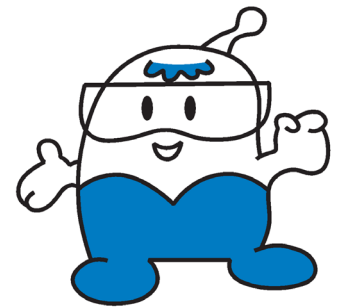


ALARA Activities at Kyushu Electric Power Company Nuclear Power Station

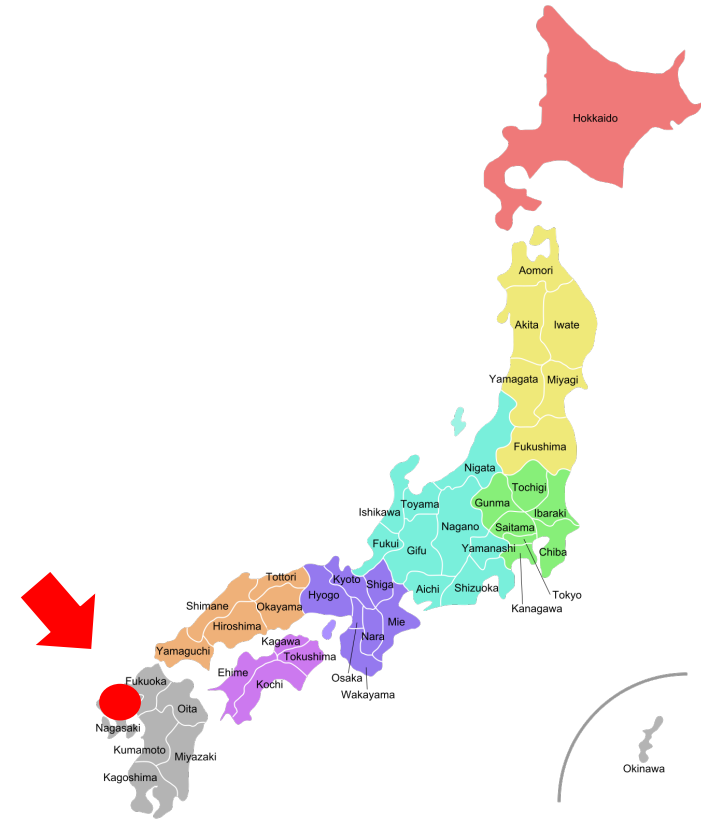
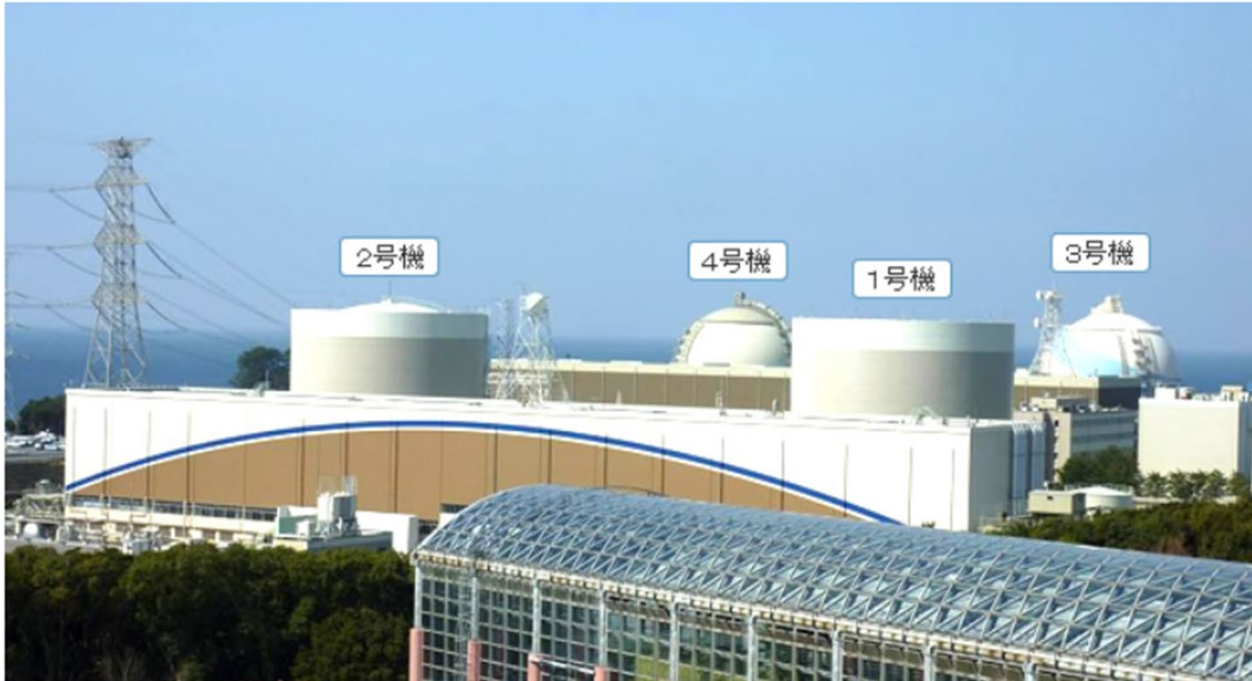


Mirai-kun

1. Kyushu Electric Power's nuclear power plant
2. Kyushu Electric Power's ALARA activities
3. Recent exposure records
4. Introduction to ALARA activities
5. Summary

