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Corroboration of source and environmental monitoring related to ALPS treated water at FDNPS and review of relevant sampling and analytical methods used

Support of the IAEA Nuclear Sciences and Applications Laboratories to the IAEA Review of Safety Related Aspects of Handling ALPS Treated Water at FDNPS

IAEA Nuclear Sciences and Applications Laboratories

IAEA 66th General Conference, Vienna, 27 September 2022

Objectives of the corroboration

1

Through **independent verification**, ensure that the radiological basis of planning for the discharge of ALPS treated water is sound

2

Provide confidence in the accuracy of data resulting from source and environmental monitoring undertaken by TEPCO/GOJ

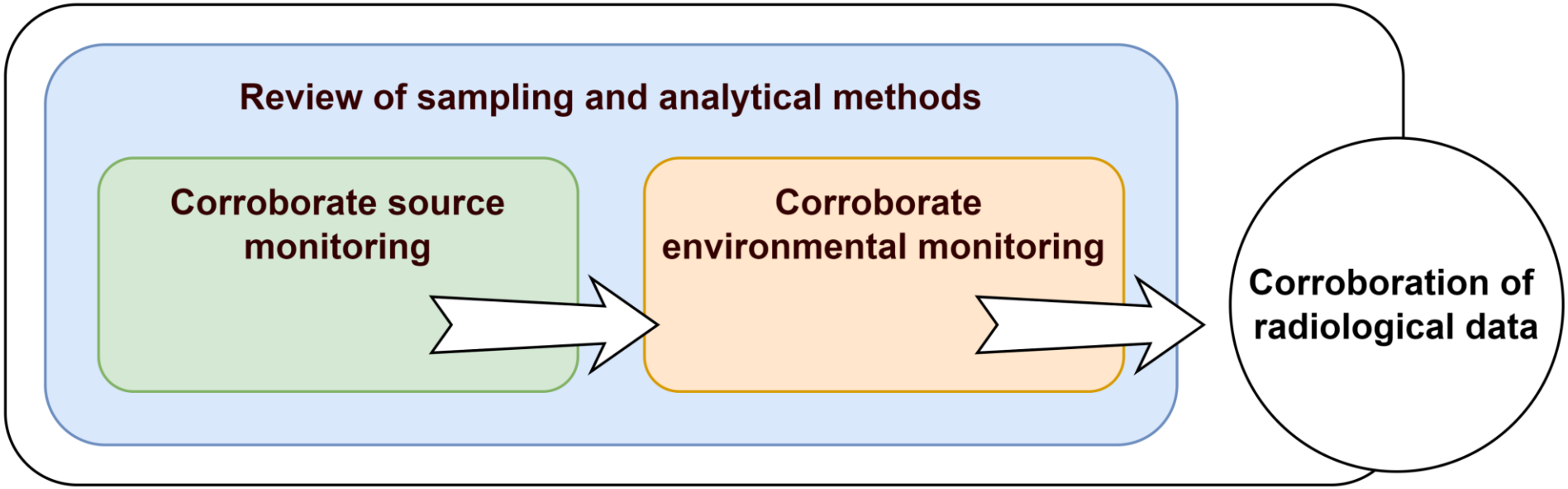
3

Enhance transparency

Process of the corroboration

1. Corroborate source monitoring
   - Independently verify the results that TEPCO measure & report
   - Check for additional radionuclides that may be present in ALPS treated water samples
2. Corroborate environmental monitoring
   - Independently verify the results that Japanese authorities measure & report
3. Review sampling & analytical methods used

Process of the corroboration



Data corroboration in a nutshell

If the IAEA laboratories analyzed the same samples*, would they get the same results?

….. and if not, why not?

** as TEPCO (for source monitoring), as Japanese laboratories involved in marine monitoring under the Comprehensive Radiation Monitoring Plan for environmental monitoring*

Participating IAEA laboratories

- **Marine Environment Laboratories, Radiometrics Laboratory** (RML), Monaco
- **Terrestrial Environmental Radiochemistry Laboratory** (TERC), Seibersdorf, Austria
- **Isotope Hydrology Laboratory** (IHL), Vienna, Austria

Why involve the 3 IAEA laboratories?

