

## Perspective of the IAEA on Fukushima Daiichi Decommissioning

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# Introduction



- In a video message on 9<sup>th</sup> March 2021, the Director General of IAEA reiterated the IAEA's support of Japan's efforts to handle the aftermath of the 2011 Fukushima Daiichi nuclear accident.
- He said the agency also drew up an action plan to strengthen the global nuclear safety framework, endorsed by member states.
- The IAEA and Japan have been cooperating extensively to deal with the aftermath of the 2011 accident in areas such as radiation monitoring, remediation, waste management and decommissioning.
- I would like to give you a short overview of the IAEA's activities related to decommissioning of Fukushima Daiichi NPP



# IAEA Action Plan on Nuclear Safety

- Endorsed by IAEA Member States in 2011
- Programme of work to strengthen global nuclear safety framework in 12 areas.
  - The IAEA's work under the Action Plan included: strengthening relevant safety standards and peer review services, and enhancing efforts to assist Member States in building capacity for safety.
- The Agency also held nine international experts' meetings that analysed technical aspects of the Fukushima Daiichi accident so that lessons could be learned. In addition, the IAEA conducted 15 international expert missions to Japan and published the reports.

- Fukushima Daiichi Accident Report by IAEA Director General, 2015:
  - Release at IAEA General Conference
  - 5 Technical Supporting Volumes address the accident's causes and consequences and aim to provide a comprehensive understanding of what happened during the accident and why.
    - Five working groups with about 180 experts from 42 Member States and several international bodies collaborated on the report.







# **Technical Volume 5: Post-accident Recovery**

- Remediation
- On-site stabilization and preparations for decommissioning
- Management of contaminated material and radioactive waste
- Community revitalization and stakeholder engagement and



FIG. 5.2-7. Landscapes before and after remediation in Tamura City (Photographs courtesy of the Ministry of the Environment) (cont.).

### **Collaboration on particular issues and covering** other post-accidental cases

IAFA-TECDOC-1927



#### **CRP** on Management of Severely **Damaged Spent Fuel and Corium**



#### **Chernobyl lavas**

Hot (1600-2300 °C) UO<sub>2</sub> fuel alloyed with zircalloy cladding contacted with concrete and metal constructions forming lava-like fuel-rich flows. They contain major fraction of the fuel from the reactor (>90 tons).



black ceramics brown ceramics black ceramics brown ceramics

pumice





Kurchatov Institute Rep B.E.Burakov, KRI

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### **Regular "comprehensive information sharing" report**



Events and highlights on the progress related to recovery operations at TEPCO's Fukushima Daiichi Nuclear Power Station

> May 2022 The Government of Japan

#### Section 1: Summary of updates from October 2021 through February 2022

#### 1.1: Decommissioning and Contaminated Water management

Since the last report, there has been progress on the decommissioning and contaminated water management at TEPCO's Fukushima Daiichi Nuclear Power Station (hereinafter "Fukushima Daiichi NPS") as detailed below. For specifics please refer to section 2.

Equipment for Unit 2 trial fuel debris retrieval arrived in Fukushima
 Equipment for the Unit 2 trial fuel debris retrieval, which had been developed in the UK,
 arrived in Fukushima at the end of January 2022. A performance verification test and
 operational training are being conducted. (For further details please refer to Page 12-13)

2. Regarding ALPS treated water

On December 21, 2021, TEPCO submitted plan for the discharge to NRA to receive necessary approval from the NRA. The NRA is reviewing this application. From February 14th to 18th, 2022 the IAEA conducted its review mission of safety aspects of handling of ALPS treated water. (For further details please refer to Page 9)

- An underwater robot was inserted into the PCV of Unit 1
   The first underwater robot was inserted to investigate the inside of the Unit 1 Primary
   Containment Vessel (PCV). A second robot will be inserted in the future. (For further details
   please refer to Page 11-12)
- 4. Publication of the Technical Strategic Plan 2021

The Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF) published the "Technical Strategic Plan 2021 for Decommissioning of the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Company Holdings, Inc." on October 29, aiming to provide a firm technical basis for the government's "Mid-and-Long-Term Roadmap" and to serve as an aid for smooth and steady implementation of decommissioning and achievement of targets of the risk reduction map. (For further details please refer to Page 16.) IAEA assessment on aspects presented in the May 2022 report 'Events and highlights on the progress related to recovery operations at Fukushima Daiichi Nuclear Power Station'

#### Equipment for trial retrieval of fuel debris from Unit 2

Japan reported that the robotic-arm equipment for fuel debris retrieval, that had arrived from the United Kingdom, was used to conduct a performance verification test and operational training in Kobe. The equipment has arrived at the Japan Atomic Energy Agency (JAEA) Naraha Center close to the Fukushima Daiichi site, where operational tests are being conducted.

The IAEA notes that this equipment may play a central role in the experimental retrieval of fuel debris from Unit 2, the start of which was postponed for about a year due to the COVID-19 pandemic. The IAEA recognizes the importance of conducting sufficient operational training at the JAEA Naraha Center, including mock-up tests that closely reproduce conditions at the Fukushima Dailchi Nuclear Power Station (NPS) recovery site.

#### An underwater vehicle in the PCV of Unit 1

Japan reported that a remotely operated underwater vehicle was inserted in the Primary Containment Vessel (PCV) of Unit 1 on 8 February 2022 to investigate the inside of the PCV and to install "guide rings". These rings will serve as track for a second and subsequent underwater robot to be inserted for future detailed investigations. These investigations will help understand the equipment needed to retrieve fuel debris inside the PCV of Unit 1. Japan also reported that the installation of four "guide rings" was completed on 9 February 2022.

