Strategy for D&D
-Fukushima Daiichi NPS

November 10, 2015

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Nuclear Damage Compensation
& Decommissioning Facilitation Corporation (NDF)

Fukushima Today -1; Removal of Spent Fuel

Unit 4: 2014/12/22 - All of 1535 FAs removed from reactor 4

Unit 3: 2015/8/2 – Removal of fallen Fuel Handling Machine (FHM)

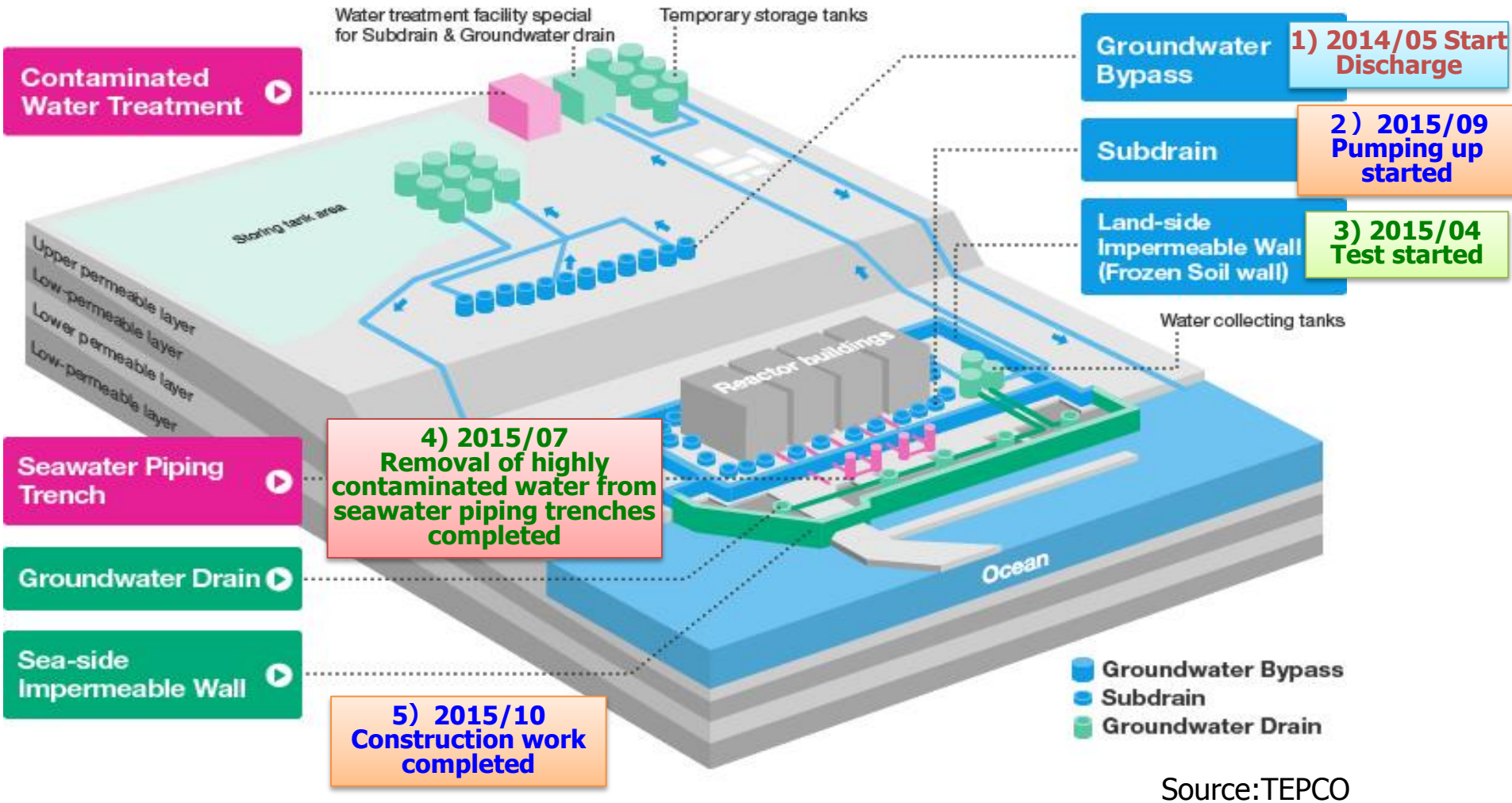
FHM being removed remotely on foggy day

Unit 1: 2015/10/ 5 – Removal of Building Roof Cover finished

FHM removed, approx. 20 ton

Source:TEPCO

Fukushima Today -2; Contaminated Water



Source:TEPCO

Birth of NDF

