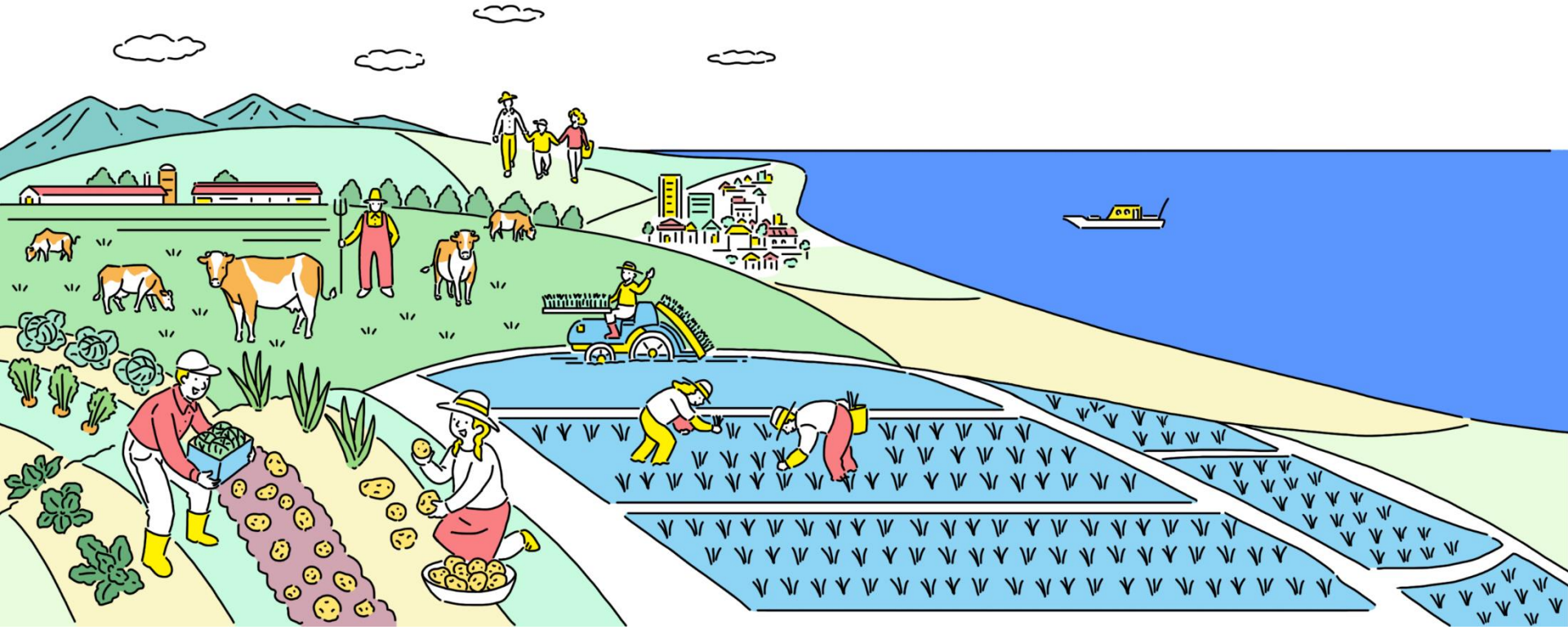
For today, tomorrow, and the future

Initiatives toward decommissioning of the Fukushima Daiichi Nuclear Power Station

Hajimu Yamana
President
Nuclear Damage Compensation and Decommissioning Facilitation Corporation
Professor Emeritus of Kyoto University



Core meltdown accidents occurred in Units 1, 2, and 3 during plant operation.

March 11, 2011
Earthquake occurred at 14:46
Tsunami hit at about 15:37

- Unit 1 Meltdown
  Rooftop wrecked
- Unit 2 Meltdown
- Unit 3 Meltdown
  Rooftop wrecked
- Unit 4 Rooftop wrecked
- Unit 5 Paused
- Unit 6 Paused

Currently, the site is stably controlled.