Independence - Part of the IAEA Secretariat

Extensive, hands-on expertise - Sampling and analysis

PT and ILC experience - Including for Japan since 2011

The whole is greater than the sum of its parts - Complementing knowledge, experience and capability in the 3 laboratories

What do the IAEA laboratories do for Member States?

Develop	• nuclear and isotopic tools
Support	• environmental monitoring programmes
Train	• scientists in Member States
Coordinate	• networks of excellence
Organise	• PTs and ILCs
Produce	• reference materials - ISO accreditation

Operational, state of the art laboratories in … Monaco

ISO compliant

Quality Management System implemented

60 years of ocean science to support Member States

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

IAEA Environment Laboratories

April 2011

Japanese Research Vessel
« Mirai »

NA EL expert Mats Eriksson on board
R/V MIRAI

Operational, state of the art laboratories in … Vienna

Low level tritium, OBT and FWT analyses

Operational, state of the art laboratories in … Seibersdorf

Gamma-ray spectrometry, alpha & beta spectrometry, radiochemistry, low background alpha-beta counting

Independence & scientific integrity

- United Nations' laboratories
- Provide independent measurements
- Ensure data quality
- Promote transparency & confidence

Proficiency tests 2022

RML

- **Seawater sample containing H-3, Sr-90 & gamma emitters (IAEA-RML-2022-01)**: total activity <12 Bq/L
- 113 participating laboratories from 52 countries
- 31 from Japan including TEPCO

IHL

- **Water samples containing H-3 (TRIC 2022)**: 3 higher activity range samples (40 – 1000 TU, 4.7 – 118 Bq/L) & 5 lower range (<10 TU, 1.18 Bq/L) H-3
- 98 participating laboratories from 30 countries
- RML & TERC are participating (higher activity samples)

Proficiency tests 2022

TERC

- **Water and soil samples containing H-3, Sr-90 & gamma emitters (IAEA-TERC-2022-01/02)** gamma-ray spectrum analysis exercise & simulated contaminated surface samples
- **419 registered participants from 79 countries** including most 1st source monitoring ILC participants

Other participating laboratories

For corroboration of source monitoring: TEPCO

For corroboration of environmental monitoring: Japanese laboratories performing ALPS-related monitoring within CRMP* (including TEPCO)

3rd party laboratories from the IAEA ALMERA network

- **1st ILC source monitoring** :
  - L'Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France
  - Korea Institute of Nuclear Safety (KINS)
  - Los Alamos National Laboratory (LANL), USA
  - Labor Spiez, Switzerland
- **2nd and 3rd ILC source monitoring, 1st ILC environmental monitoring**:
  - ✓Korea Institute of Nuclear Safety (KINS)

*CRMP = Japan's Comprehensive Radiation Monitoring Plan

1 Corroborate source monitoring

3 ILCs planned prior to start of discharges of ALPS treated water

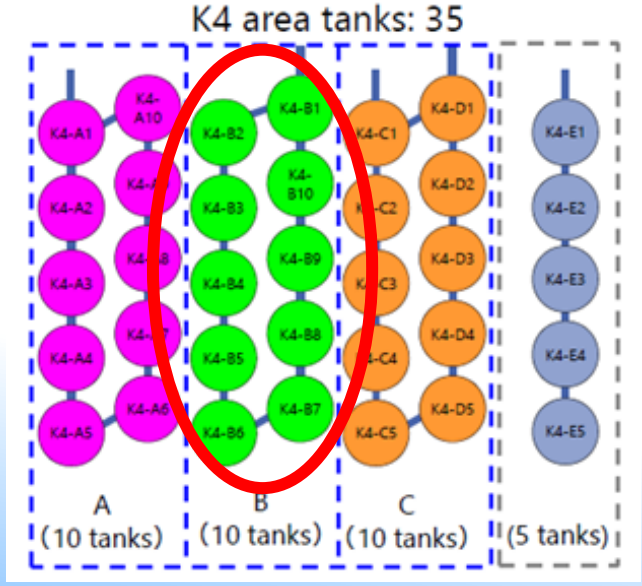
- Pilot: Test samples collected in Feb 2022
- 1st ILC: Sampling in Mar 2022
- 2nd & 3rd ILCs: Sampling Oct 2022