Fukushima Daiichi Accident 2011.03.11

Cold Shutdown
2011.12.16

Reinforce Decommissioning Strategy

1st Road Map
2011.12.26

Road Map Revised
2012.07.30

Road Map Revised
2013.06.27

Road Map Revised by METI
2015.06.12

Contaminated Water Troubles mid-2013

ALPS Troubles
2014.05~

Reinforce R&D

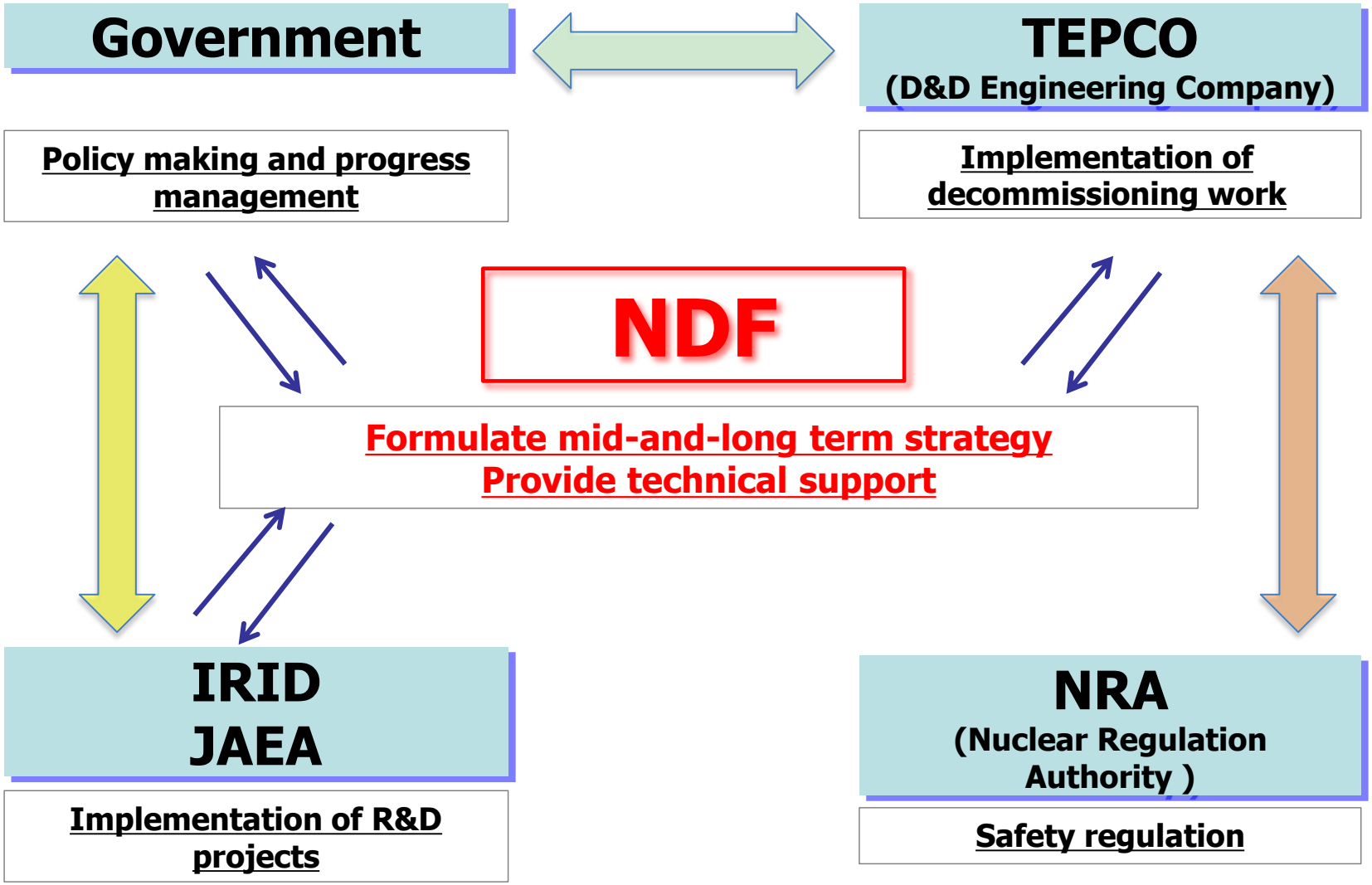
IRID
2013.08.01

NDF
2014.08.18

Strategic Plan! by NDF
2015.04.30

Already existed NDF incorporated decommissioning function

Role of NDF



Strategic Plan-1; Risk Reduction

Strategic Plan: 221 Pages, issued on Apr. 30, 2015

http://www.dd.ndf.go.jp/ddwp/wpcontent/themes/theme1501/pdf/SP2015_20150624_en.pdf

