Initiatives for Fostering Employees' Awareness of ALARA at Tsuruga Power Station

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Overview of the Tsuruga NPP

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Tsuruga NPP

in Tsuruga City, Fukui Pref.

Unit 1 [BWR]

Electric Power Output: 357 MW
Thermal Output: 1064 MW
Fuel: Low Enriched Uranium（52tons）
Enrichment 3.7wt%

Decommissioning phase

Unit 2 [PWR]

Electric Power Output: 1160 MW
Thermal Output: 3423 MW
Fuel: Low Enriched Uranium (89tons)
Enrichment 4.1wt%

Under review for conformity to new regulatory standards

Unit 3&4 [PWR]

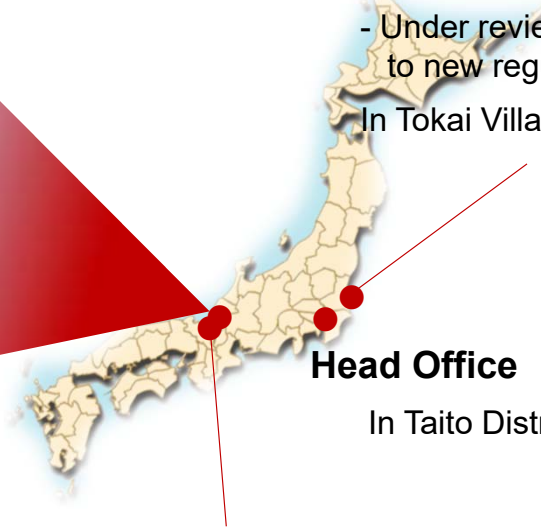
Preparations phase

Offices & Plants of JAPC

Tokai NPP [GCR]
- Decommissioning phase

Tokai II NPP [BWR]
- Under review for conformity to new regulatory standards

In Tokai Village, Ibaraki Pref.



Head Office

In Taito District, Tokyo

Mihama Nuclear Emergency Assistance Center

In Mihama Town, Fukui Pref.

Overview of the Tsuruga NPP

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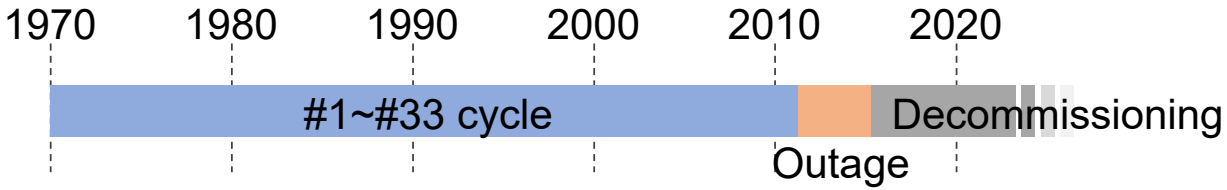
Decommissioning phase



1970 Start of commercial operation
- Japan's first commercial light water reactor

2017 Start of decommissioning

Unit 2 [PWR]

