NRA JAPAN
Nuclear Regulation Authority

NRA presentation

C-2-1 Assessment for Representative Person and Reference Animals and Plants

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IAEA Regulatory Review Mission on ALPS Treated Water Handling
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1. NRA's Views on Assessment for Representative Person and Reference Animals and Plants

- **NRA reviews the TEPCO's radiological environmental impact assessment**

  – whether the assessment methodology is in line with the relevant IAEA Safety Standards;

  – whether the assessed impact to **humans** is sufficiently small. For this review, NRA has set the criteria of 50 μSv/y for the **Representative Person**, which is practically regarded as the dose constraint; and

  – whether the assessed impact to the **flora and fauna** is smaller than the lowest value of the Derived Consideration Reference Levels for the **Reference Animals and Plants**.

1. NRA's Views on Assessment for Representative Person and Reference Animals and Plants

i. Uncertainties

TEPCO should explain uncertainties involved in the Radiological Impact Assessment and identify which uncertainties could affect the assessment or make it conservative.

ii. Transfer Model

TEPCO should explain the concept of selection, including the comprehensiveness and the reasoning of excluding some from the assessment.

iii. Exposure Pathways

TEPCO should explain the concept of selection, including its comprehensiveness and the reasoning of excluding some from the assessment.

iv. Parameters

For the applied input values not from the reference documents such as the IAEA Guides, TEPCO should explain the basis and appropriateness thereof, taking into account the associated uncertainties in the assessment.

1. NRA's Views on Assessment for Representative Person and Reference Animals and Plants

v. Dose Coefficients for Tritium

TEPCO should explain the consideration on the existing ratio of tritiated water (HTO) and organically bound tritium (OBT) and provide its reference documents.

vi. Potential Exposure

TEPCO should explain the concept of the assessment which does not follow the flow shown in Fig. 3 of GSG-10, including the basis for selection of the scenario.

vii. Seawater Intake

TEPCO should explain the impact of radioactive materials contained in the intake seawater on dose assessment.

- **Dispersion model** is covered by the presentation C-2-2.
- **Potential exposure** is covered by the presentation C-2-3.

2. TEPCO's Responses and Points to be Further Clarified

i. Uncertainties

- TEPCO examined the magnitude of uncertainties for each item listed below in the REIA report.
  - Selection of source term, dispersion and transfer model in the environment, exposure pathways, setting of representative person, and dose assessment
- TEPCO explained that the assumed uncertainty falls within the range of conservatism mainly associated with the source term and the seafood intake setting.

Points to be further clarified

- To be based on more **realistic assumptions** and then consider uncertainties, rather than building up excessive conservatism.
- This is the **general comment** that the NRA is seeking at the review meetings for the **entire REIA report**.

2. TEPCO's Responses and Points to be Further Clarified

ii. Transfer Models And ii. Exposure Pathways

- Based on GSG-10, TEPCO explained how the transfer models and exposure pathways were selected in the REIA report.
- To confirm the validity of the exclusion of some in the selection, an additional evaluation was conducted in accordance with TECDOC-1759*.
- TEPCO confirmed that the initially selected models and pathways were sufficiently dominant and valid.
- However, internal exposure due to inadvertent ingestion of seawater during swimming will be added in the revised report.
- TEPCO revised the settings of representative person in light of the prevailing circumstances surrounding the site.

Points to be further clarified

- None – waiting for detailed documentation

* IAEA TECDOC-1759, Determining the Suitability of Materials for Disposal of Sea under the London Convention 1972 and London Protocol 1996: A Radiological Assessment Procedure (2015).

2. TEPCO's Responses and Points to be Further Clarified

iv. Parameters

- TEPCO provided the source of the citation and the reason for using parameters that are not in the IAEA or other references

Points to be further clarified

- None – waiting for detailed documentation

2. TEPCO's Responses and Points to be Further Clarified

v. Dose Coefficients for Tritium

- TEPCO presented that OBT was not detected in the results of previous environmental sampling in the surrounding area.
- As a reference, a dose assessment was conducted for the case where a certain percentage of Tritium in the on-site storage tanks existed as OBT, and it was confirmed that the results were not significantly affected.