Five Guiding Principles

- **Principle 1: Safe**

Reduction of risks posed by radioactive materials and work safety

- **Principle 2: Proven**

Highly reliable and flexible technologies

- **Principle 3: Efficient**

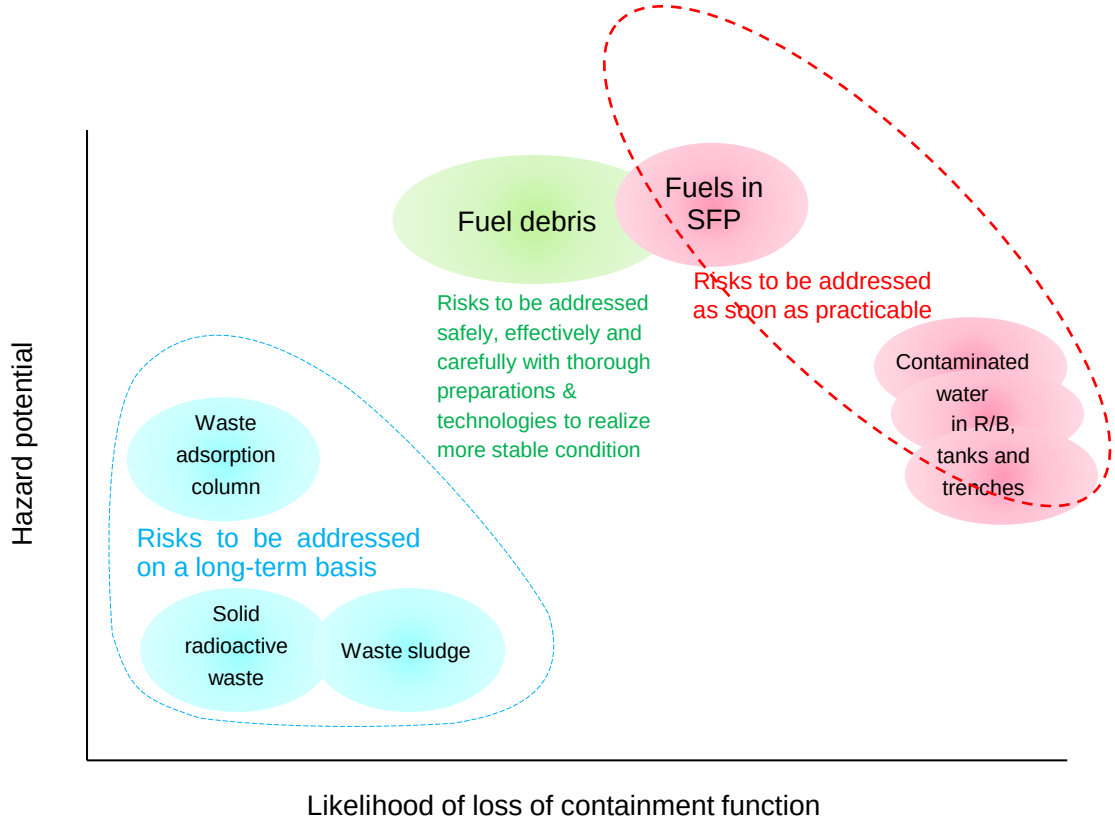
Effective utilization of resources (human, physical, financial, space, etc.)

- **Principle 4: Timely**

Awareness of time axis

- **Principle 5: Field-oriented**

Thorough application of Three Actuals (the actual place, the actual parts and the actual situation)