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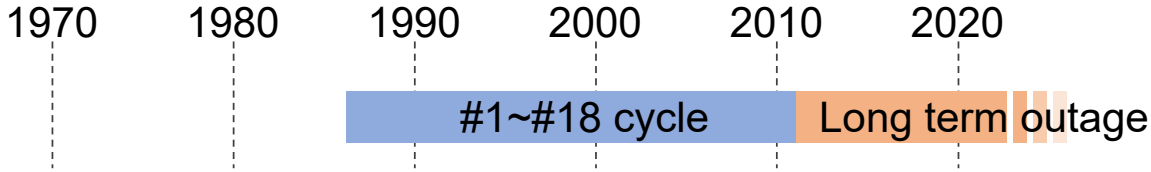
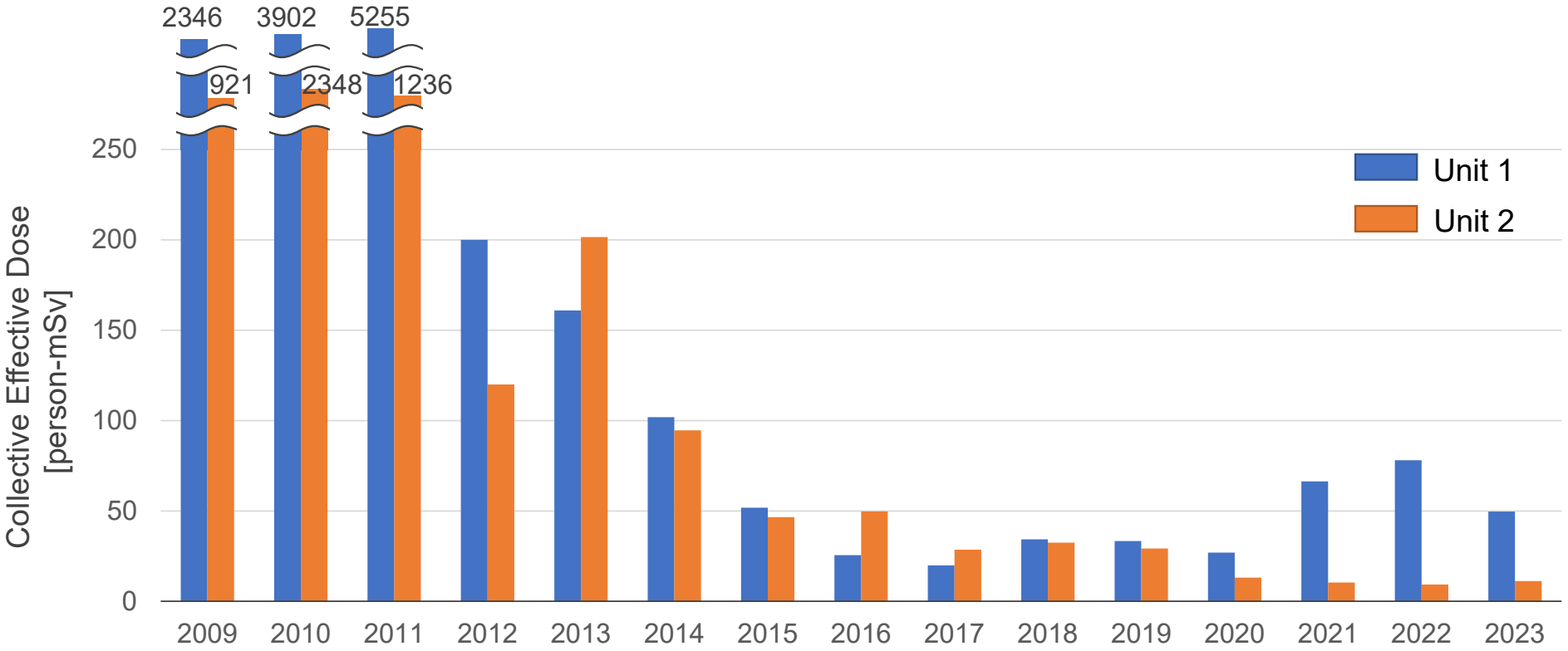


1987 Start of commercial operation
- Japan's first 1.1 million kW class domestic improved standard light water reactor

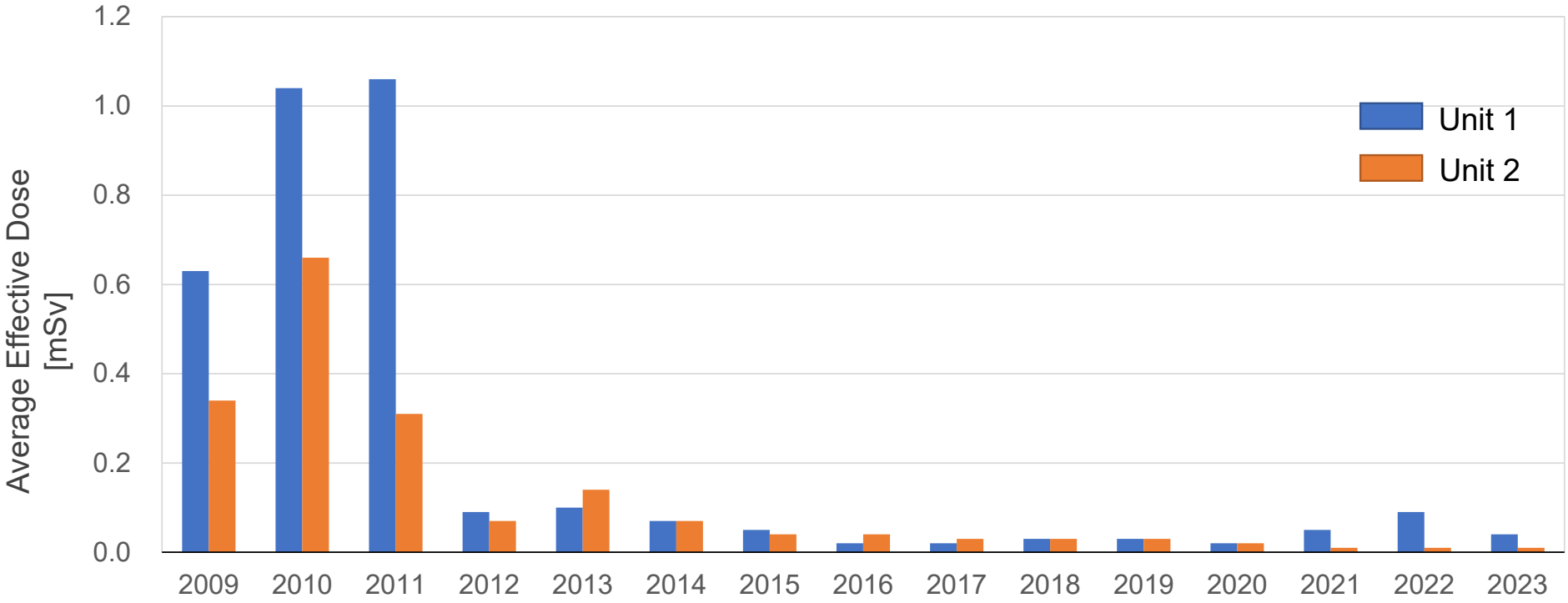
2015 Application for confirmation of conformity to new regulatory standards

