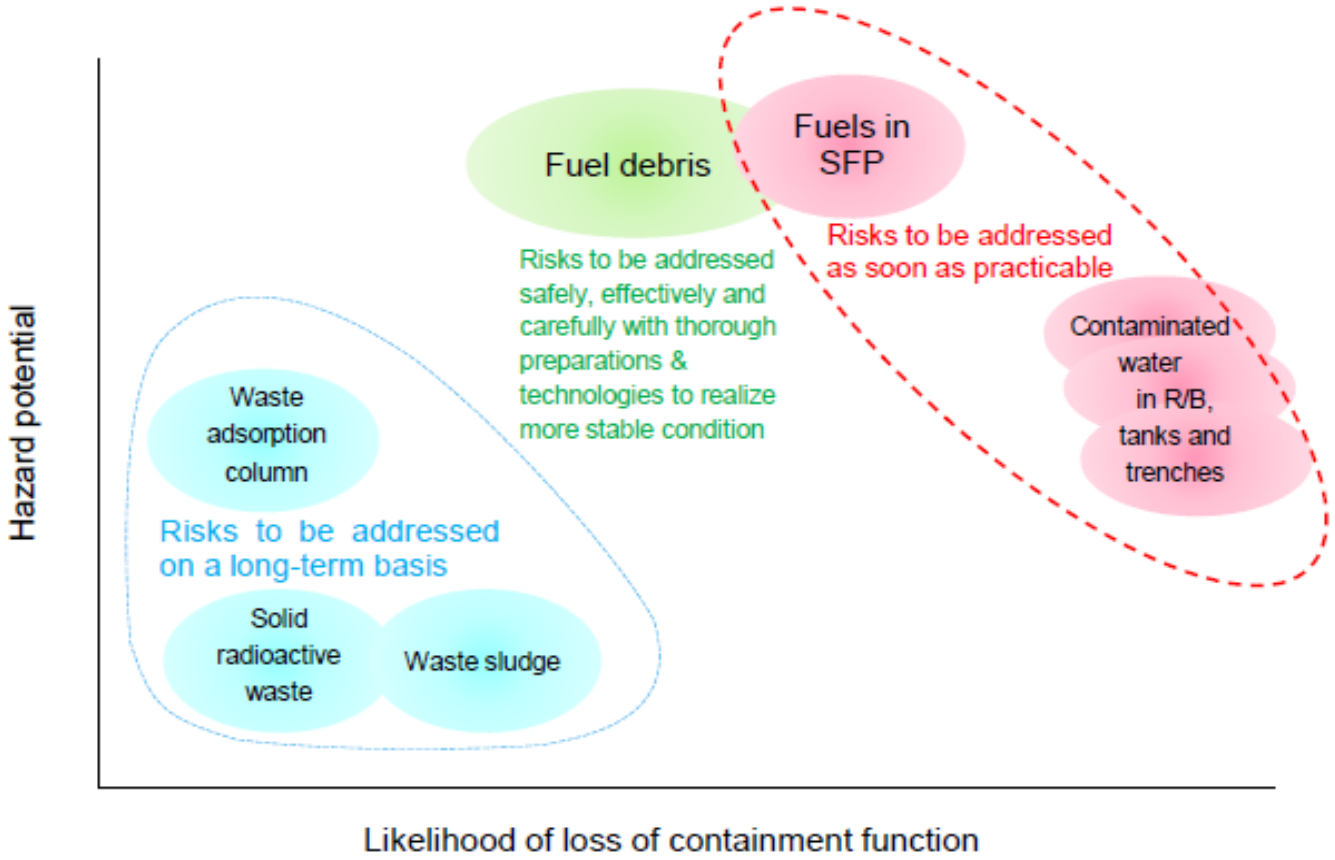
Assuming that the equipment and other objects outside RPV pedestal in PCV are removed