Kyushu Electric Power's nuclear power plant

Genkai Nuclear Power Plant

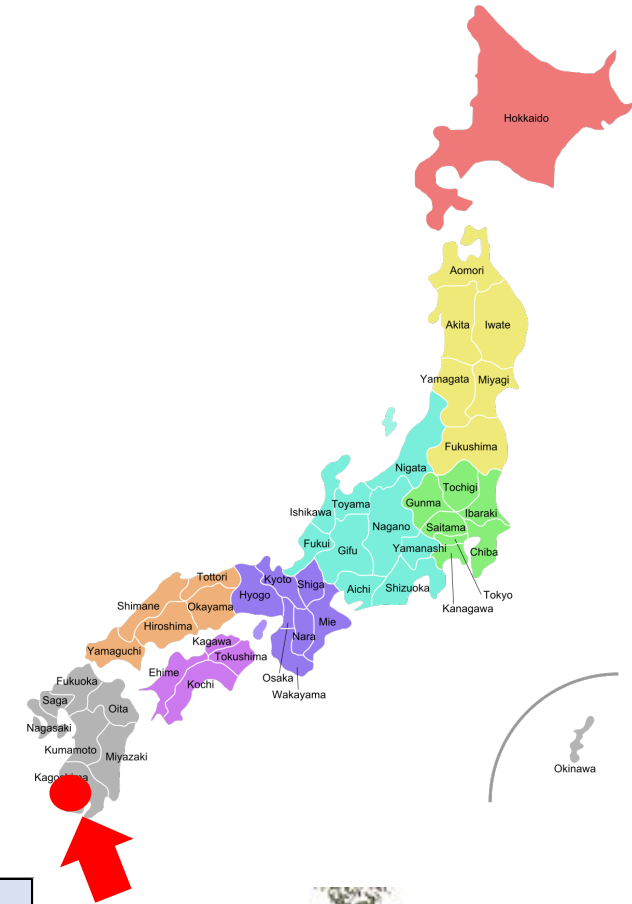


Operation type	Pressurized Water Reactor (PWR)			
unit	Unit 1	Unit 2	Unit 3	Unit 4
location	Imamura, Genkai-cho, Higashimatsuura-gun, Saga Prefecture			
Site area	Approximately 870,000 square meters			
Electric output (kW)	559,000	559,000	1.18 million	1.18 million
Start of operation	1975/10	1981/3	1994/3	1997/7
End of operation	2015/4	2019/4	—	—



Kyushu Electric Power's nuclear power plant

Sendai Nuclear Power Plant



Operation type	Pressurized Water Reactor (PWR)	
unit	Unit 1	Unit 2
location	Katahirayama, Kumizakicho, Satsumasendai City, Kagoshima Prefecture	
Site area	Approximately 1.45 million square meters	
Electric output (kW)	890,000	890,000
Start of operation	1984/7	1985/11
End of operation	—	

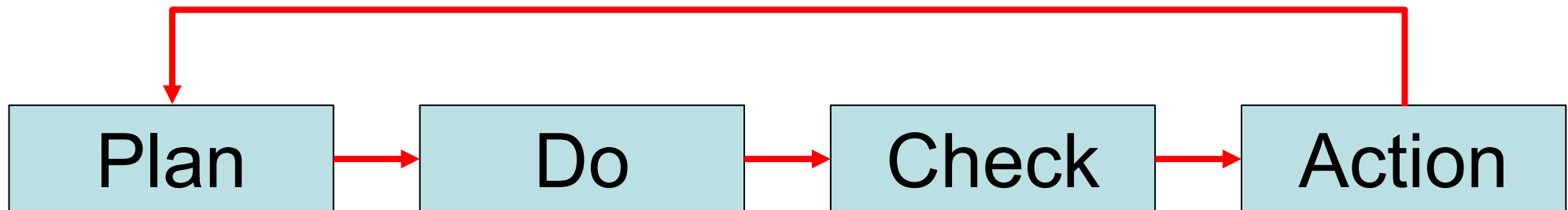


◆ Radiation Exposure Reduction Activity Policy

In reducing radiation exposure, the basic policy is to “follow the spirit of ALARA (as low as reasonably achievable), maintain a strong awareness of the importance of self protection, and ensure that employee exposure to radiation and radioactive material emissions remains below established limits and as low as reasonably achievable.”

◆ Structure

When carrying out work, always be aware of the need to reduce radiation exposure and effectively utilize the PDCA (Plan ⇒ Do ⇒ Check ⇒ Action) cycle for each task to strive to reduce radiation exposure.