Points to be further clarified

- None – waiting for detailed documentation

2. TEPCO's Responses and Points to be Further Clarified

vi. Potential Exposure

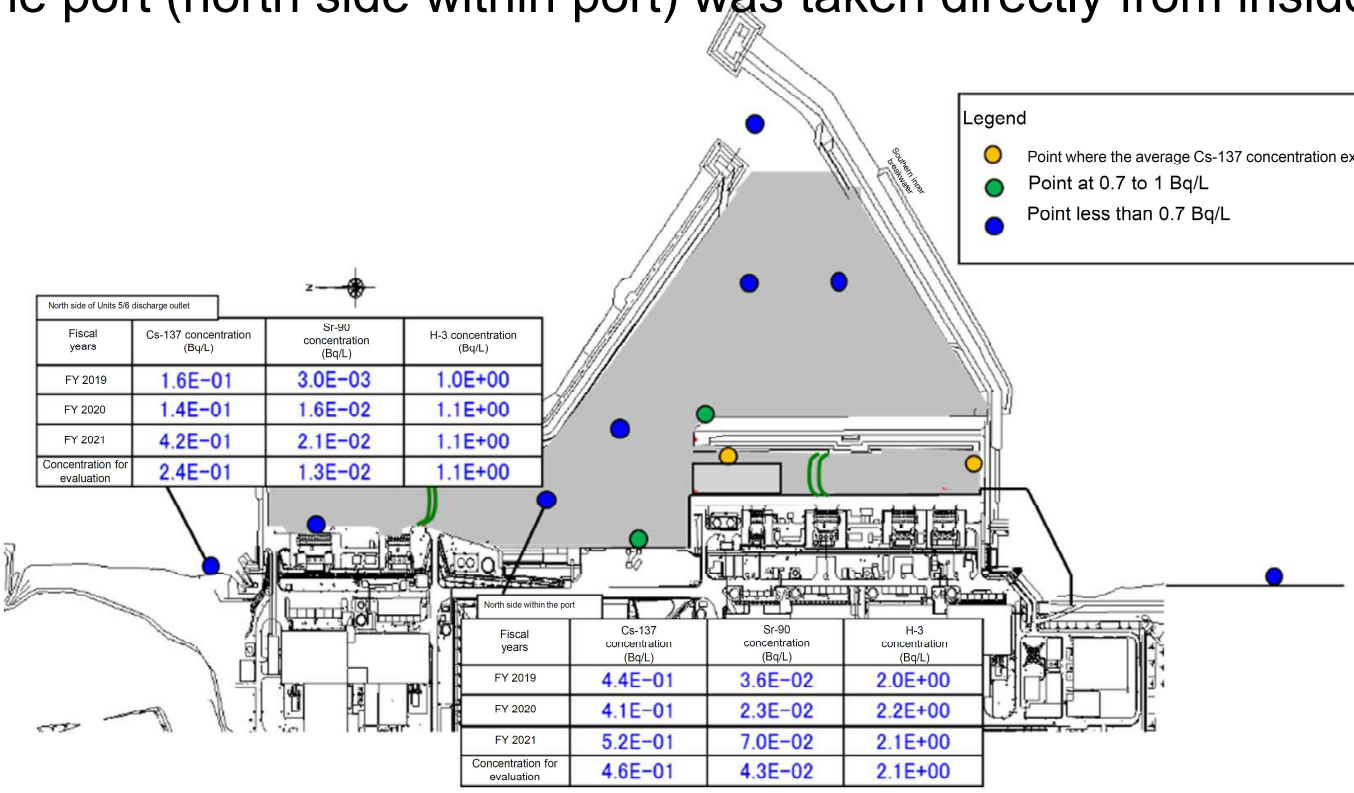
- TEPCO reorganized the exposure pathways for potential exposure
- New exposure pathways listed below were added
  - External and internal exposure during underwater work, external exposure from ship hulls, beaches, and fishing nets, and internal exposure from ingestion of marine products
- Dose assessment results increased from 10^{-5} to 10^{-1} order of magnitude. However, they were still below the dose criterion of 5 mSv.

- **Potential exposure** is covered by the presentation C-2-3.