Source: Strategic Plan 2015, NDF

Decommissioning as risk reduction

Risk defined in the Technical Strategic Plan 2015
by NDF, Japan

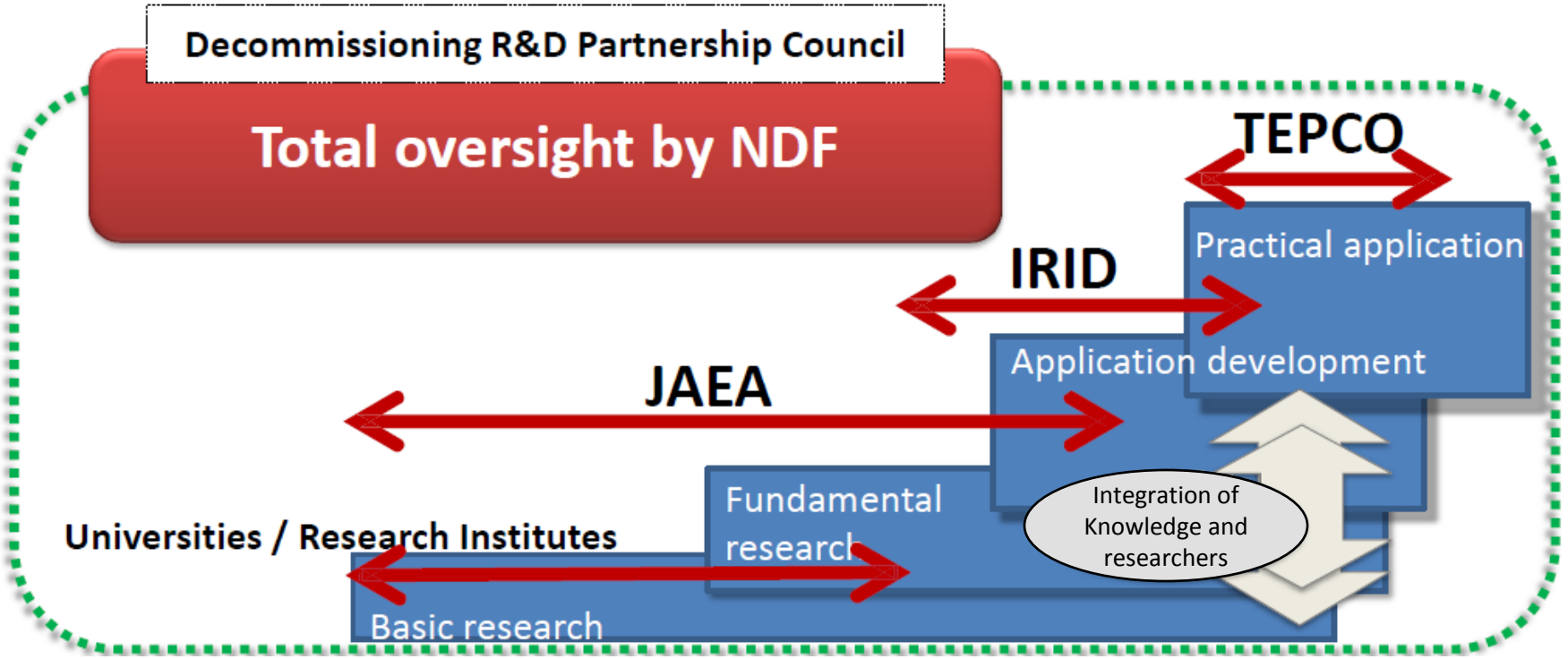
Figure 3-5 shows the levels of risks for major risk sources in the Fukushima Daiichi NPS based on the "hazard potential" and "likelihood of loss of containment function."



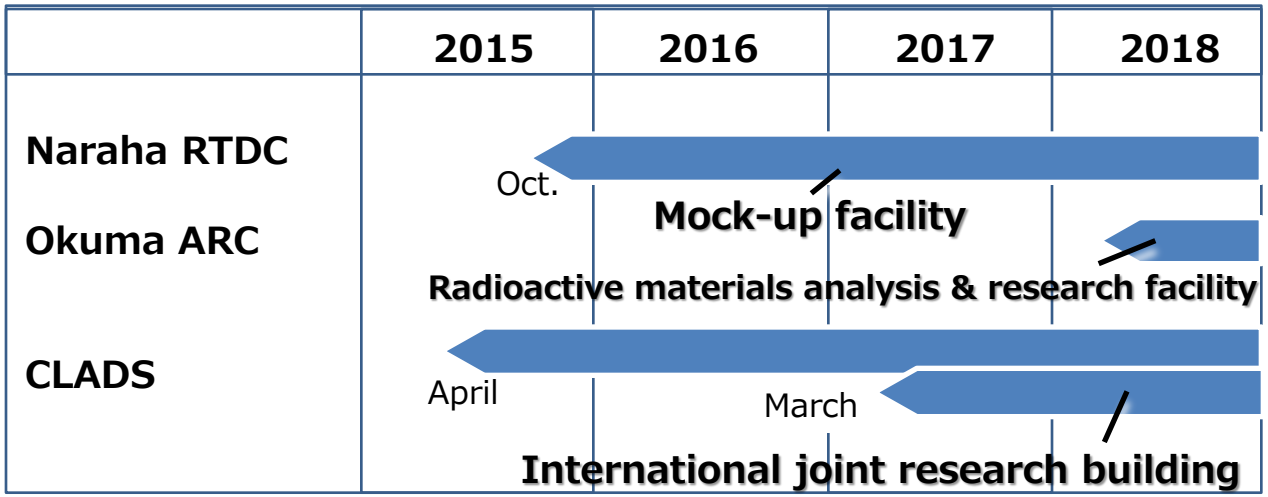
Source: Technical Strategic Plan 2015, NDF

Integration from basic research to practical application

- It is important to facilitate interaction among researchers and engineers involved in R&D initiatives.
- The Decommissioning R&D Partnership Council integrates management from fundamental research to practical application.