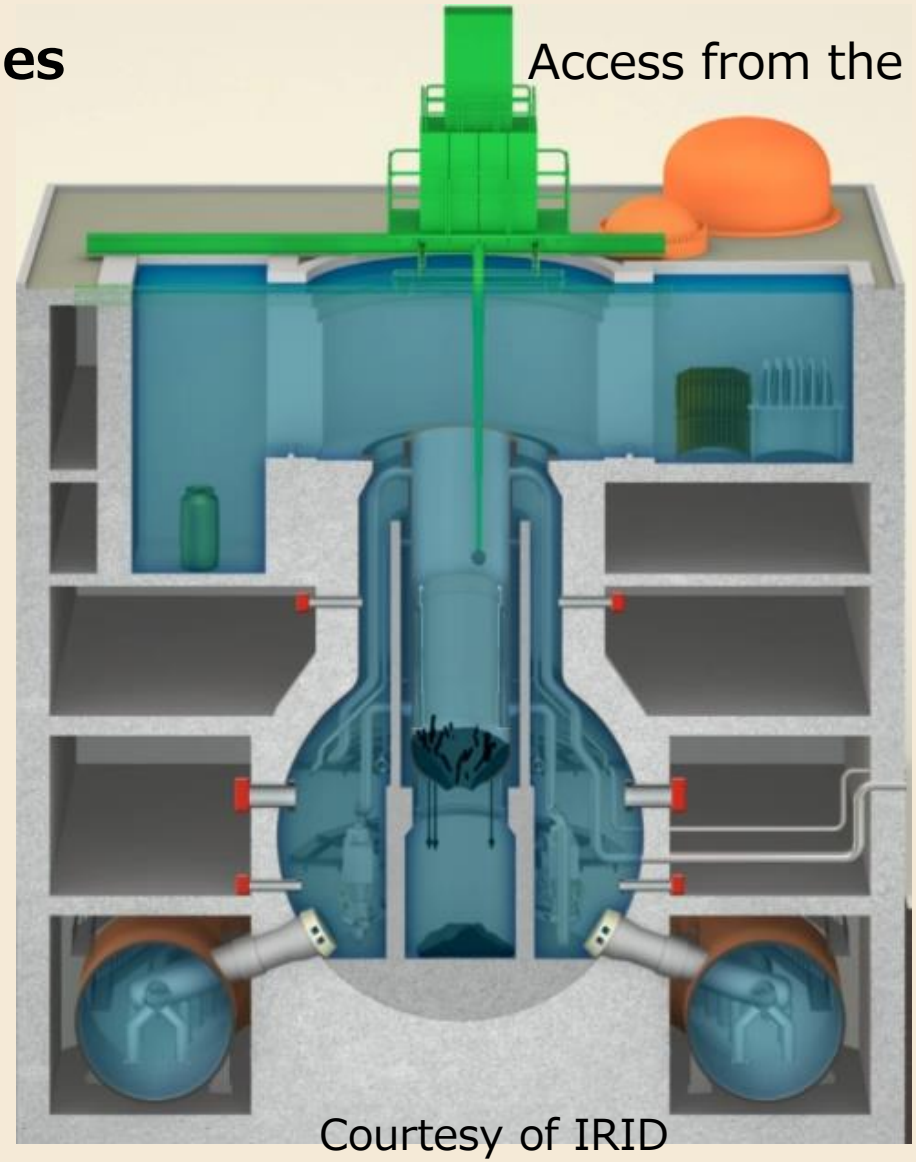


Fuel-debris retrieval as the most challenging operation

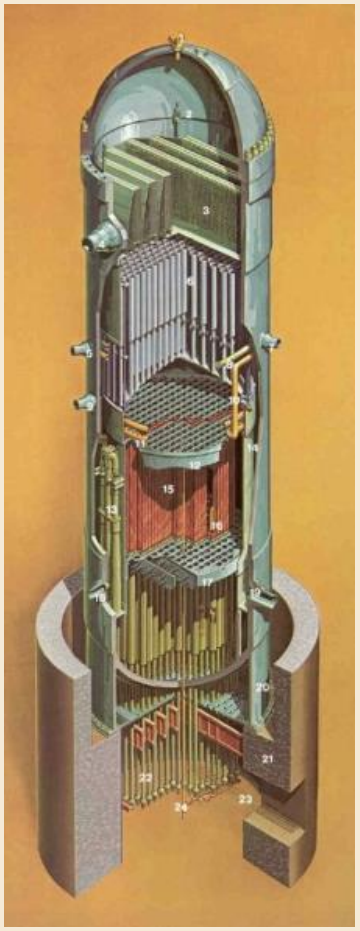
Technical difficulties

- Decontamination of rooms of the building
- Full-remote detection of leak points of PCV
- Decontamination of the inside of reactor vessels
- Full-remote fixing of leak points of PCV
- Cutting and pull-up of fuel-debris
- Encapsulation of retrieved fuel-debris
- Removal of heavy internal structures of RPV
- Safety assurance for re-criticality, radiation, and radioactive dust formation

Access from the top with full subme

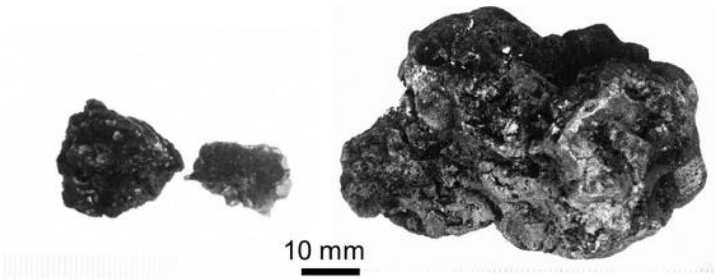


Courtesy of IRID



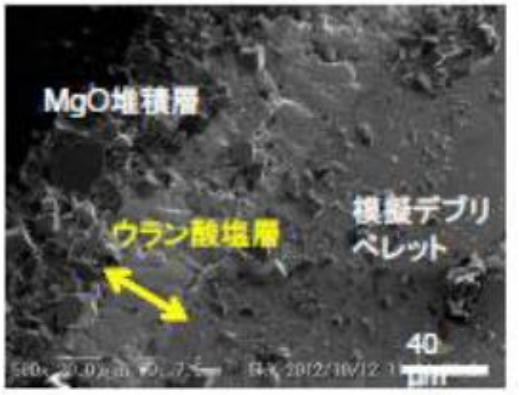
Fuel-debris

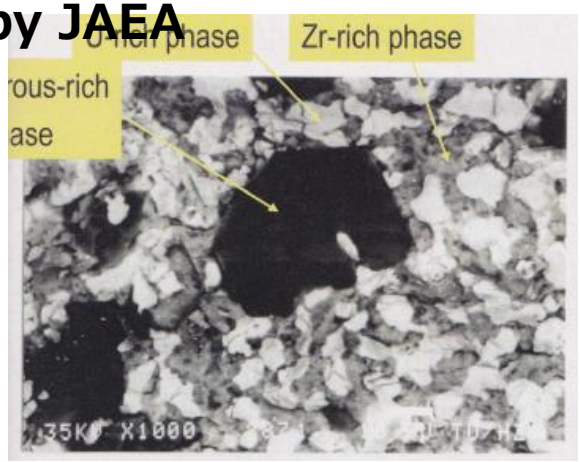
Sample of fuel debris taken from TMI-2 core (investigated by JAEA)



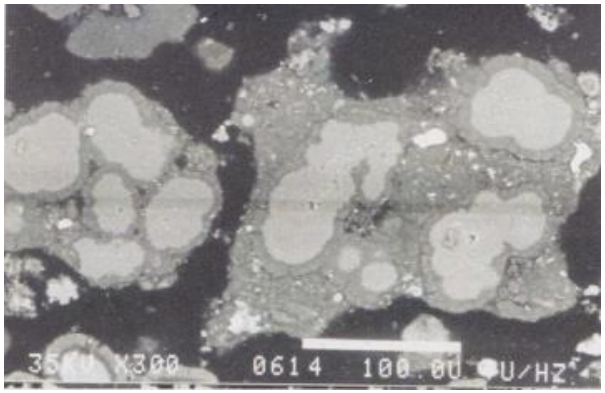
Quotation: The TMI-2 Chronicle, GPU Nuclear Communic