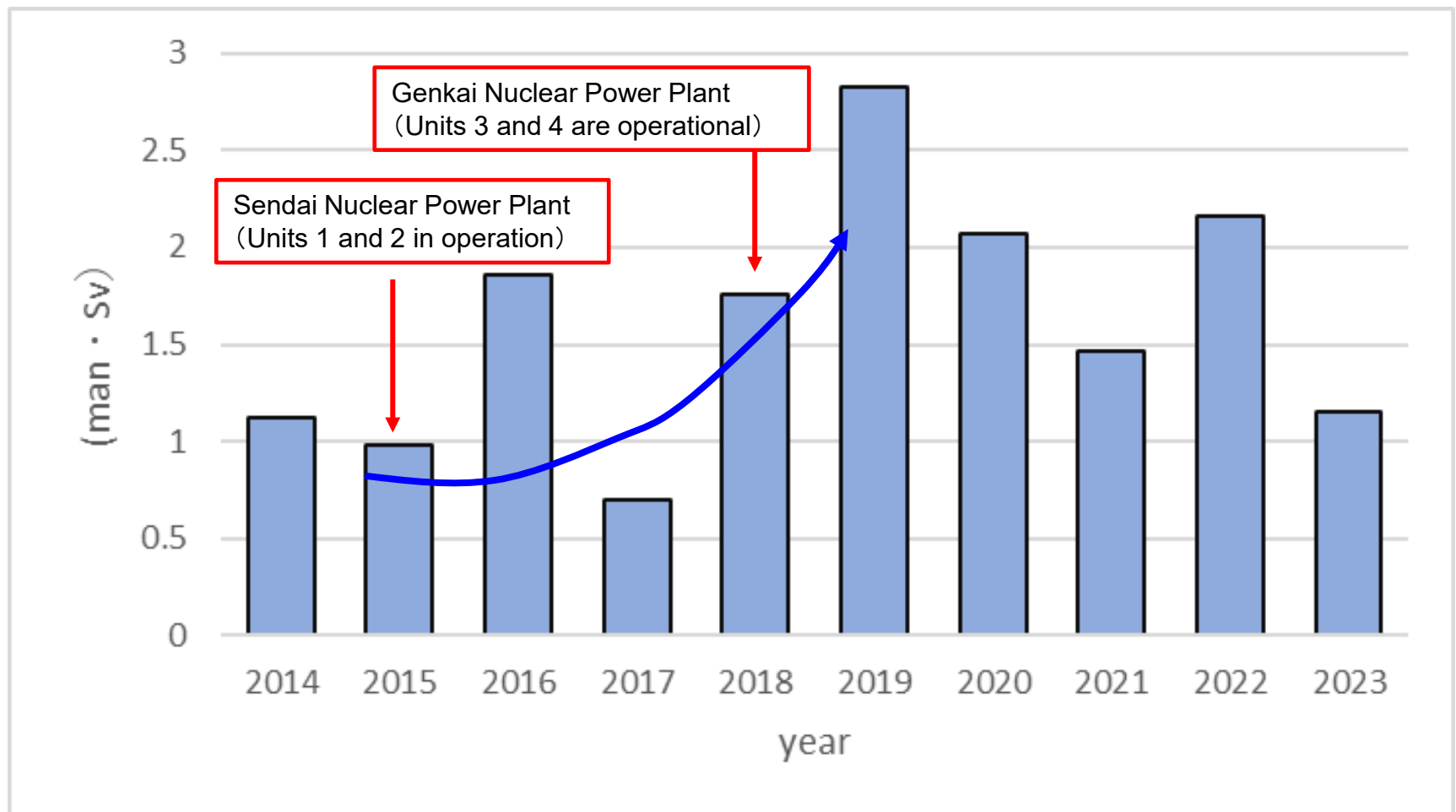
Recent exposure records

○Kyushu Electric Power's recent cumulative radiation dose record

After the Sendai and Genkai nuclear power plants restart, radiation exposure doses increased, but various efforts to reduce radiation exposure have led to lower doses.

2 units in operation

4 units in operation



Recent exposure records

○ Problem

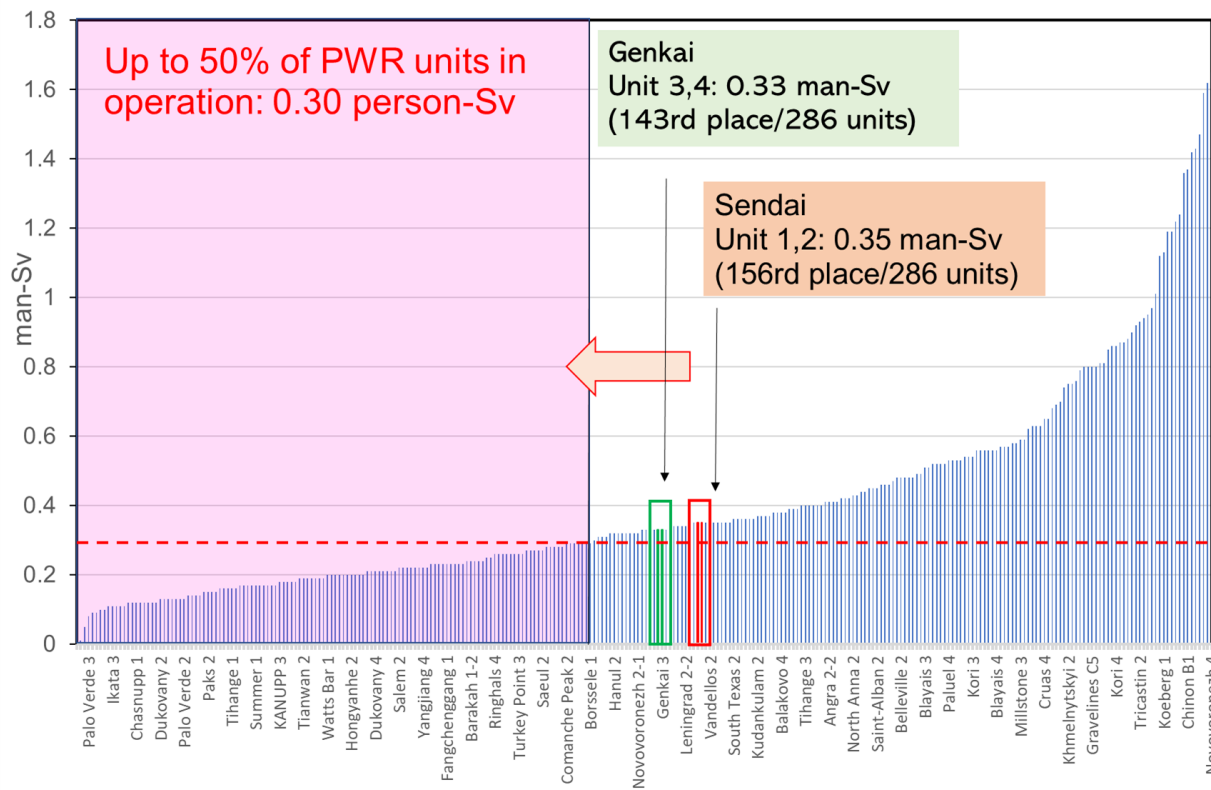
Although radiation exposure doses have been decreasing, our cumulative exposure dose remains high compared to other operating PWRs worldwide.