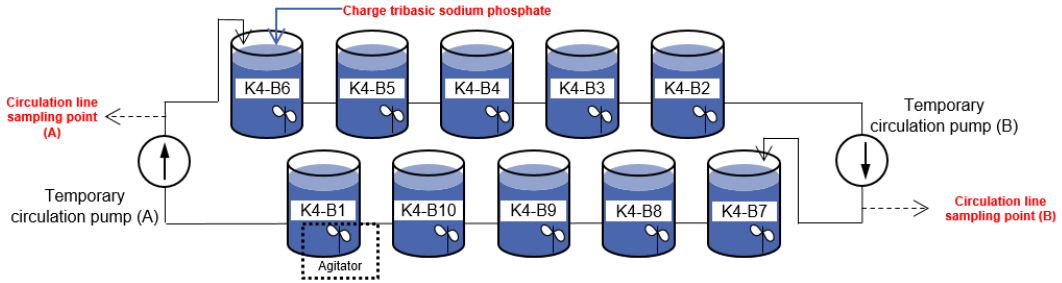
Two objectives to ILCs

- **Statistical comparison** of TEPCO's results with those of IAEA & ALMERA laboratories
  - H-3, "seven major radionuclides" (Sr-90, I-129, Co-60, Ru-106, Sb-125, Cs-134, Cs-137), C-14, Tc-99, gross α & β
- **Radiological characterisation** of samples of ALPS treated water
  - Activity concentrations for any other radionuclide that may be present (or detection limits)
  - High yield fission & activation products/ actinides

Sampling for corroboration of source monitoring

- ALPS treated water identified by TEPCO as suitable for discharge, pending confirmatory measurements
- Discharge methodology in compliance with IAEA Safety Standards:
  - "homogenized batch prior to discharge"
  - "intermittent sampling & laboratory measurements of activity concentrations in the sample"
- Sample collection observed by IAEA





Agitation demonstration test: Performed in November 2021
Circulation and agitation demonstration test: Performed in February 2022

IAEA Safety Guide No. RS-G-1.8, Environmental and Source Monitoring for Purposes of Radiation Protection

Analyses undertaken by IAEA & ALMERA laboratories – source monitoring

Direct comparison
H-3, 7 major radionuclides, C-14, Tc-99, gross alpha/beta
H-3
C-14
Gamma (Co-60, Ru-106, Sh-125, Cs-134, Cs-137)
Sr-90
Tc-99
I-129
Gross alpha/ beta

Radiological characterisation
Beta: *Fe-55, Ni-59,* Ni-63
Gamma: *Cd-113m,* Sn-126, Ba-133, Pm-146, Eu-152, Eu-154, Eu-155
Actinides: isotopes of Th, U, Np, Pu, Am, Cm, Pa, Ra *

* *U-233,* U-234, U-235, U-236, U-238, *Np-236,* Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Am-241, *Am-242m, Am-243*, Cm-243, Cm-244, *Cm-245*, Cm-246, Th-230, Th-232, Pa-231, *Pa-233,* Ra-226, Ra-228
Note: Radionuclides in *italics* analysed by ALMERA laboratories only

2 Corroborate environmental monitoring

Corroboration of environmental monitoring related to discharges of ALPS treated water undertaken by GOJ as defined by CRMP*

Two ILCs currently planned (baseline & after start of discharges)