Long-term Trends in Radiation Levels



- After the shutdown in 2011, the total radiation dose has been on a declining trend. The number of people entering has also decreased by 80% to 90% compared to during regular inspections.
- Until 2011, both Unit 1 and Unit 2 were undergoing regular inspection work. Unit 1 recorded high values due to tasks such as the replacement of PLR piping.
- The increase for Unit 1 from 2021 is due to the inspection of the filter sludge storage tank.

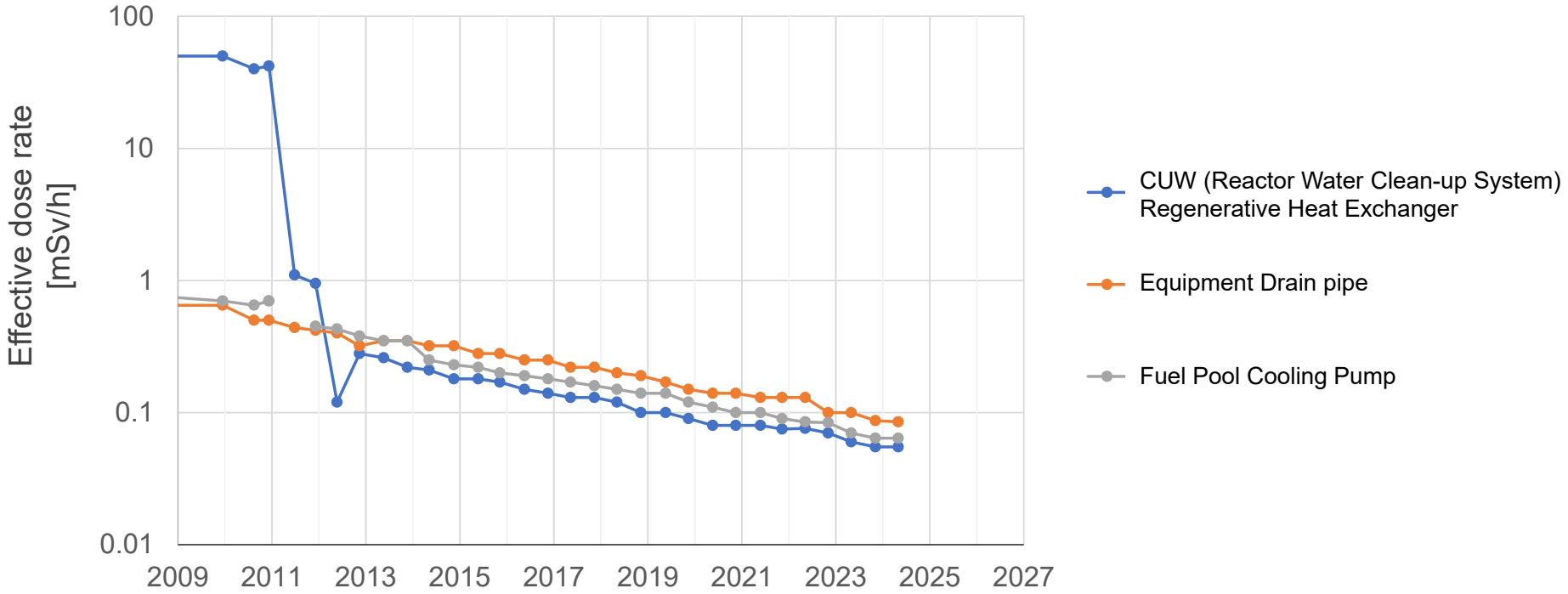
Long-term Trends in Radiation Levels



- After the shutdown in 2011, the average effective dose has been on a declining trend too.