○ Solution

Setting dose targets by comparing radiation exposure with the rest of the world

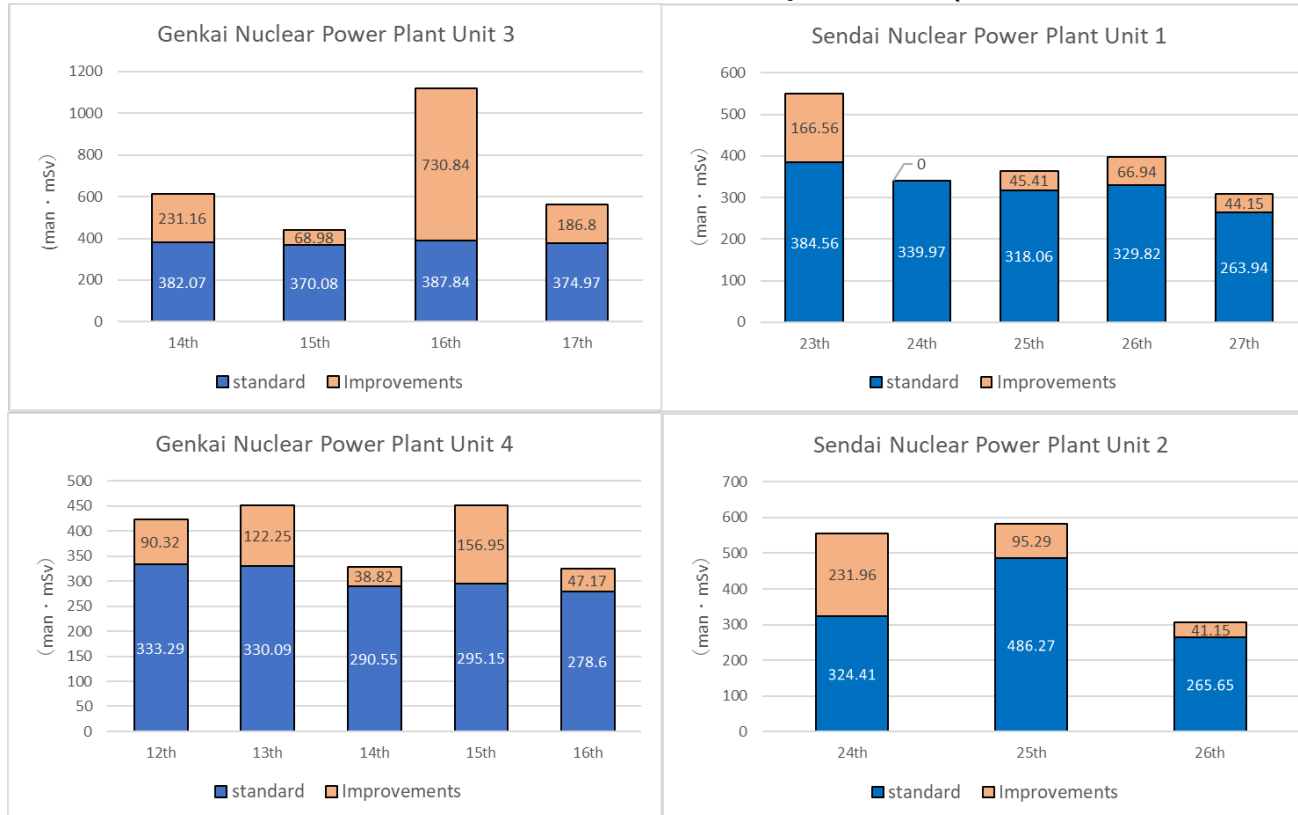
A target was set for reducing radiation exposure in operating PWR units to 50% or less (0.3 man-Sv) compared to other operating PWRs worldwide. This 50% target is intended to reduce radiation exposure to workers and create a safer working environment.



Recent exposure records

► Approach to achieving the target

- During periodic inspections, the radiation dose from standard works accounts for the majority of the total radiation exposure. Therefore, it is a priority to reduce radiation exposure during standard works.
- To achieve this, we will work to reduce radiation exposure (**ALARA activities**)