Sim. fuel debris studied by JAEA





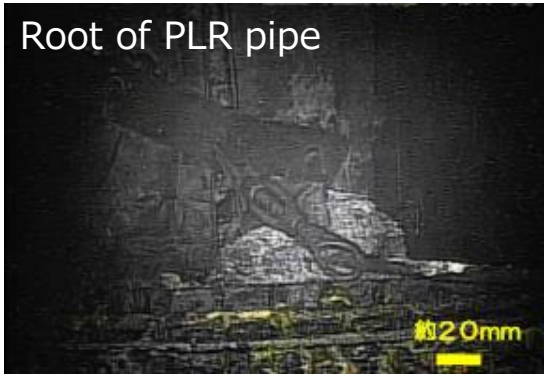
TMI-2

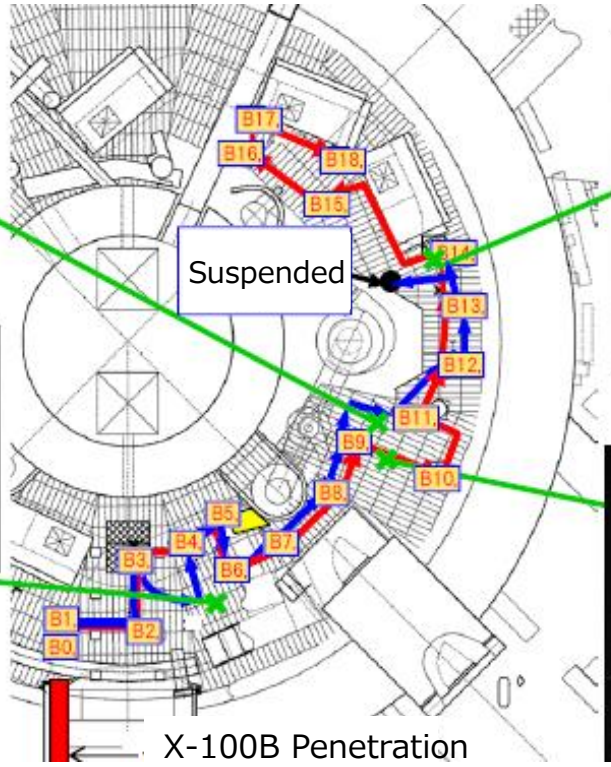


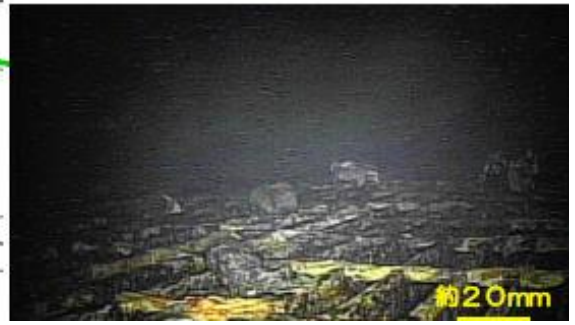
made from open information from TEPCO and others

Remote inspection inside the PCV in Unit-1

	(Sv/h)	(℃)
B 3	7.4	17.8
B 4	7.5	19.2
B 5	8.7	19.4
B 7	7.4	19.5
B 11	9.7	19.2
B 14	7.0	20.2