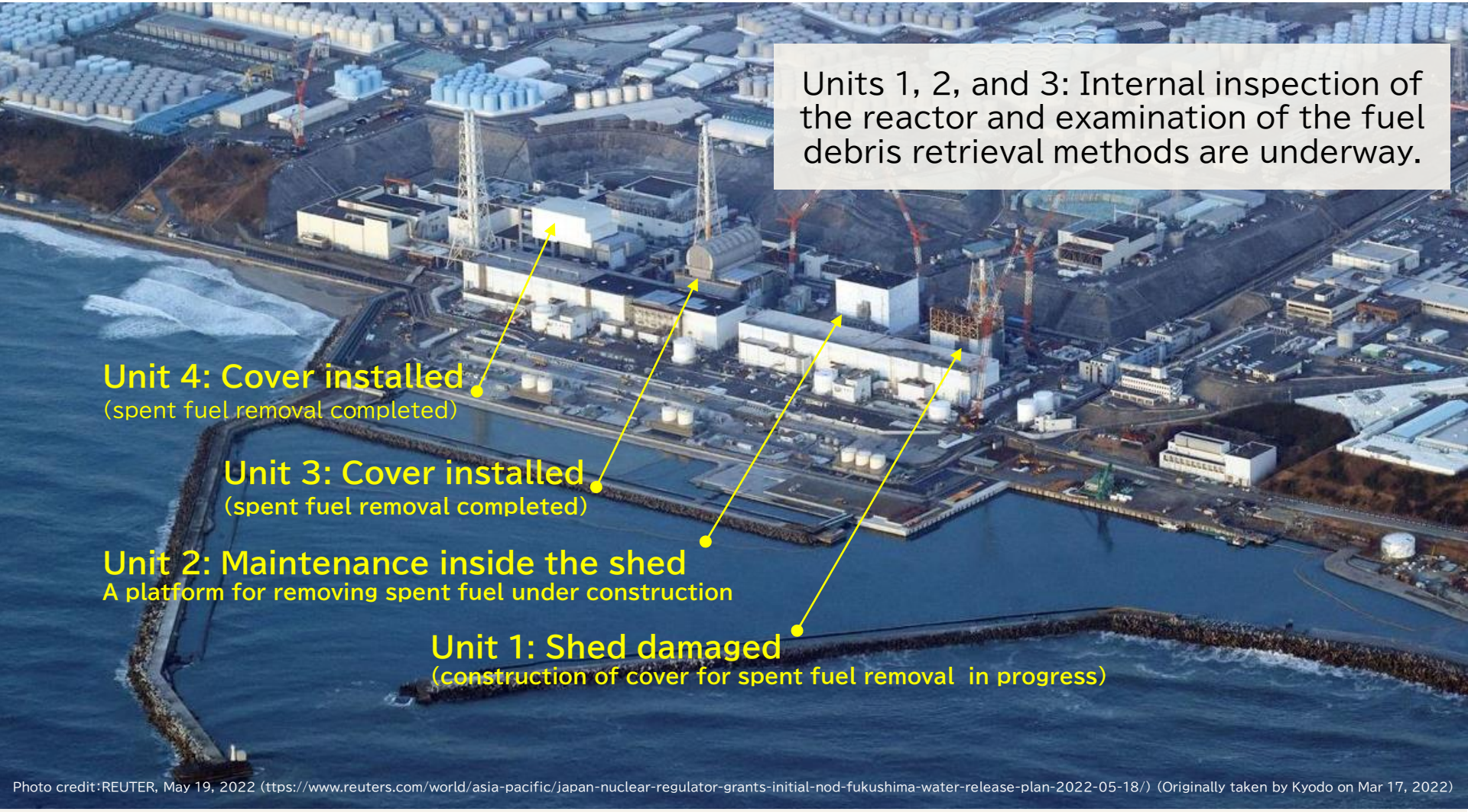


Photo credit:REUTER, May 19, 2022 (ttps://www.reuters.com/world/asia-pacific/japan-nuclear-regulator-grants-initial-nod-fukushima-water-release-plan-2022-05-18/) (Originally taken by Kyodo on Mar 17, 2022)

Four major radiation risk sources are spent fuel, fuel debris, contaminated water, and solid radioactive waste.

Spent nuclear fuel stored in storage pools

↓

Almost soundly stored in water

Fuel debris formed by molten nuclear fuel in the reactor core

↓

Resided in the PCV

Contaminated water generated from cooling water in the reactor core

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Part of the water remains in the buildings, most has been cleaned up by chemical treatment.

Large volume of solid radioactive waste generated by the leakage of radionuclides