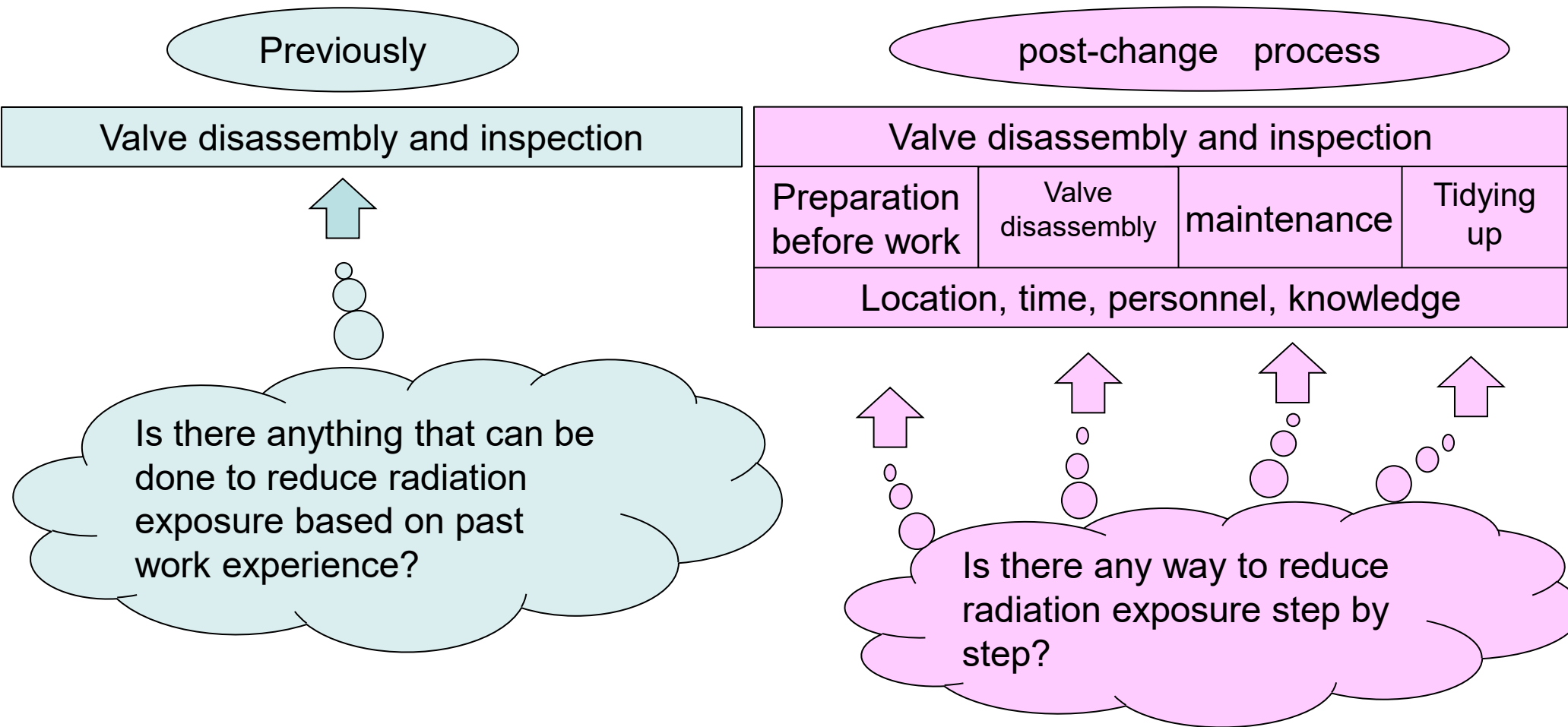


○ Standard: Standard work to be performed at every regular inspection (valve disassembly and inspection, R/V opening work, etc.)

○ Improvement: Special work carried out during regular inspections (replacement of R/V top lid, etc.)

○ Consideration of radiation exposure reduction for each work step

⇒ Examine the work content for each step, and consider and provide guidance on radiation exposure reduction measures.



Valve disassembly and inspection

Preparation before work



- Is it possible to measure the radiation dose rate before the work simultaneously with other tasks?
- Are the prepared protective equipment appropriate?
- Is it possible to install additional lead shielding panels in work area ?
- Are the number and capabilities of the work personnel appropriate?
- Is the frequency of disassembly appropriate? (Changes in inspection frequency)

Valve disassembly and inspection

Valve disassembly



- Is it possible to perform remote operation using a special jig?
- Is the radiation dose rate in the work area appropriate? (Are tasks being performed in unnecessarily high dose rate or highly contaminated areas?)
- Is it possible to shorten the disassembly time?

Valve disassembly and inspection

maintenance



- Is it possible to perform remote operation using a special jig ?
- Is the radiation dose rate in the work area appropriate? (Are tasks being performed in unnecessarily high dose rate or highly contaminated areas ?)
- Is it possible to speed up maintenance with the introduction of new equipment ?
- Is it possible to streamline maintenance tasks?

Valve disassembly and inspection

Tidying up



- Is it possible to streamline tidying up?
- Is it possible to carry out tidying up simultaneously with other tasks?
- Is the location of the tidying up area appropriate?

Various ALARA activities

- ① Calling attention to high radiation areas
- ② Clarification of signs for waiting areas around the work area
- ③ Wearing a dosimeter vibration unit (with LED)
- ④ Identification of Radiation Safety Officers by Wearing ALARA Vests

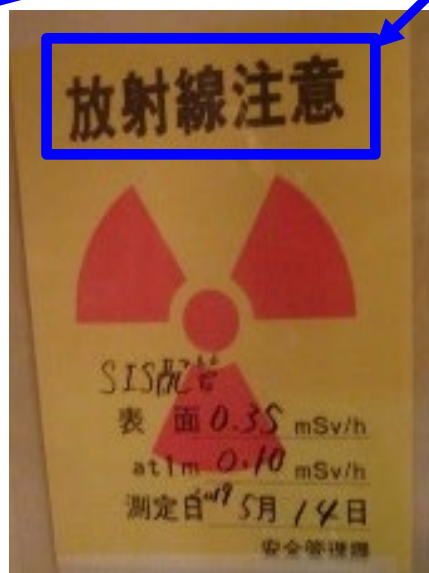
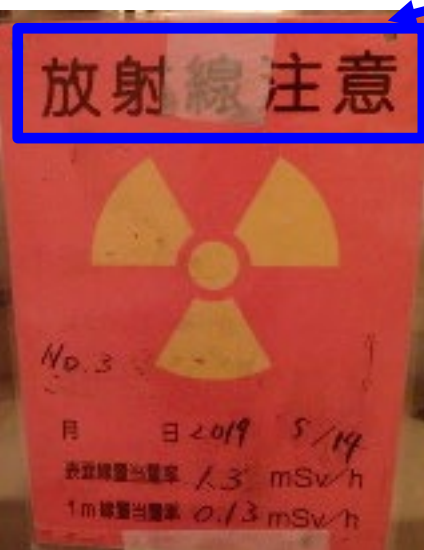
Introduction to ALARA activities (Various ALARA activities ①)