Long-term Trends in Radiation Levels

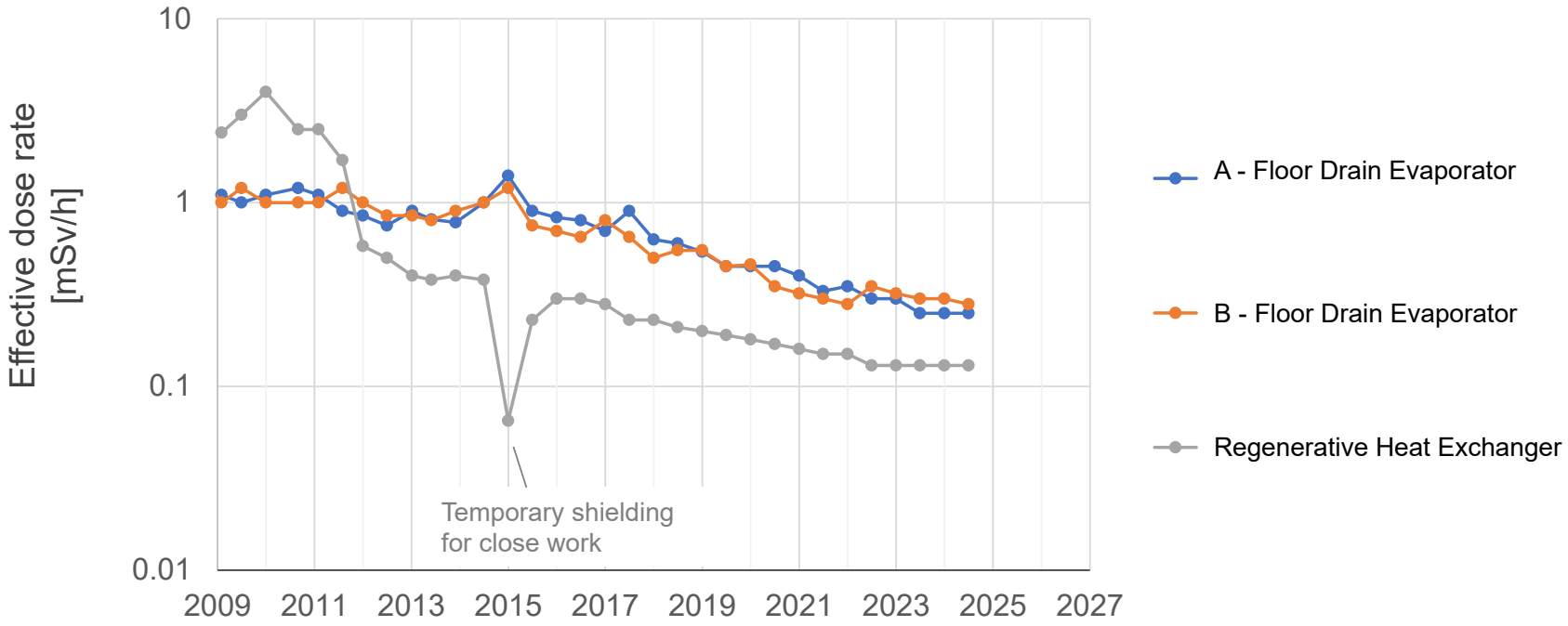
Surface Effective Dose Rate in **Unit 1**



- Due to the half-life of Co-60 (5.3 years), the on-site radiation dose rate decreases annually.
- Using 2011 as a baseline of 1, it has decreased to 0.17 in 2024 (an 83% reduction).

Long-term Trends in Radiation Levels

Surface Effective Dose Rate in **Unit 2**



- Due to the half-life of Co-60 (5.3 years), the on-site radiation dose rate decreases annually.
- Using 2011 as a baseline of 1, it has decreased to 0.17 in 2024 (an 83% reduction).