- Seawater, sediment, fish, seaweed
- Joint sampling, split samples

Statistical comparison of results

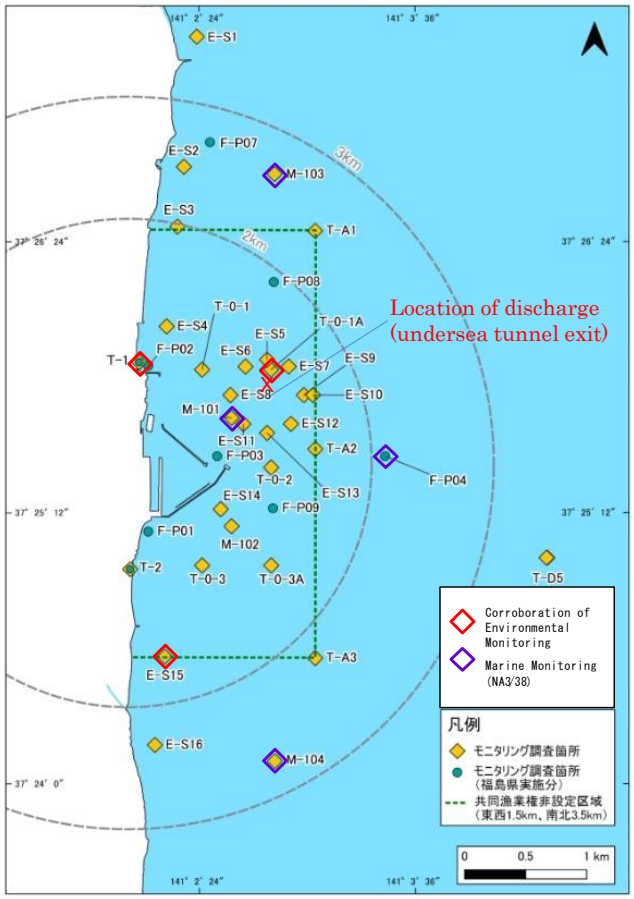
Participating laboratories

- IAEA
- Japanese laboratories performing ALPS-related monitoring within CRMP (including TEPCO)
- Selected IAEA ALMERA laboratories

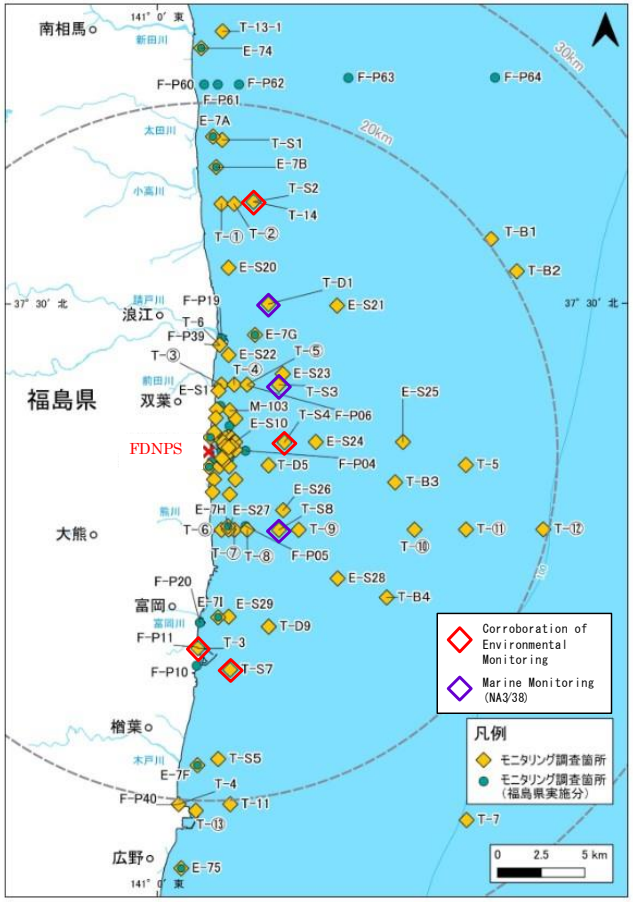
Required sample collection/ pre-preparation undertaken alongside other data quality support projects