2. TEPCO's Responses and Points to be Further Clarified

vii. Seawater Intake

- Seawater for dilution of ALPS process water is planned to be taken from seawater outside the port (on the north side of the water discharge outlets of Units 5 and 6) to the intake of Unit 5, after a dike is constructed between the port and the intake of Unit 5.
- **<u>TEPCO evaluated the radiation effects of radioactive materials contained in the seawater in two cases</u>**: one in which seawater from outside the port was taken from the north side of the Unit 5 and 6 intakes, and the other in which seawater from inside the port (north side within port) was taken directly from inside the port.



North side of Units 5/6 discharge outlet

Fiscal years	Cs-137 concentration (Bq/L)	Sr-90 concentration (Bq/L)	H-3 concentration (Bq/L)
FY 2019	1.6E−01	3.0E−03	1.0E+00
FY 2020	1.4E−01	1.6E−02	1.1E+00
FY 2021	4.2E−01	2.1E−02	1.1E+00
Concentration for evaluation	2.4E−01	1.3E−02	1.1E+00

North side within the port

Fiscal years	Cs-137 concentration (Bq/L)	Sr-90 concentration (Bq/L)	H-3 concentration (Bq/L)
FY 2019	4.4E−01	3.6E−02	2.0E+00
FY 2020	4.1E−01	2.3E−02	2.2E+00
FY 2021	5.2E−01	7.0E−02	2.1E+00
Concentration for evaluation	4.6E−01	4.3E−02	2.1E+00

(Source: TEPCO, the 9th Review Meeting, 15 February 2022)

Note:

1. Regarding the concentration of Cs-137, for the north side of Units 5/6 discharge outlet, weekly detailed analysis results were used, and for the north side within the port, daily analysis results were used.
2. Regarding the concentration of Sr-90, for the north side of the Units 5/6 discharge outlet, monthly analysis results were used, and for the north side within the port, weekly analysis results were used.
3. For the H-3 concentrations, the weekly analysis result are used for both cases.
4. The calculation period for FY2021 is 9 months from April 1, 2021 to December 31, 2021.

2. TEPCO's Responses and Points to be Further Clarified

vii. Seawater Intake

- TEPCO confirmed that in all cases, the impact of radioactive materials in seawater on the representative person is well below 50 μSv/year.

Table1 : results of human exposures assessment

Assessment case		Measured values of K4 tank group			The hypothetical ALPS treated water			Remarks
		Radiological Impact Assessment Report	Intake on the north side of Units 5/6 discharge outlet	Intake on the north side within the port	Radiological Impact Assessment Report	Intake on the north side of Units 5/6 discharge outlet	Intake on the north side within the port	
External exposure (mSv/year)	Exposure from sea level	6.5E-09	5.1E-08	9.3E-08	1.8E-07	2.3E-07	2.7E-07	
	Exposure from the hull	5.2E-09	4.1E-08	7.4E-08	1.4E-07	1.7E-07	2.0E-07	
	Exposure during undersea work	2.8E-10	2.3E-09	4.1E-09	7.9E-09	9.9E-09	1.2E-08	
	Exposure from sandy beach	5.0E-07	4.1E-06	7.5E-06	1.4E-05	1.7E-05	2.1E-05	
	Exposure from fishing nets	1.6E-06	1.2E-05	2.1E-05	4.5E-05	5.5E-05	6.4E-05	
Internal exposure (mSv/year)		6.1E-05	6.9E-05	7.6E-05	2.0E-03	2.0E-03	2.0E-03	Adult value
Total (mSv/year)		6.3E-05	8.5E-05	1.1E-04	2.1E-03	2.1E-03	2.1E-03	

Table 2: results of internal exposures assessment by age

Assessment case		Measured values of K4 tank group			The hypothetical ALPS treated water			Remarks
		Radiological Impact Assessment Report	Intake on the north side of Units 5/6 discharge outlet	Intake on the north side within the port	Radiological Impact Assessment Report	Intake on the north side of Units 5/6 discharge outlet	Intake on the north side within the port	
Internal exposure (mSv/year)	Adult	6.1E-05	6.9E-05	7.6E-05	2.0E-03	2.0E-03	2.0E-03	
	Child under school age	9.4E-05	9.7E-05	1.0E-04	3.1E-03	3.1E-03	3.1E-03	
	Infants	1.1E-04	1.1E-04	1.2E-04	3.9E-03	3.9E-03	3.9E-03	

Points to be further clarified

- None – waiting for detailed documentation

(Source: TEPCO, the 9th Review Meeting, 15 February 2022)