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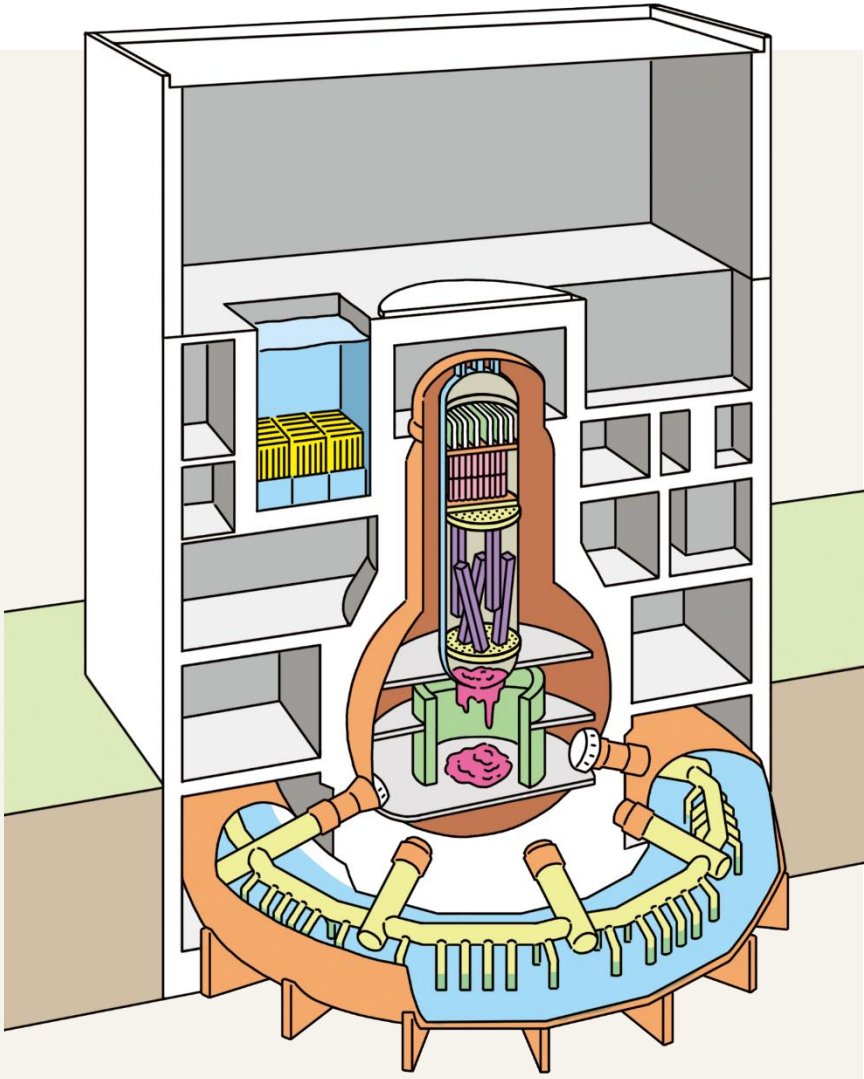
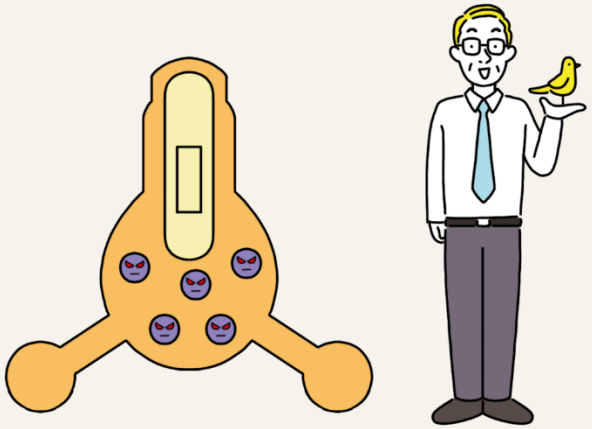
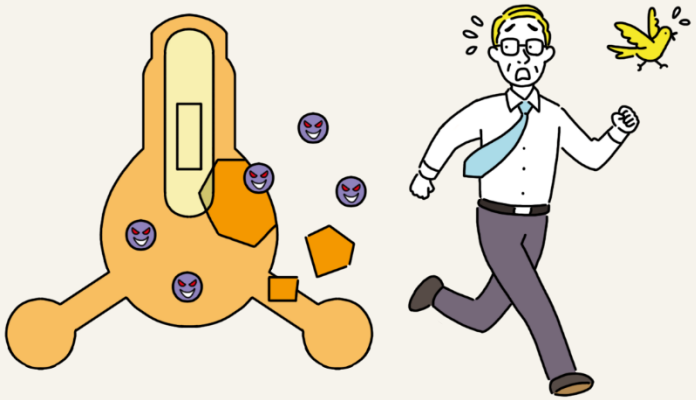
Storage and volume reduction are being promoted



Radiation risk is the product of
"amount of radioactivity" and "imperfect state of containment".

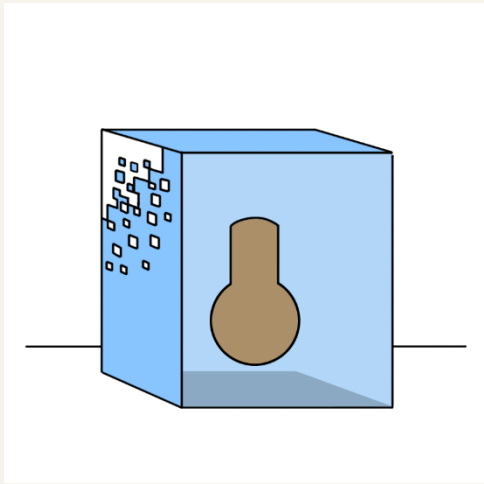
Radiation Risk	=	Amount of Radioactivity	×	Imperfect state of containment





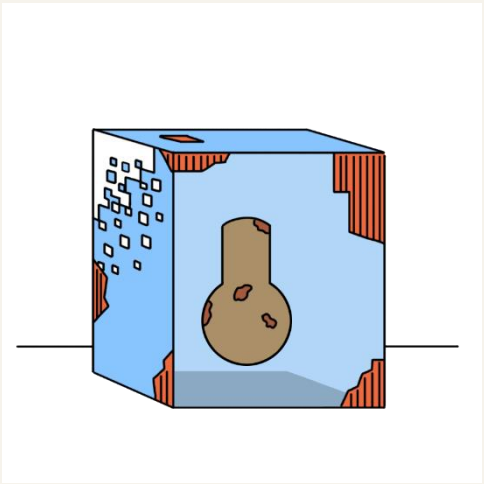
Accident reactor buildings and the containment vessels may deteriorate in the future in the future.