*CRMP = Japan's Comprehensive Radiation Monitoring Plan

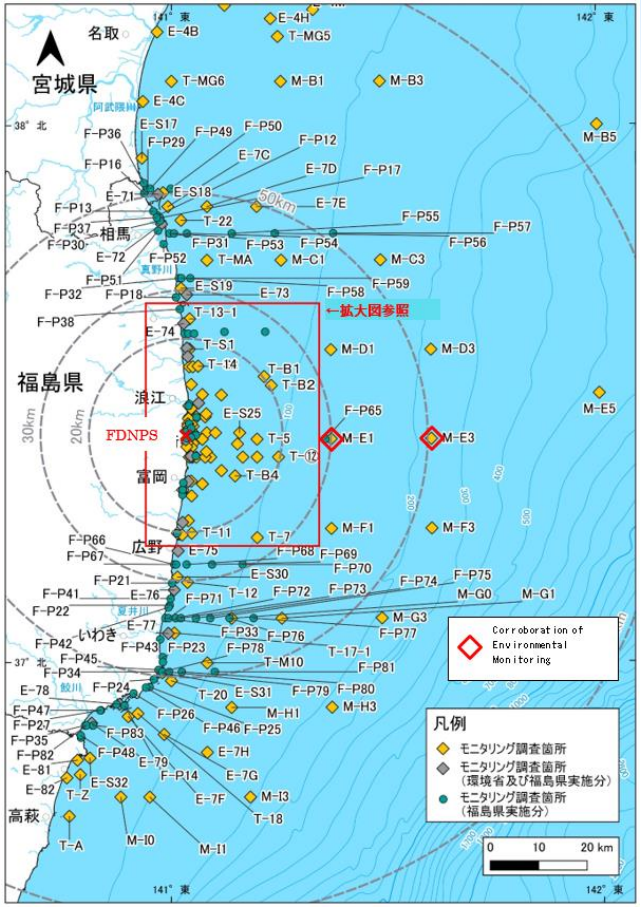
Sampling for corroboration of environmental monitoring



~ 3 km



~ 20 km



~ 50 km

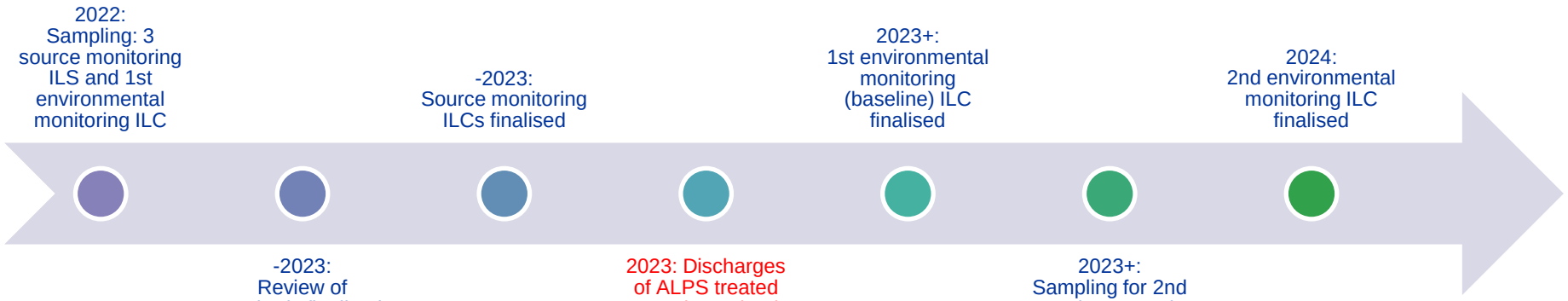
Maps provided by NRA

Analyses to be undertaken by participating laboratories

Seawater
H-3
Gamma (Co-60, Ru-106, Sb-125, Cs-134, Cs-137)
Sr-90
I-129
Sediment
Gamma (Co-60, Ru-106, Sb-125, Cs-134, Cs-137)
Fish
H-3 (OBT, FWT)
C-14
Seaweed
I-129

Corroboration timeline

1. Review of sampling & analytical methods
2. Corroborate source monitoring – 3 ILCs
3. Corroborate environmental monitoring – 2 ILCS



Start 2022

2024

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Thank you!