Concerns about the decrease in site dose: Decrease in ALARA awareness

Decrease in ALARA awareness among workers due to lower site dose

(2013 JANSI Peer Review／AFI)

- Tasks that could result in high doses are not always identified during the planning stage
- There are cases where environmental doses increase, or exposure doses exceed planned levels
- The radiation management department is not systematically involved in the planning stage of tasks
- The management of the power plant does not provide comprehensive expectations regarding radiation work plans
- Effective leadership is not demonstrated in setting long-term exposure goals, including modification work, and in building a systematic collaboration between the work department and the radiation management department

Establish a new forum for the work department and the radiation management department to discuss dose reduction measures and radiation management precautions for each project

Committee on ALARA at Tsuruga NPP

- Dose Reduction Promotion Committee
- ALARA Coordination Meeting

Dose Reduction Promotion Committee / ALARA Coordination Meeting

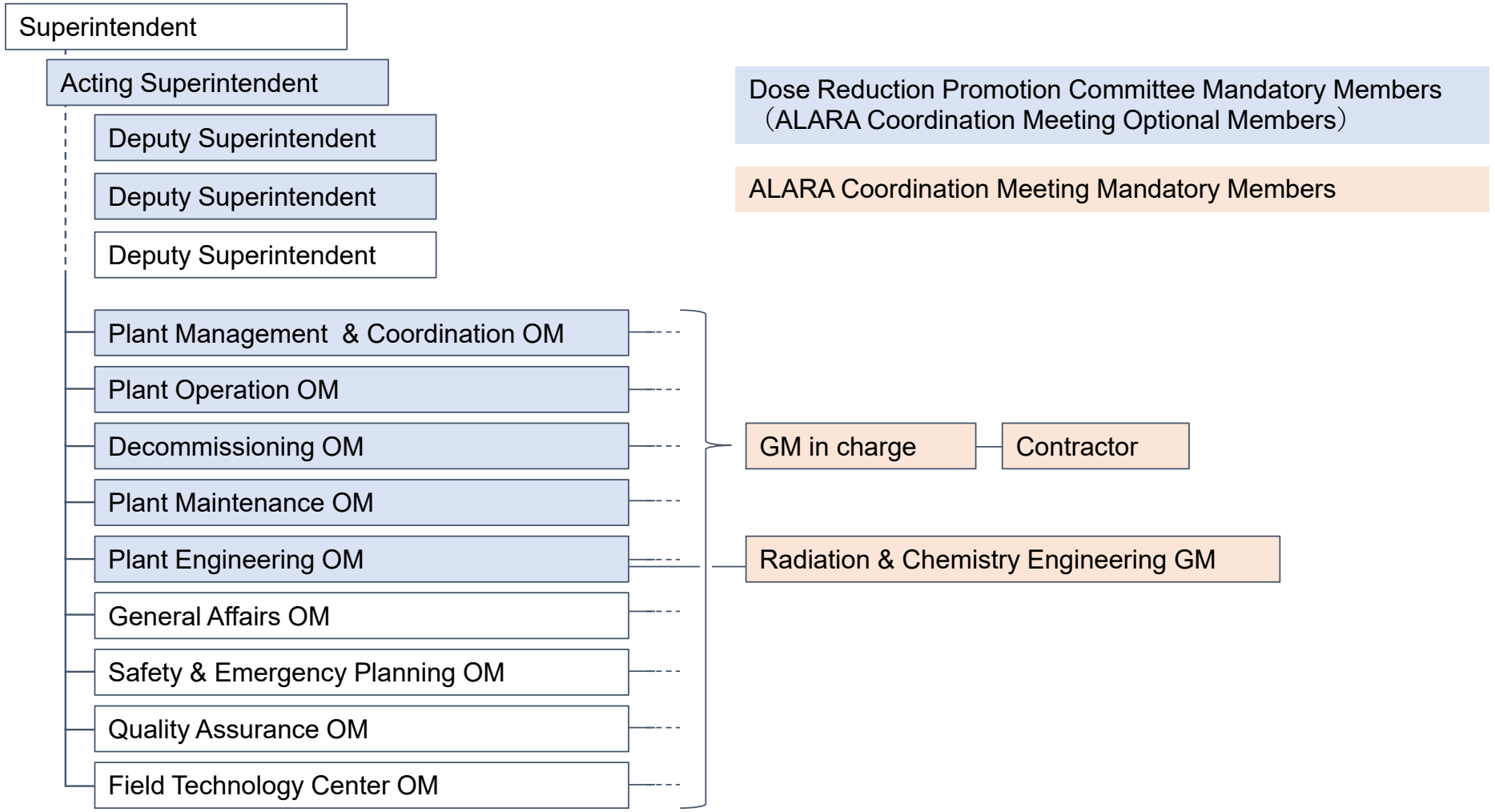
Dose Reduction Promotion Committee

Chief Examiner	Acting Superintendent
Mandatory Members	Plant Management & Coordination OM, Plant Operation OM Decommissioning OM, Plant Maintenance OM, Plant Engineering OM
Optional Members	Deputy Superintendent
Discussion Topics	Setting annual dose targets, Contents of dose reduction activities, Selection of tasks for the ALARA Coordination Meeting
Reporting Topics	Achievements of the above discussion topics
Frequency	Once at the end of the year and as needed