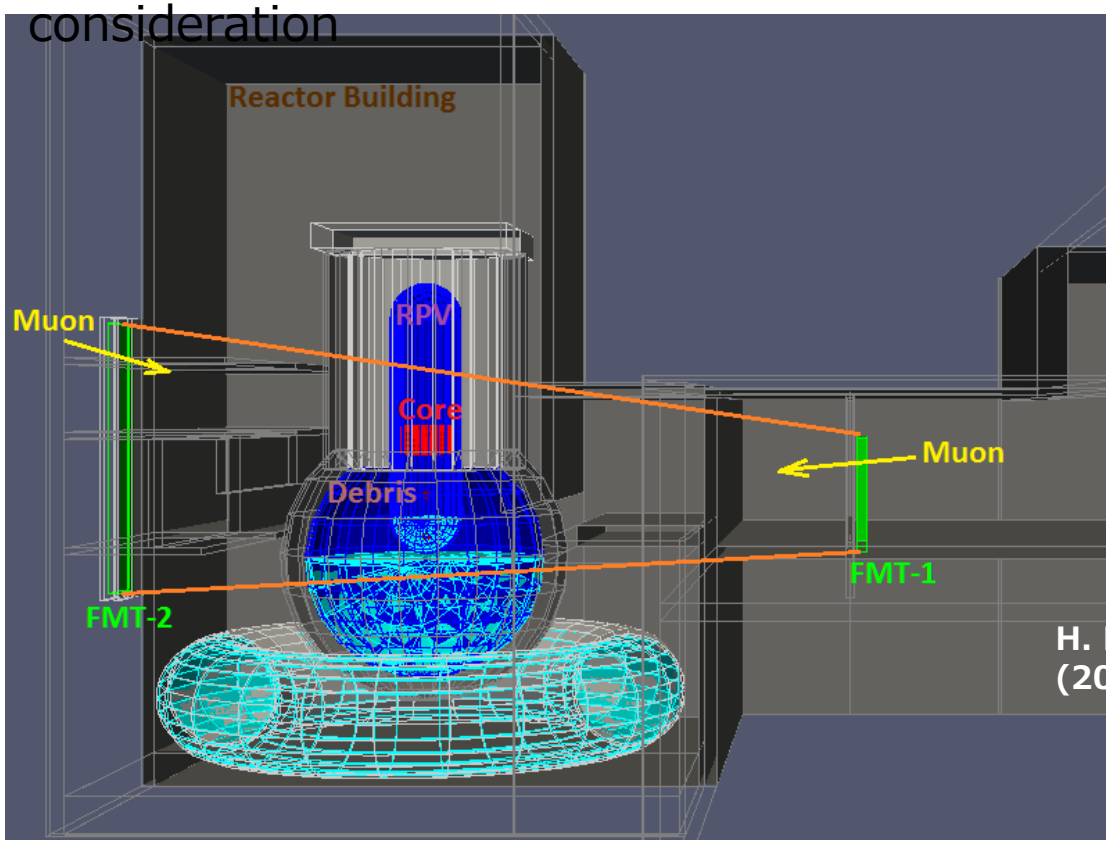


Planned route
Inspected route
Falling objects

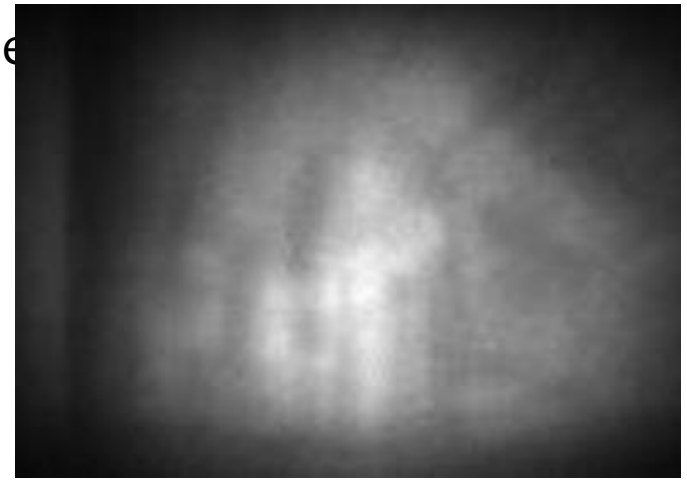
Source: Open information by TEPCO

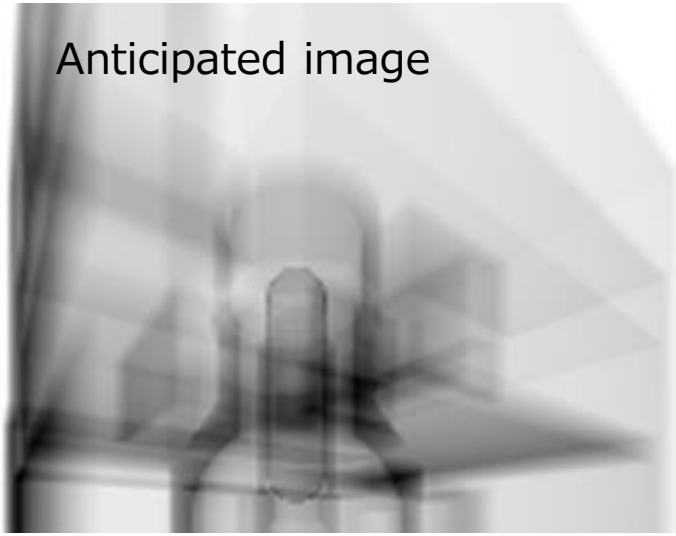
Muon-tomography

Scattering method under consideration



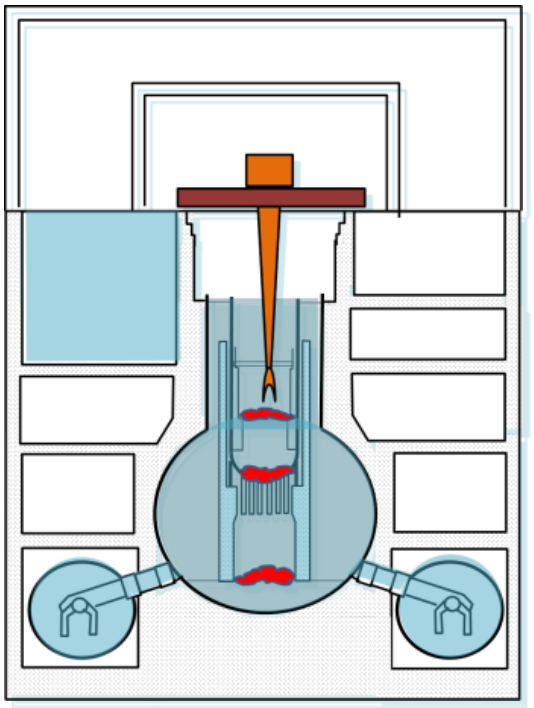
Unit-1 Transmission me





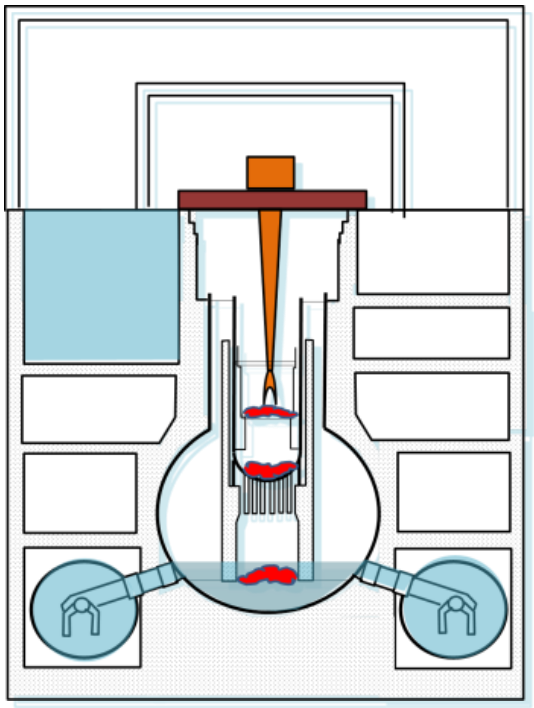
Source: Open information by TEPCO

Strategic Plan-2; Fuel Debris Retrieval



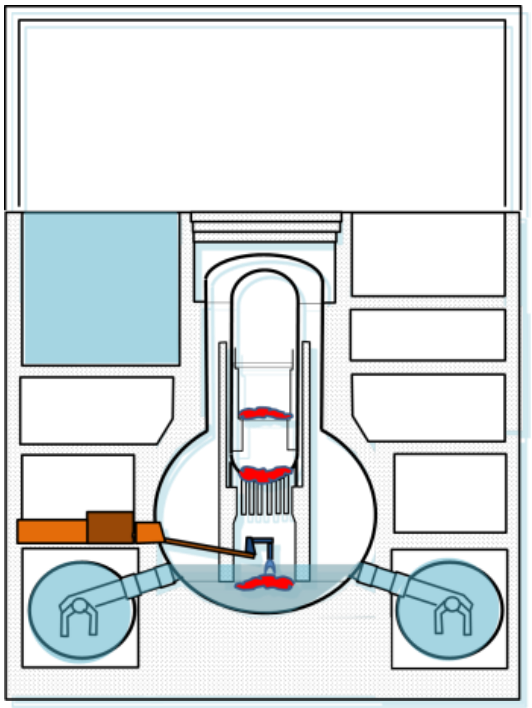
Submersion method

Image on condition that the removal of core internals above fuel debris has finished.



Partial submersion - Top entry method

Image on condition that the removal of core internals above fuel debris has finished.



Partial submersion - Side entry method

Image on condition that RPV pedestal exterior component inside PCV and the interference have been removed.

Strategic Plan-3; Radioactive Waste Management

Important references; GSR-part5 and SSR-5 of IAEA

- Contain the waste
- Isolate the waste from the accessible biosphere and reduce substantially the likelihood of, and all possible consequences of, inadvertent human intrusion into the waste
- Inhibit, reduce and delay the migration of radionuclides at any time from the waste to the accessible biosphere
- Ensure that the amounts of radionuclides reaching the accessible biosphere due to any migration from the disposal facility are such that possible radiological consequences are acceptably low at all times