○ Calling attention to high radiation areas

⇒ Install signs (Radiation Caution) on pipelines with high-dose rate spots.

This prevents workers from being exposed to unnecessary radiation.

Radiation Caution



● The purpose

Hot spots are clearly defined so that workers can easily identify them.

● Evaluation

The red (yellow) signs make people aware of the danger (warning) and they try not to go near it.

● Supplement

Rooms with those signs are locked and the keys are managed by our companies radiation safety officers.

Introduction to ALARA activities (Various ALARA activities ②)

○ Clarifying signs for waiting areas installed around work areas
Waiting area signs will be posted on-site.

This prevents workers from being exposed to unnecessary radiation.



Standby available

● The purpose

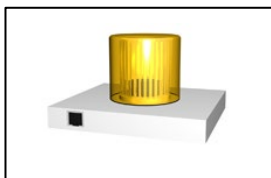
This is installed to avoid unnecessary radiation exposure during on-site meetings.

● Evaluation

Pre-work meetings are held in areas with low radiation levels

● Supplement

Lamps are also installed with the signs.



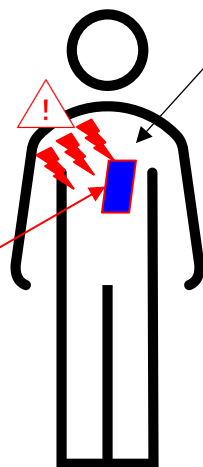
Introduction to ALARA activities (Various ALARA activities ③)

○ Wearing a dosimeter vibration unit (with LED)

⇒ Even in noisy environments, when the radiation dose reaches the planned value, sound, emission of light, and vibration alerts will be triggered, allowing the recognition of dose exceedance

This helps avoid unnecessary exposure.

If exposed to radiation, a buzzer will sound (and the LED will light up at the same time).



● The purpose

In the event of exposure, workers cannot hear the sound in a noisy environment, so a buzzer can be set to alert them.

An LED lights up, allowing surrounding workers to become aware.

● Evaluation

Even in noisy environments, the radiation dose can be monitored using the buzzer and LED.

Introduction to ALARA activities (Various ALARA activities ④)

○Identification of Radiation Safety Officers by Wearing ALARA Vests
⇒Radiation control personnel wear fluorescent clothing.

Even if the radiation control officer is far away, workers can find him from a distance and implement appropriate radiation control



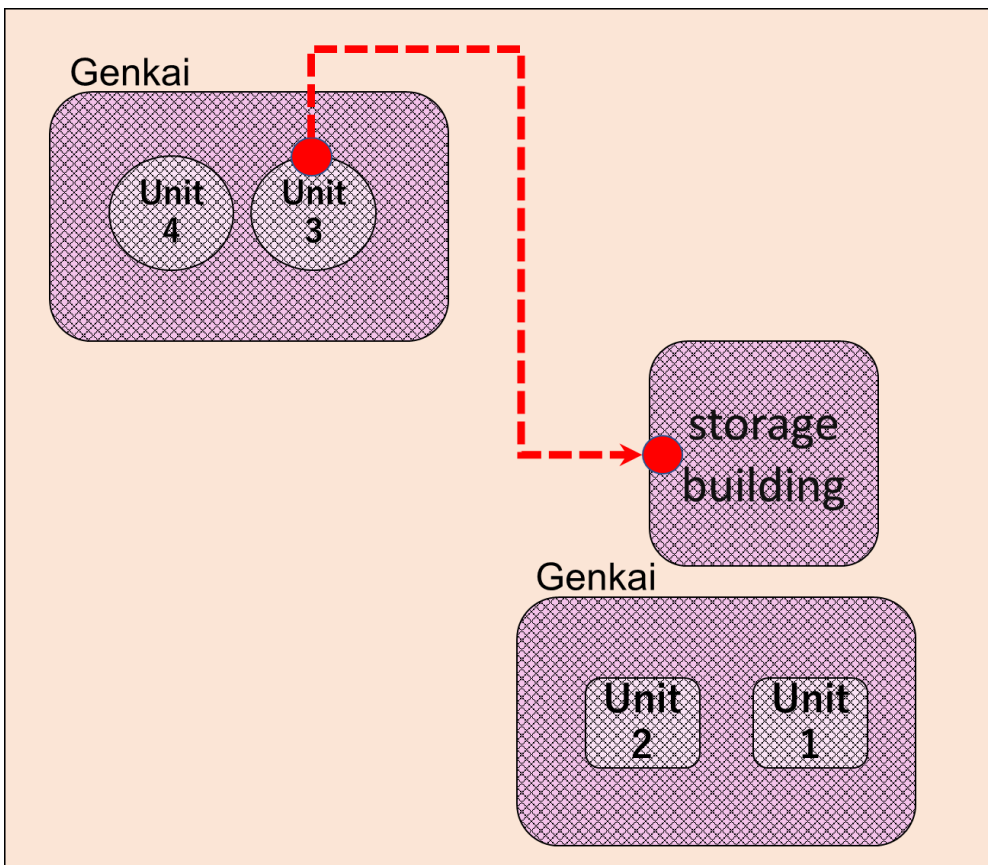
●The purpose
Radiation control personnel are worn so that they can be recognized on-site.