ALARA Coordination Meeting

Members	GM in charge, Contractor, Radiation & Chemistry Engineering GM
Optional Members	Members of Dose Reduction Promotion Committee
Discussion Topics	Confirmation of work content and methods, dose reduction measures, contamination prevention measures, and consideration of additional measures
Frequency	When planning or changing work content, and as needed

Dose Reduction Promotion Committee / ALARA Coordination Meeting



Dose Reduction Promotion Committee

Setting Annual Dose Target

Review the planned doses and set the total value reduced by 10% as the target value

- This method has been adopted since 2019.
- Before that, the values were set at the beginning of the year. It was revised because the details of each work were unclear at the beginning of the year, and the dose situation at the beginning of the year could differ from the actual working period.

Continued achievement of target values since 2019

2019: **66%** of the target value
2020: **73%** of the target value
2021: **88%** of the target value
2022: **63%** of the target value (due to significantly lower doses during high-dose tasks)
2023: **80%** of the target value

At the time of the working procedure hearing, the planned doses are reviewed, and it can be seen the accuracy of the review is improving. In the future, if the accuracy of the planned doses further improves, there is a possibility that the target values may be exceeded, and it will be necessary to consider the method of setting the target values.

Dose Reduction Promotion Committee

Dose Reduction Activities

1. Monthly Communication of Dose Target Values and Actual Values
   Inform staff and partner companies of the total dose target values and actual values each month. This aims to regularly raise awareness of dose reduction among supervisors and partner companies.
2. Implementation Status of On-site Patrols
   Conduct on-site patrols once a month, observing high-dose and high-contamination tasks for about 30 minutes. Confirm that no inappropriate actions are being taken in terms of radiation management at each work site. If good practices are identified, they will be communicated through CR (Condition Report).
3. Dose/Waste Reduction Awareness Campaign
   In September 2023, in collaboration with partner companies, distribute awareness towel with messages on dose reduction and waste reduction as part of an awareness campaign.
4. Benchmarking Dose Reduction Activities at Other Plants
   Good practices identified through benchmarking of other plants consider their application to Tsuruga Power Station.

Dose Reduction Promotion Committee

Selection of tasks for the ALARA Coordination Meeting

Applicable tasks for the ALARA coordination meeting:
planned dose exceeds 10 man-mSv and as needed

ALARA coordination meeting will be held in the following case:

- When the planning of the tasks
- When there are changes to the task plans
- When discussing matters related to other dose reduction and contamination prevention methods

Discuss at the ALARA Coordination Meeting

Confirmation of work content and methods,
dose reduction measures, contamination prevention measures, and consideration of additional measures

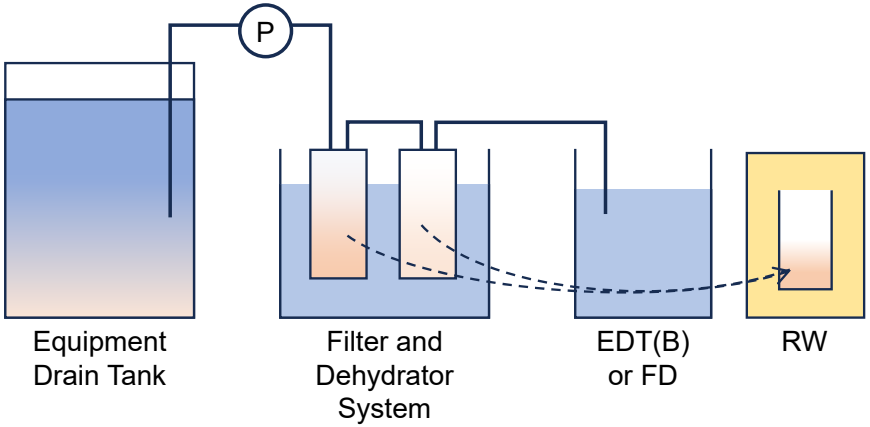
ALARA Coordination Meeting

Year	Works Undertaken	Number of Meeting held	Key Guidance and Advice Items
2020	3	6	• Cancellation of scaffolding removal work in high-dose areas (reuse for next work) • Method for removing sources discovered during the work • Change in the timing of insulation removal (after water drainage → before water drainage)
2021	4	18	• Adoption of water shielding due to change in tank water transfer timing • Change from filter recovery to manual recovery of filter sludge using a ladle (A)
2022	2	15	• Flushing of bubbling pipes inside the tank • Improvement of proficiency through pre-rehearsal of high-dose work (B)
2023	2	6	• Selection of ladles with extended handles considering workability (A) • Increasing proficiency in low-dose areas before working in high-dose areas (C)

In ALARA coordination meetings, it has been observed that the worker side is increasingly proposing proactive dose reduction methods. This is because the contractors thoroughly consider dose reduction measures in advance to present them at the ALARA coordination meetings. Therefore, even if no additional reduction measures are proposed during the meetings, this activity itself is evaluated as effective in reducing doses.