- Control the release of radioactive materials to ensure that their concentrations without having do not have significant health effects

Approaches to the radioactive waste treatment to be developed.

Roadmap- Revision by the Government

1. Give priority to Risk Reduction

2015.06.12 following revision of NDF's Strategic Plan

Focus on Speed		Focus on Risk Reduction
Contaminated water management, Fuel removal from SFP	⇒	Deal with as soon as possible
Fuel debris removal	⇒	Deal with safely, surely and carefully with adequate preparation
Solid radioactive wastes, Secondary waste generated from contaminated water treatment	⇒	Deal with in a long-term

2. Clarifying Milestones ⇒ Clarifying Milestones in a few years, taking stakeholder's opinions into account

3. Build-up Trust with local Community by maximizing Transparency

Establishment of **Fukushima Council** ⇒ Further enhanced communication

4. Further reduction in workers' exposure dose, Enhancement of Organization for Industrial Safety and Health Management

5. Reinforcement of Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF), as the Control Tower of technical strategy for decommissioning

Enhancement of NDF ⇒ Integration R&D Management
Gather Wisdom from all over the World

R&D-1; Partnership Council

Decommissioning R&D Partnership Council established in NDF
1st meeting July.6 2015.

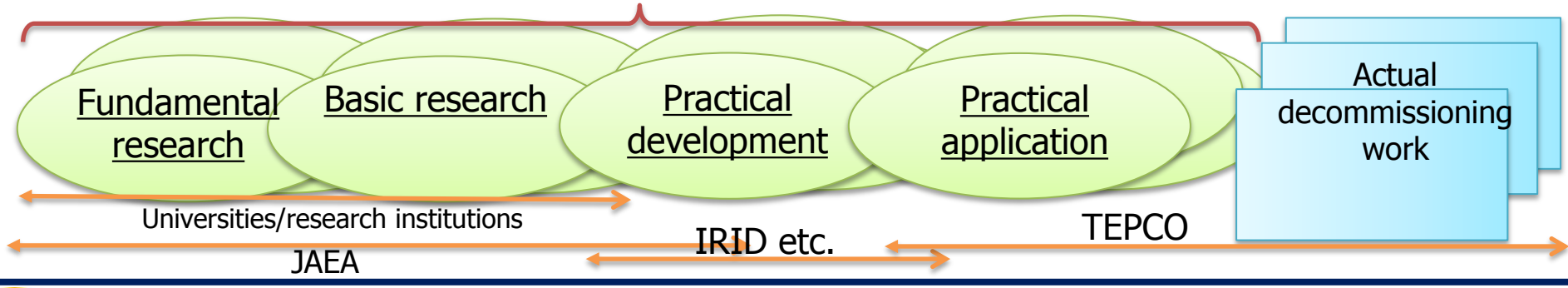
Team leader: Minister of Economy, Trade and Industry