The IAEA acknowledges the investigations, the preparatory work and the progress made to retrieve fuel debris deposited in the PCV of Unit 1.

#### Publication of the NDF's Technical Strategic Plan 2021

Japan reported that the Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF) has published the "Technical Strategic Plan 2021" which provides a technical basis to the Government of Japan's "Mid-and-Long-Term Roadmap towards the Decommissioning of Fukushima Dailchi NPS" and facilitates the smooth and steady implementation of decommissioning activities.

The IAEA notes that the "Technical Strategic Plan 2021" presents a technical strategy from a medium- to longterm perspective that deals with the overall efforts for Tokyo Electric Power Company (TEPCO) to steadily implement decommissioning work at the Fukushima Dalichi NPS, in line with the goals set in the "Mid- to-Long-Term Roadmap" that was revised by the Government of Japan in 2019. In particular, the "Technical Strategic Plan 2021" devotes attention to solid waste management.

#### Handling of ALPS treated water

Japan reported that TEPCO had made available a Radiological Environmental Impact Assessment (REIA) to the public on 17 November 2021. TEPCO submitted the REIA and a revised implementation plan accounting for the proposed Advanced Liquid Processing System (ALPS) treated water discharge facility and related facilities to Japan's Nuclear Regulatory Authority (NRA) on 21 December 2021. The NRA is in the process of reviewing both documents against national laws and regulations.

- 3 reports received after the 5<sup>th</sup> review mission
  - Recognized steady progress on preparation for discharging the ALPS treated water
  - ✓ Steady progress on preparation for test retrieval of fuel debris from Unit 2
  - ✓ Negative impact of COVID-19 pandemic



### International peer-review: Background

- "Mid-and-Long-Term Roadmap" was adopted by the Government of Japan and TEPCO Council on Mid-to-Long Term Response for Decommissioning in December 2011, revised in July 2012, in June 2013, in June 2015, in September 2017 and in December 2019.
- ✓ The Roadmap includes description of the main steps and activities to be implemented for the decommissioning of the TEPCO's Fukushima Daiichi NPS.
- ✓ Government of Japan (GoJ) asked the IAEA to organize International Peer Review of the Roadmap including review of relevant individual topics.
  - ✓ First Mission in April 2013
  - ✓ Second Mission in Nov/Dec 2013
  - ✓ Third mission in February 2015
  - ✓ Fourth mission in November 2018, follow-up in April 2020
  - ✓ Fifth mission in Summer 2021

### **Objectives of the Peer Review**



- To provide an independent review of activities associated with the planning and implementation of Fukushima Daiichi NPS decommissioning. In particular, Missions were intended to:
  - Provide advice and commentary on both the safety and technological aspects of decommissioning, waste management and other related activities;
  - Provide advice to improve the planning and the implementation of predecommissioning and decommissioning activities at Fukushima Daiichi NPS; and
  - Facilitate sharing of good practices and lessons learned for decommissioning operations after the accident with international community.

### Conduct of the 5<sup>th</sup> Review (Summer 2021)



- Before June 30<sup>th</sup>
  - First set of reference document received
- From June 30<sup>th</sup> to August 2<sup>nd</sup>
  - Twice weekly web-based presentations from Japan officials and TEPCO's managers and discussions with the review team
- August 2<sup>nd</sup> to August 6<sup>th</sup>
  - Identification of the findings by the review team, shared with Japan, and writing of the preliminary report
- August 23<sup>rd</sup> to 26<sup>th</sup>
  - Fukushima site visit with appropriate Covid restrictions
- August 27<sup>th</sup> Hand-Over of the Review Report

Review Team: 12 international experts 9 experts from the IAEA and 3 international experts from UK, USA, Indonesia

### Reviewing, site visiting and handing-over the review report











### Some Acknowledgments, among others

- Decision made on the disposition path of ALPS treated water a major advisory points from the previous review missions
- Reorganization of FDEC along with a strengthening of the project management function and of the safety leadership
- Spent Fuel Pond Unit 3 emptied, preparation for Unit 1 and 2
- Improved knowledge on fuel debris, including a remote arm developed for trial retrieval in unit 2
- Progress on site management to address flooding, earthquake and tsunami risks
- Reduction of water ingress and of stagnant water
- Development of solid waste management facilities (storage, volume reduction)
- Efforts towards industrial localization, in line with the two pillars
  - "decommissioning and reconstruction"
- Explicit plan to collect data during decommissioning to learn from the accident

### Some Advisory Points, among others



- Keep-on strengthening the program and project management functions
- Keep-on strengthening overall coordination of involved organizations (esp R/D)
- Maintain attention on technological development, in particular the ramp-up from trial to scaled up routine operation
- Start allocate resources to plan and prepare beyond the next 10 years
  - Integrated planning for the whole decommissioning (6 units) for the whole site
  - Test robustness of possible plans through scenario development
  - Identification of options for fuel debris <u>management</u>, after retrieval and storage
  - Life asset management over the duration of the decommissioning
  - Identification of full waste inventory and circular economy management options
- Further development of radiation imaging system
- Further development of knowledge management tool
- Facilitate international dissemination of knowledge and of access to fuel debris samples

### 5<sup>th</sup> Peer Review Overall Major Findings



- Significant progress made since 2018
  - Organizational
  - Risk reduction
  - Technical
- Looking to the future
  - Strengthen planning up to the end of the decommissioning for the whole site
  - Technological and R/D for fuel debris management



# **Continuing collaboration**



- Transparency, information sharing
- Collaborative lessons learning
- Collaborative research and developments
- Peer reviews and advisory services
  - Accessing progress, identifying new challenges and issues
  - Sharing achievements and good practices
  - Looking for further opportunities for collaborative actions



# Thank you!