Present



Internal situation not fully known, but stability ensured by active control

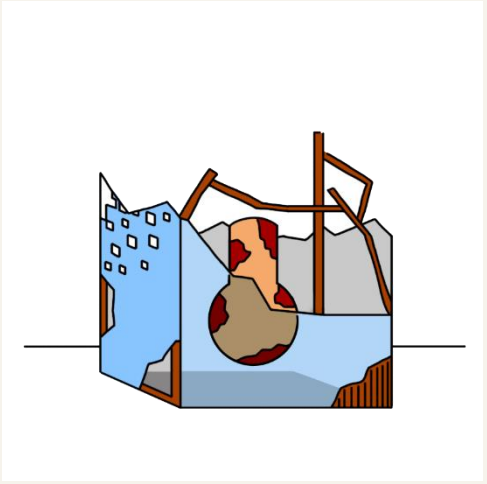
After several decades



Will the buildings and the containment vessels deteriorate?

Monitoring and control need to be strengthened

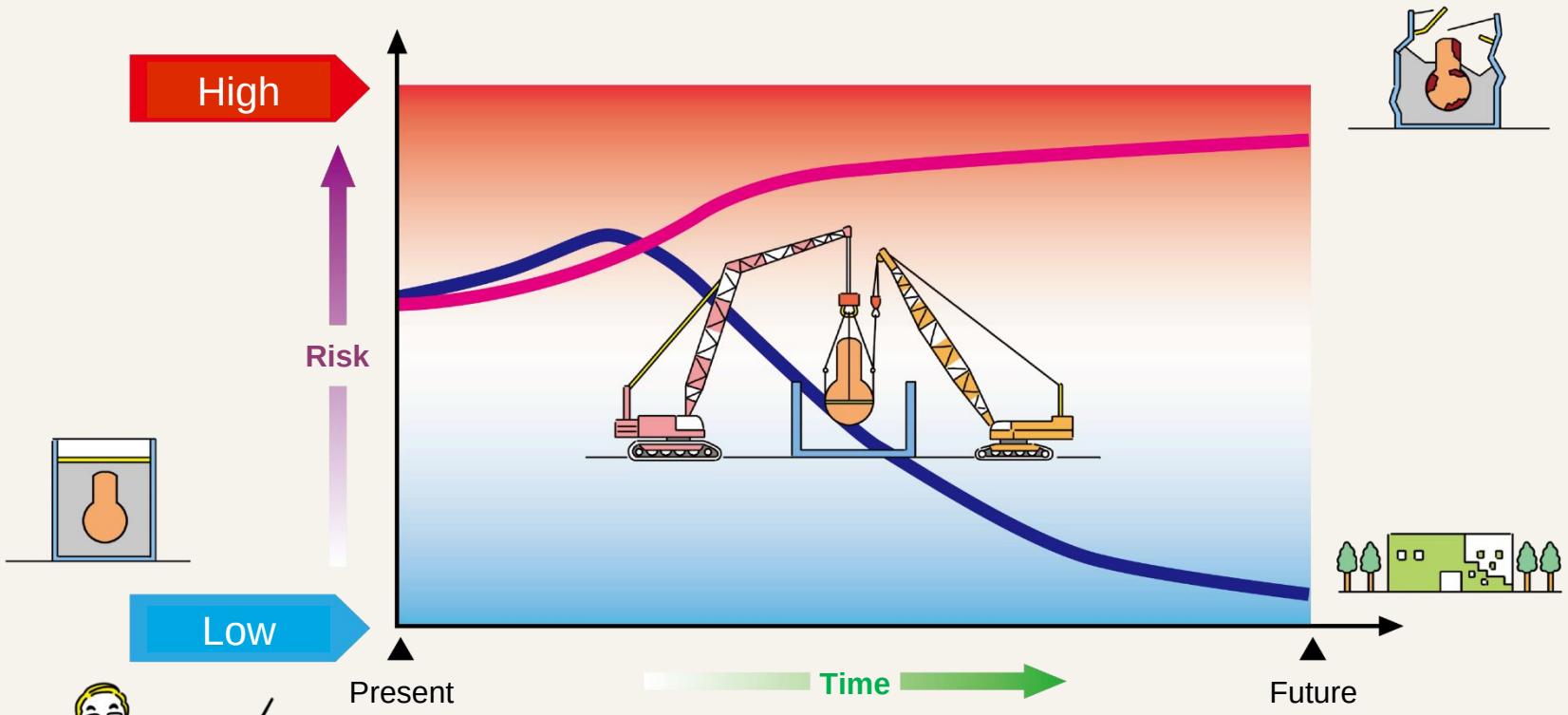
Far future



Will the radionuclides leak by deteriorating the buildings and the containment vessels?