Chief of Secretariat: Vice Minister of Economy, Trade and Industry

Decommissioning R&D Partnership Council

Integration of overall R&D management
NDF as headquarters function of R&D planning covering all Japanese R&D related organizations including academia

Toward the effective and practical Application of R&D results



R&D-2; Government Facilities

- Construction and consolidation of R&D facilities (JAEA)
  - Naraha Remote Technology Development Center:
    Mock-up test facility (Oct 19, 2015~)
  - Okuma Analysis and Research Center:
    Radioactive material analysis and research facility (JFY 2018~)
  - CLADs (Collaborative Laboratories for Advanced Decommissioning Science)(2015.4~):
    International joint research building (2017.3~)

Mock-up test facility

©JAEA

Risk Communication

Decommissioning, Contaminated Water Measures **Fukushima Council**

First meeting : February17, 2014.

Latest 9th meeting : September 29, 2015.

Purposes:

1. Build-up Trust by maximizing Transparency and further enhanced Communication
2. Listen to the opinions concerning the PR and decommissioning work.

Member:

METI, Fukushima prefecture, Local town/ village councils, TEPCO, NDF, Local opinion leaders

©METI

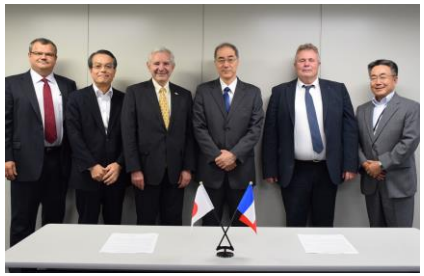
International Cooperation

Information/Experience Exchange Agreement

1) NDF

With NDA

With CEA



With DOE

On Project Management, Institutional/organizational Aspect

3)ANRE/NDF's First International Forum; April 2016 @Fukushima

2) TEPCO

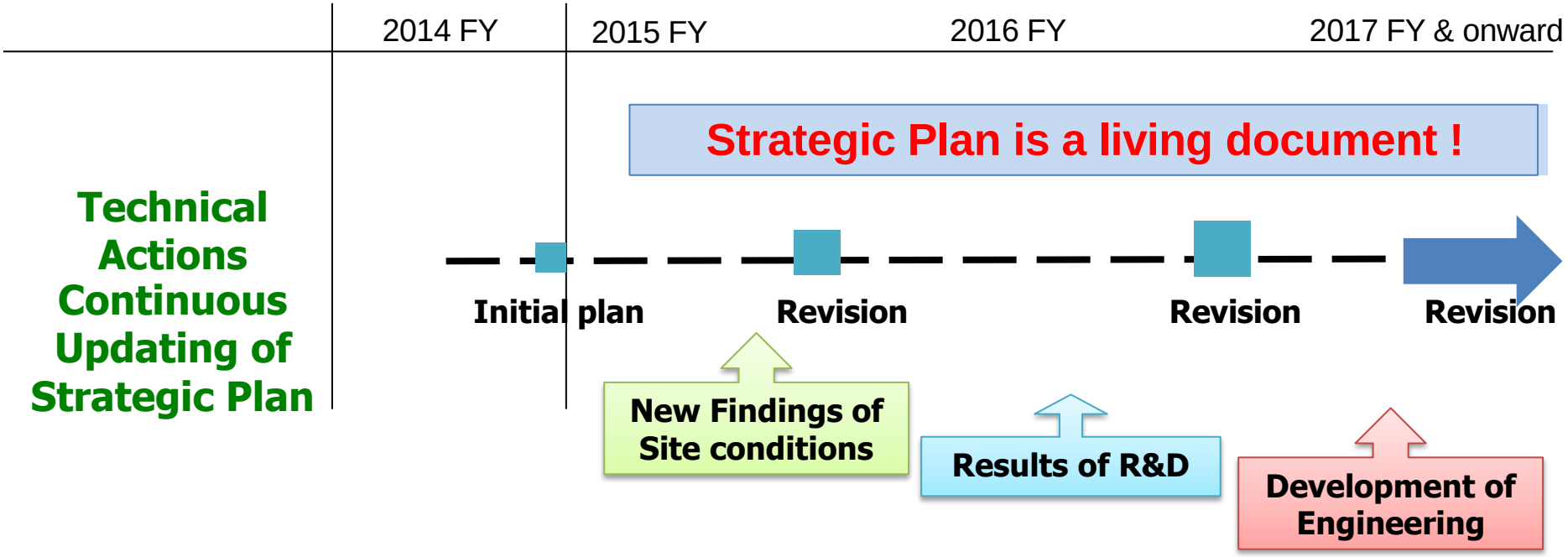
Sellafield, Ltd.

CEA

DOE (Pacific Northwest National Laboratory, Savannah River National Laboratory etc.)

On Operational, site-related and technical Aspect

Future Action based on Strategic Plan



Implementation of the actions defined in Strategic Plan like Selection of Fuel Debris Retrieval Methods etc. under 8 Technical Teams involving related organizations through the frequent and thorough Discussion

Information/experience exchange with overseas partners is of critical importance

Not limited to scientific and technical aspect, but organisational/institutional issues, such as project management, human resources development, knowledge management, risk management and risk communication etc.

Thank you for your Attention!