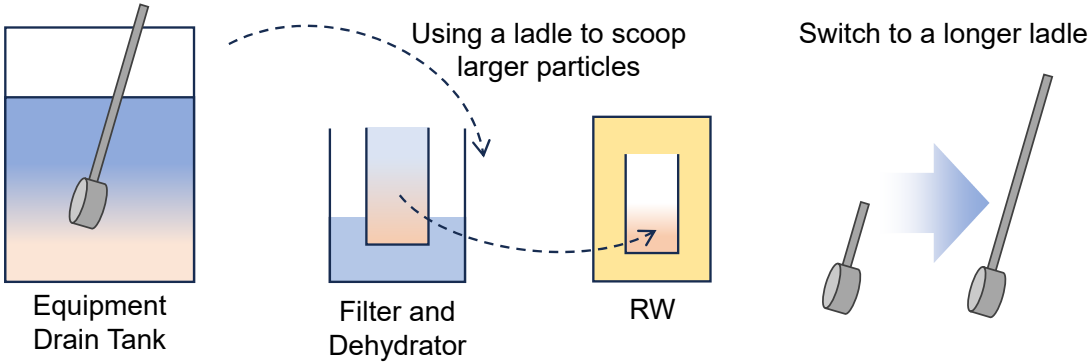
(A) Change from filter recovery to manual recovery using a ladle for filter sludge

Filter sludge collection of EDT



- Initially, we used a system equipped with filters and a dehydrator to collect sludge, but frequent filter clogging prevented efficient sludge collection, resulting in increased work time.

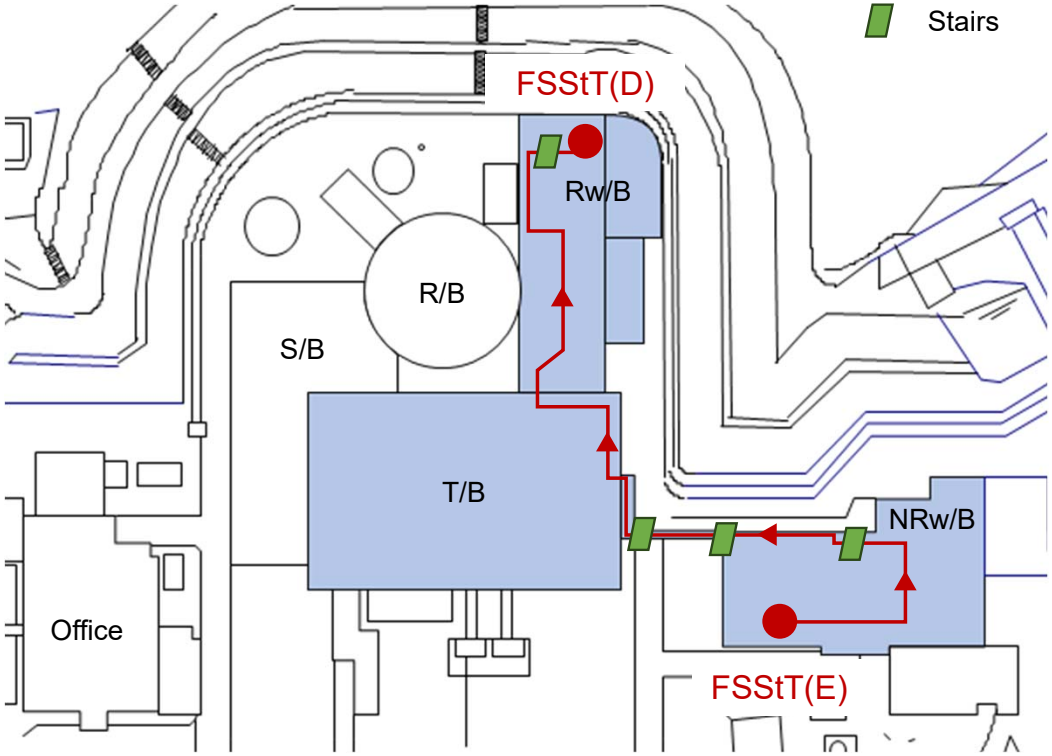
After improvement



- By using a ladle to directly scoop out larger particles of sludge, we significantly reduced the work time.
- Later, we switched to a longer ladle to further reduce exposure levels.