Can adequate control and monitoring be guaranteed?

Decommissioning aims to actively reduce the risks from accident reactors.



Recover risk sources including fuel debris from the facilities at an early stage and bring them to more secure isolation status. Careful preparation and all possible measures are taken to ensure that short-term risks are not increased during the recovery process.

Two most important tasks are "Recovery and isolation of fuel debris (long-life radioactive)" and "Removal and isolation of cesium, etc. (medium-life radioactive)".

Tritium has relatively low toxicity and environmental impact, and decays quickly.

ALPS-treated water

Cesium has high radiological impact and takes several hundred years to decay.

Radioactive waste
Spent fuel

Nuclides in fuel debris have very high radiological impact and do not decay over a long period.

Fuel debris
Spent fuel

In the future, full-scale decommissioning projects will gradually begin (fuel debris retrieval, waste management).

2011 — 2020 — 2030 — Aim to complete in 30 to 40 years

Stabilization of post-accident conditions

Spent fuel removal will be completed around 2030.

Waste storage, spent fuel removal, contaminated water management, reactor surveys, and technology development

Preparation for fuel debris retrieval (from trial retrieval to gradual expansion of fuel debris retrieval)

Discussed at Subcommittee for the Evaluation of Fuel Debris retrieval methods 2023

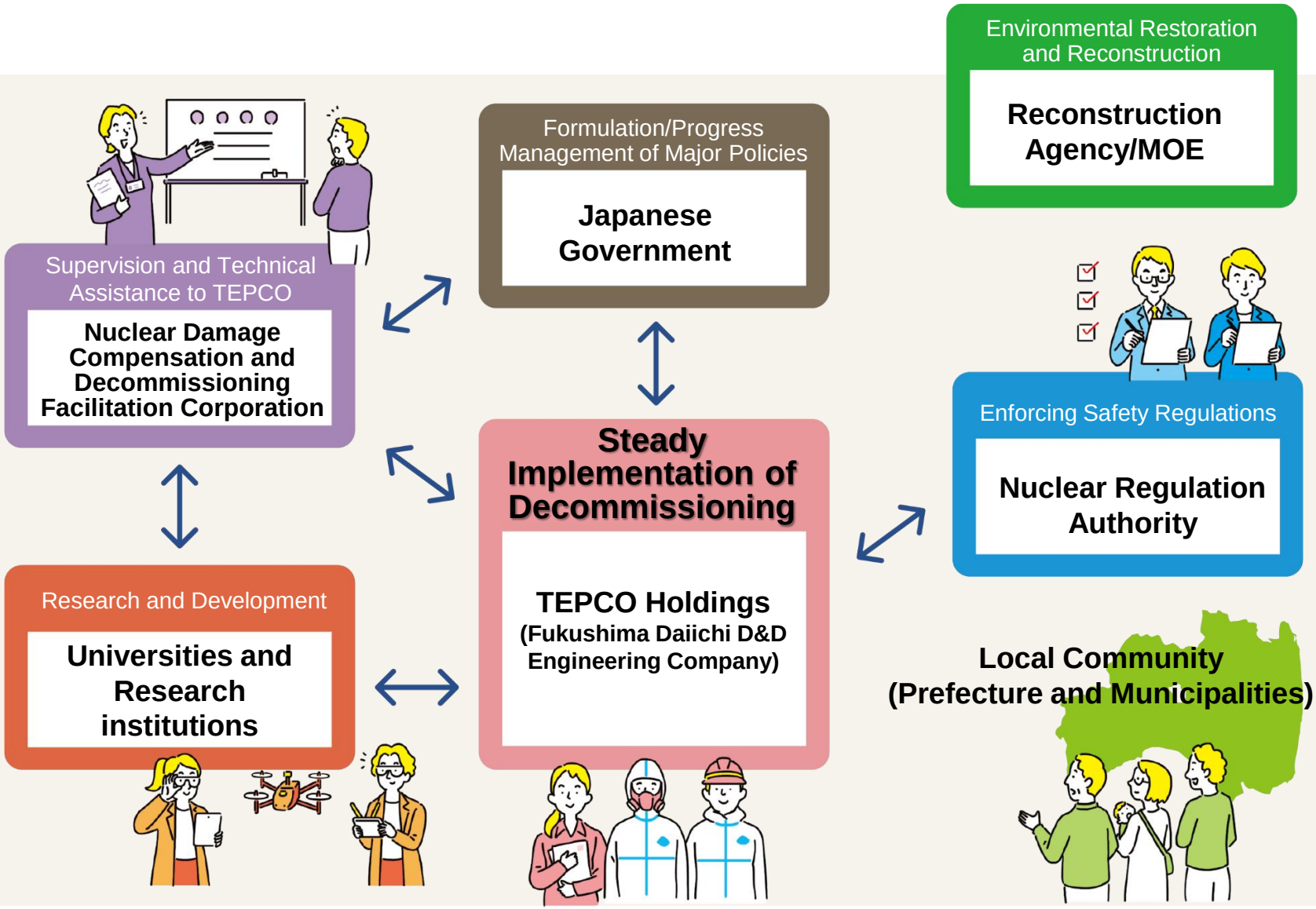
Full-scale fuel debris retrieval

Demolition of buildings

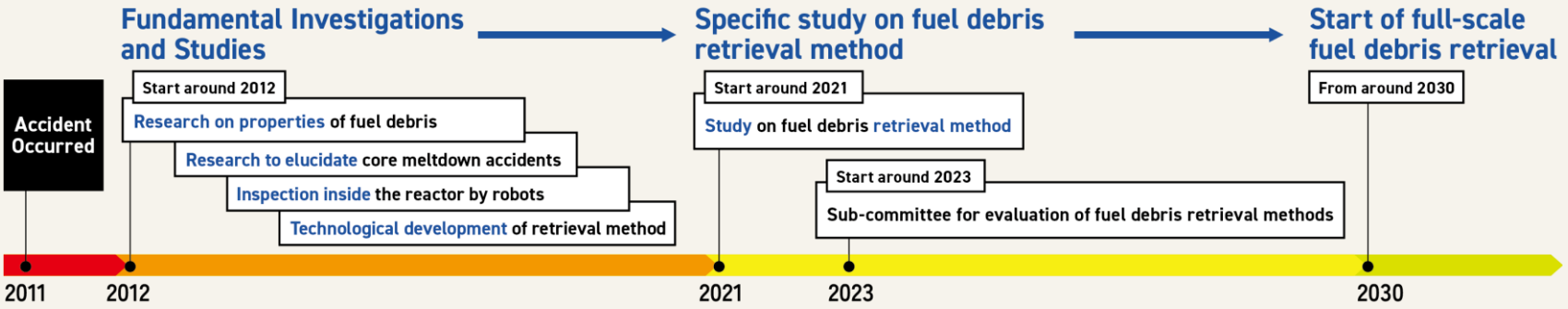
Radioactive waste research/technical studies/management and storage/volume reduction/processing/disposal, etc.

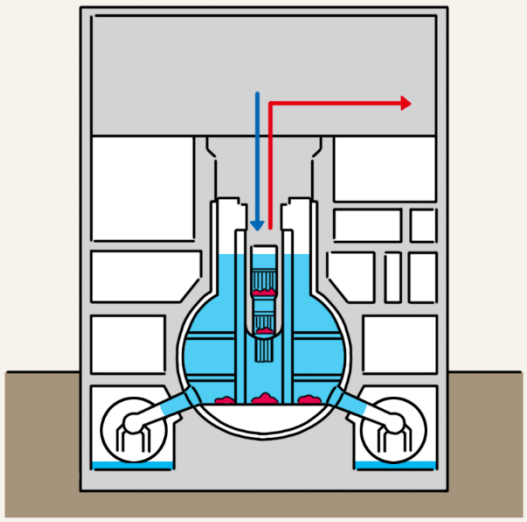
Several key milestones have been set.

Nationwide coordination systems for decommissioning have been established.

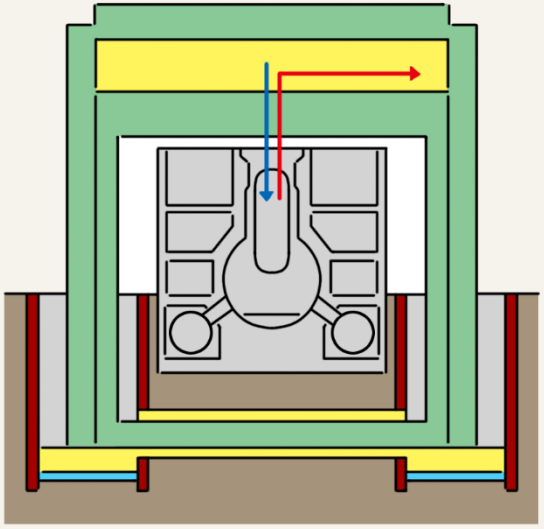


A sub-committee organized by diverse experts has started to evaluate proposal retrieval methods since 2023.