●Evaluation
The fluorescent color makes it easy to see from a distance, so you can easily ask about radiation management.

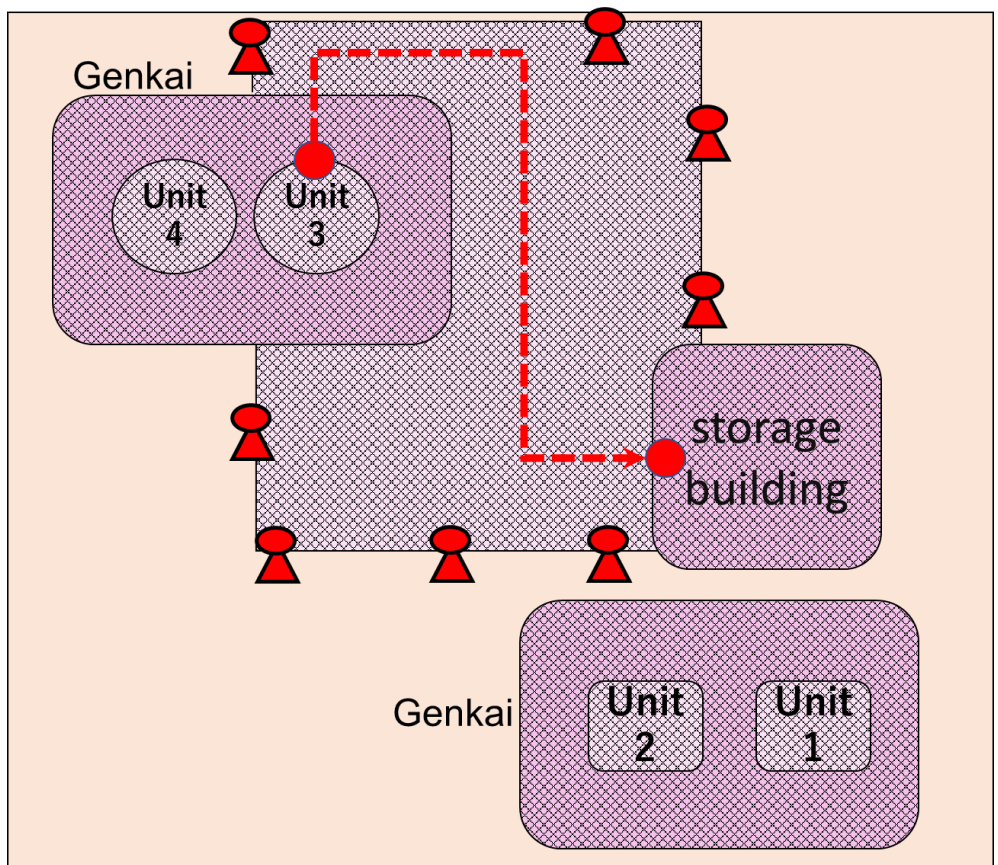
Introduction to ALARA activities (ALARA activities for improvement works)

- : Reactor vessel top lid transportation route
- ▨ : Building (controlled area)
- : Outdoor

Site map before transporting the reactor vessel head



Reactor vessel head being transported - Site map



: Watcher

○ALARA Activities for Improvement Works (1/2)

(Efforts to reduce radiation dose)

- Setting outdoor controlled areas
 - At the Genkai Nuclear Power Plant, when work was being carried out to replace the upper lid of the reactor vessel during the 17th periodic inspection of Unit 3, a controlled area was established outdoors.
 - Our company's standards set the controlled area boundary at 0.0026mSv/h (2.6 μSv/h).
 - To prepare for exceeding standard values during the transportation of the upper lid, non-controlled areas were designated as temporary controlled areas.

- **Establishment of temporary controlled areas in connection with reactor vessel head replacement work**
 - All workers outdoors are required to wear dosimeters to manage their radiation exposure.
 - To prevent unauthorized persons from entering outdoor controlled areas, fences were installed along the boundary of the outdoor temporary controlled area, and guards were stationed.

Photographs taken during transportation
(from inside the power plant to storage in a separate building)