(B) Improvement of proficiency through pre-rehearsal of high-dose work

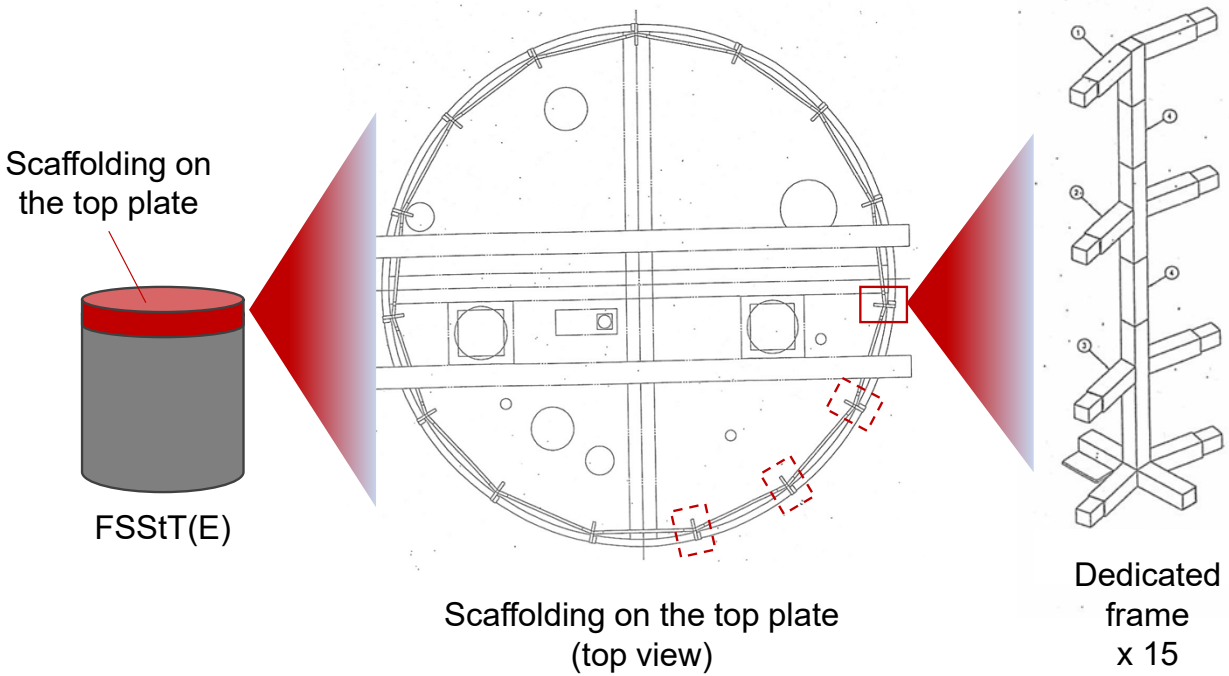
Unit 1



UN Standard Container

- It was necessary to transport the remaining water from Filter Sludge Storage Tank E in UN standard containers.
- Since the tank contained filter sludge, the surface dose rate was estimated to be around 4 mSv/h.
- Due to the long transport route and the presence of stairs, a rehearsal was conducted to prevent unnecessary exposure.

(C) Increasing proficiency in low-dose areas before working in high-dose areas



- For the work on the top plate of Filter Sludge Storage Tank (E), it was necessary to set up a greenhouse with a dedicated frame.
- By using a mock-up and pre-assembling parts in a low-dose area, we aimed to reduce the work time on the top plate.

	Estimated Dose	Actual Dose
Without Mock-up	4.03 person-mSv	-
With Mock-up	1.38 person-mSv	0.26 person-mSv

The actual work time was 1/3 of the expected.

Conclusions

- The decommissioning of Unit 1 and the long-term shutdown of Unit 2 have led to decrease in the dose equivalent rate.
- A challenge has been the decline in workers' ALARA awareness due to the decrease in dose equivalent rates.
- To address this, the Dose Reduction Promotion Committee and the ALARA Coordination Meeting were established as forums for discussing dose reduction methods between the maintenance and radiation management departments, yielding positive results.
- Moving forward, we aim to continue maintaining and enhancing ALARA awareness for the decommissioning of Unit 1 and the reactivation of Unit 2.