An example of partial submersion method (combination of top-access and side-access)



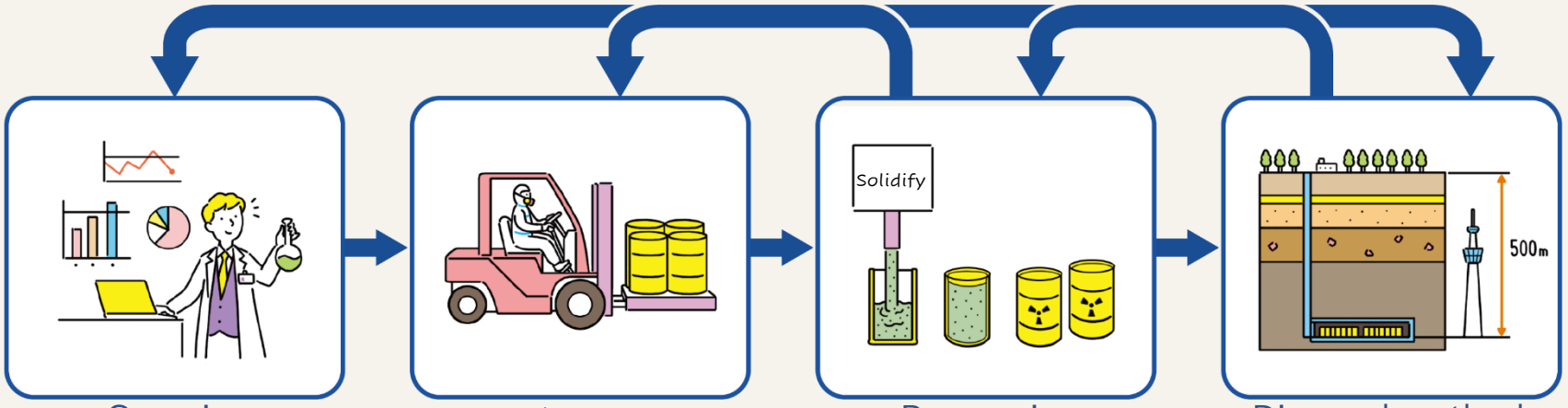
An example of submersion method

Requirements, etc. for retrieval methods.

- Certainty and reliability in construction
- No impact on the surrounding area
- Ensuring worker safety
- Prevention of leakage of radioactive materials completely
- Complete the project as soon as possible

Optimization of the overall picture covering the entire Waste Stream up to final disposal is being studied for large volume of solid radioactive waste that have been temporarily stored.

Optimizing entire Waste Stream



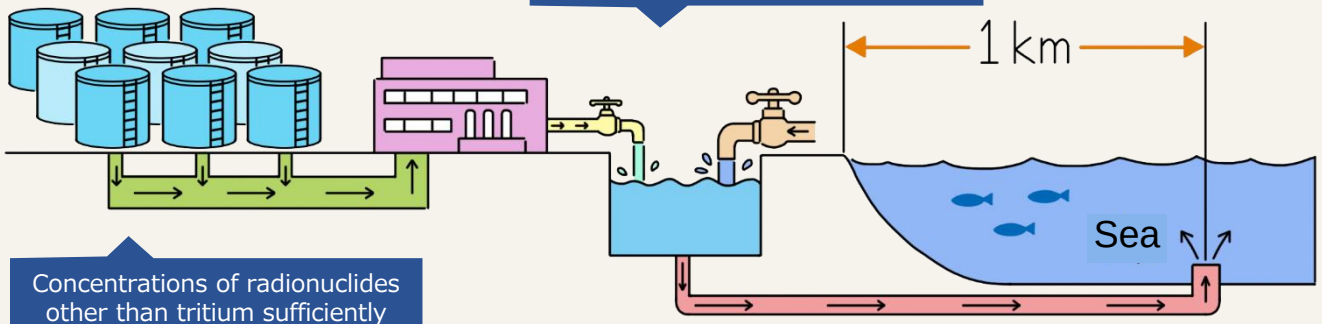
Miscellaneous solid waste incineration facility

Expanded waste storage facility

Okuma Analysis Research Center Lab. 1

Safely discharge ALPS-treated water
after taking all possible measures against reputational damages

Diluted with seawater so that the concentration of tritium is less than 1/40th of the permitted value

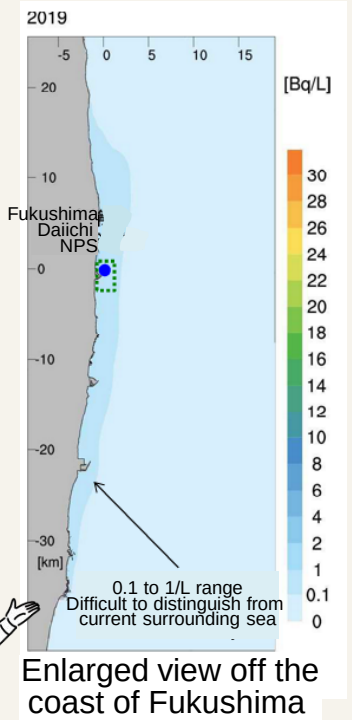


Concentrations of radionuclides other than tritium sufficiently lower than the permitted values