R&D Facilities



Mock-up test facility

RTDC: Remote Technology Development Center
ARC: Analysis and Research Center
CLADS: Collaborative Laboratories for Advanced Decommissioning Science

Analysis & R&D facility

International joint research center for decommissioning

Source:JAEA

International Cooperation

International Community

IAEA
- Peer review missions
- Safety report series
- “DAROD” project
- May Conference in Madrid

OECD/NEA
- Joint research program
  - BSAF-2
  - SAREF
- EGWMF

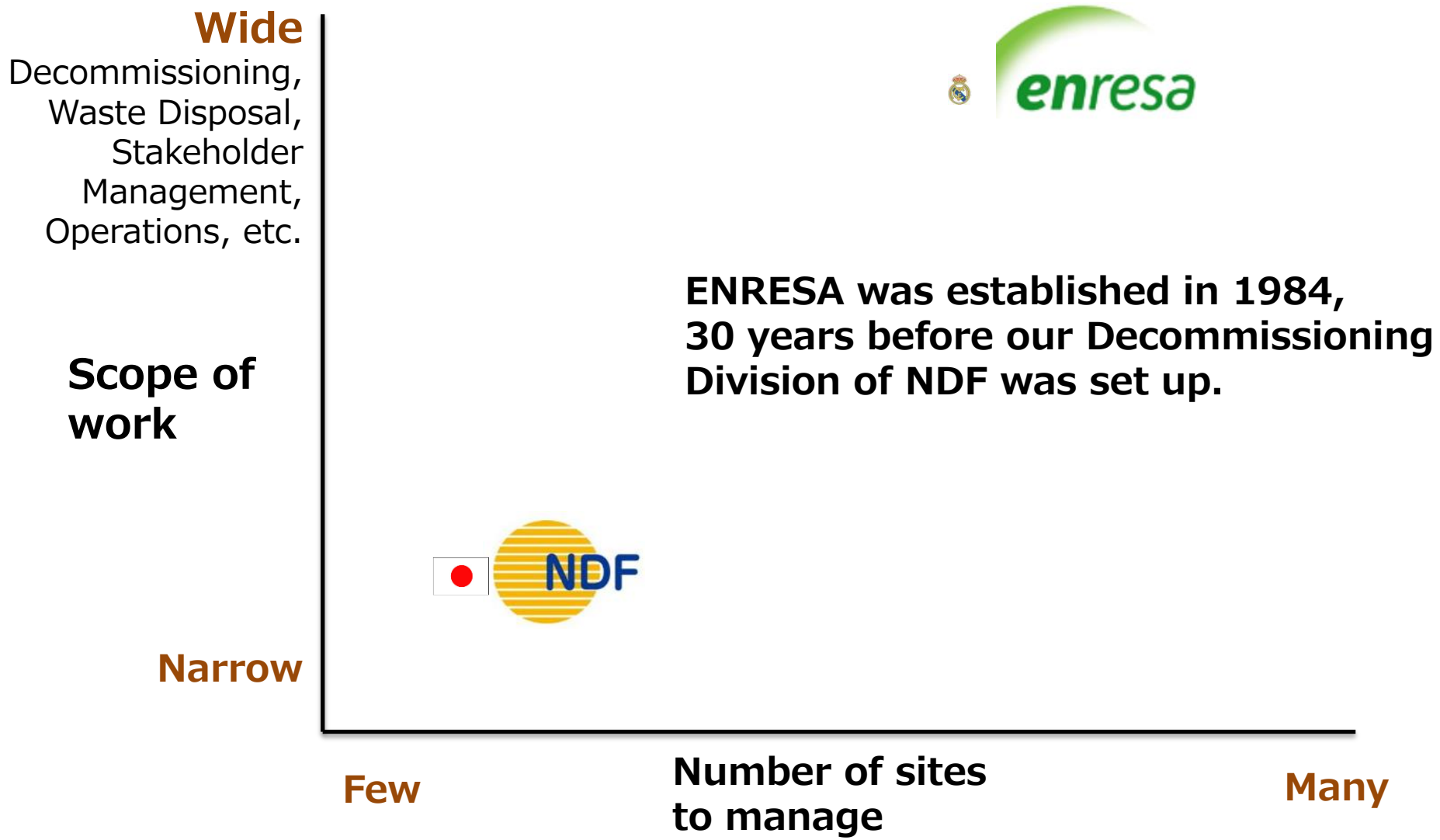
Bilateral framework
- Dialogue
- Cooperation
- Partnership

etc.

International Forum on the Decommissioning of the Fukushima Daiichi NPS

For the people and reconstruction of Fukushima area, and for the decommissioning and safety enhancement of nuclear facilities all over the world

Decommissioning in Spain, and ENRESA



Thank you for your attention!

Source: TEPCO photo archive