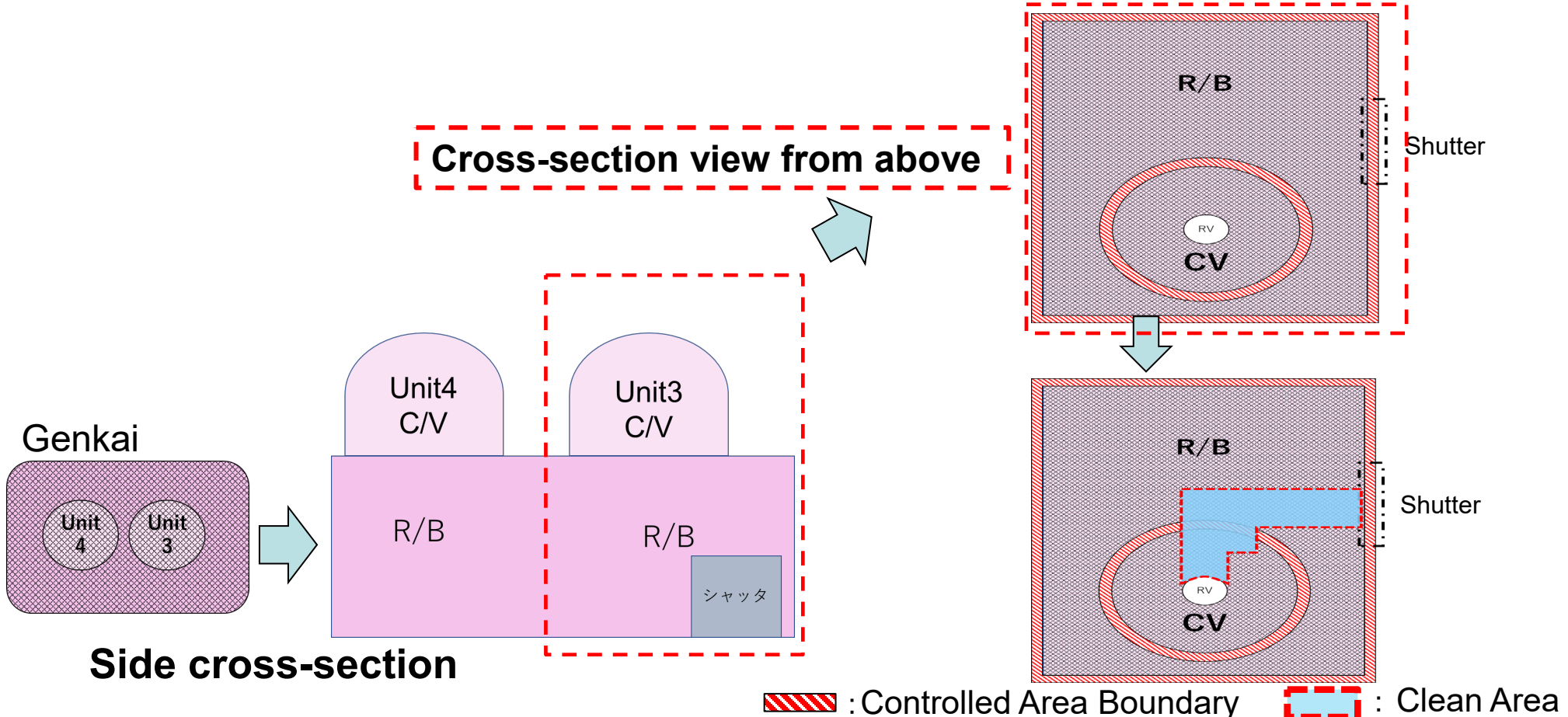
○ALARA Activities for Improvement Works (2/2)

(Initiatives to reduce pollution)

- Setting clean areas in buildings (controlled areas)
 - In the reactor vessel upper lid replacement work, to minimize exposure from decontamination work on the upper lid surface, a clean area was set up inside the building (controlled area) as a measure to prevent surface contamination.

- The rules for the clean area are as follows
 - Before bringing in any items, check that they are not contaminated with radioactive material. (Our standard is 0.40 Bq/cm²)
 - When entering the area, participants are required to change into special shoes, helmet covers, and gloves.
 - They will be allowed to enter the area only after it has been confirmed that their clothing is not contaminated.
 - When bringing in items, they will be brought in as "specially controlled items."

○ Installation of clean areas



What is a clean area?
→ This is an area managed to prevent the introduction of radioactive materials.
When bringing items into the light blue area, identify them as specially controlled items.

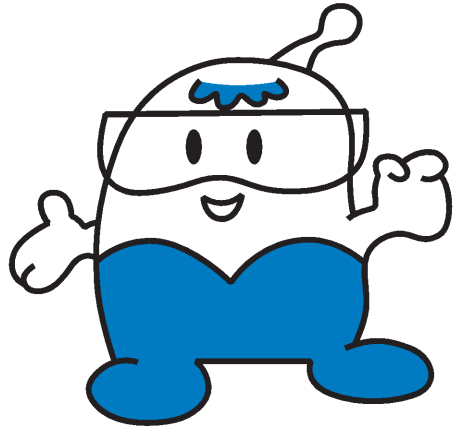
Introduction to ALARA activities (PDCA)

item		Radiation Dose		(Check)
		(Plan) (person/mSv)	(Do) (person/mSv)	
Standard Work	ISI	46.91	41.74	<ul style="list-style-type: none"> ○When working near high radiation levels, we will review the situation in advance to reduce unnecessary entry so that work can be completed quickly. ○Reduction by effective use of waiting areas
	Pump related	3.09	2.29	<ul style="list-style-type: none"> ○By properly allocating skilled workers, work times can be reduced.
	RCP related	14.70	14.76	<ul style="list-style-type: none"> ○Increased access to high radiation areas during inspections
Improvement works	Reactor vessel upper lid replacement work	105.13	87.57	<ul style="list-style-type: none"> ○Additional shielding plates were installed around the existing R/V lid storage area to reduce the spatial dose rate and radiation exposure. ○Work time was shortened by using a temporary crane. ○Vent pipe removal was changed from a band saw to a pipe cutter to reduce work time. ○Reduction by installing temporary shielding for temporary crane operators

(Action) Optimize work locations and consider installing additional shielding panels

Summary

- Kyushu Electric Power compares radiation exposure levels to those of PWR units worldwide and strives to further reduce it.
- In order to accomplish these targets, we will continue to carry out various radiation exposure reduction activities (ALARA activities).



Thank you so much for listening