The annual tritium release does not exceed the pre-accident upper limit target

Photo credit :REUTERS, Feb 14,2022 (https://www.reuters.com/world/asia-pacific/japan-welcomes-iaeas-inquiry-into-fukushima-water-release-2022-02-14/)

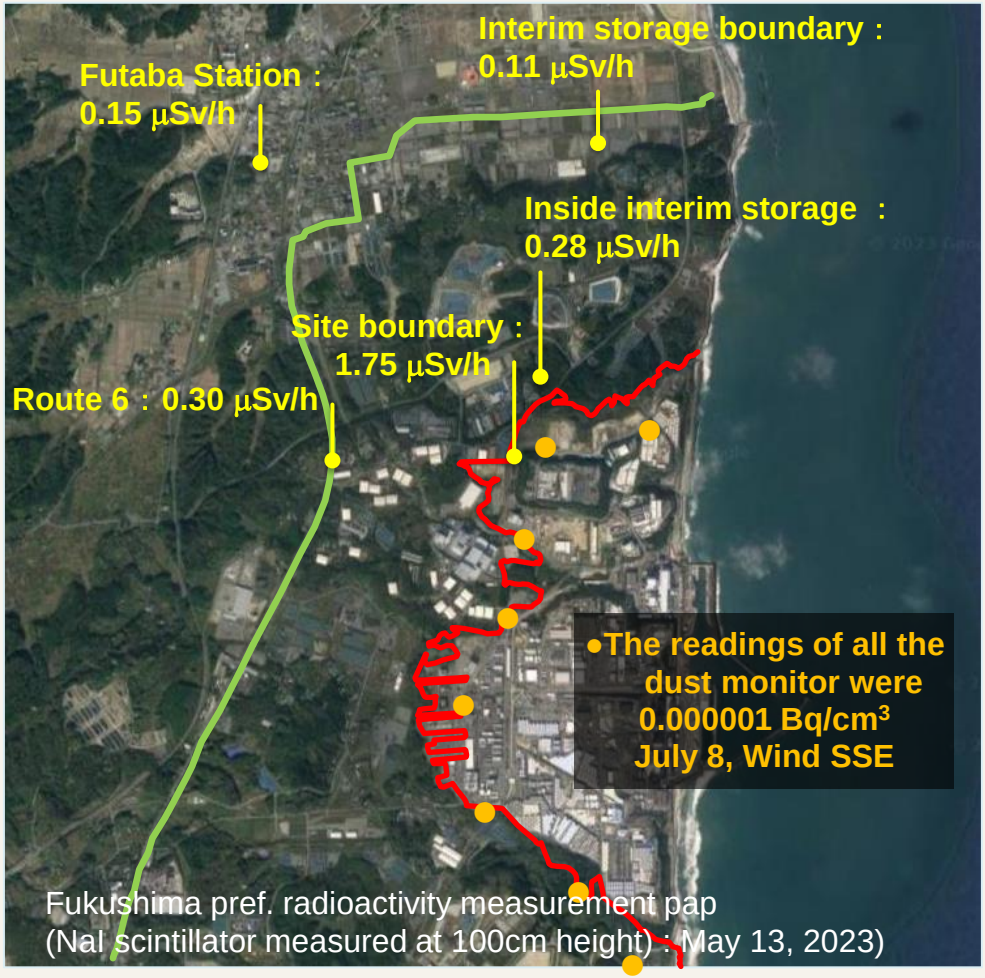
Results of marine dispersion assessment



Enlarged view off the coast of Fukushima

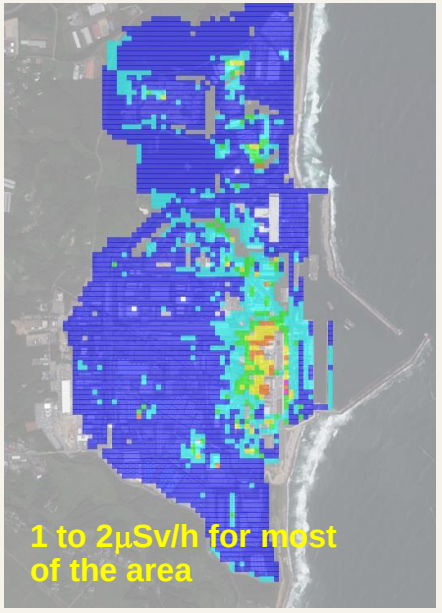
Regular monitoring of seawater and fish/shellfish in the surrounding area

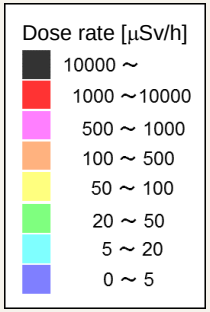
Decommissioning will proceed on the condition that there is no radiological impact on the reconstruction activities.



No radiological impact from decommissioning as a precondition.

- High-dose area is around the accident reactor only
- Doses in the reconstruction area are generally 0.2μSv/h or less.
- Doses around the site are generally 0.3μSv/h or less.





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