



Project for
**Promoting
Minamata
Convention
on Mercury**



by making the most of Japan's
knowledge and experiences

Networking Webinar #11

Enhancing collaboration and communication among mercury analytical laboratories

Presentations at the webinar on 24 April 2025

Ensuring Reliable Mercury Data through Proficiency Testing and Certified Reference Materials

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National Institute for Minamata Disease
Ministry of the Environment, Japan



Collaborative programme between
National Institute for Minamata Disease
and
Ministry of the Environment, Japan





Every measurement has some degree of bias.

Common Causes of Bias

Using degraded standard /
Dilution error



Uncalibrated Balances



Weak Reduction Reagents



If bias leads to underestimating risks
or overestimation

Trigger unnecessary
public alarm

Guideline

Risk may go
unnoticed.

Biased data results in unreliable decisions



Even with validated methods, poor precision can occur.

Common Causes of Poor Precision



Contaminated glassware/
sample boat

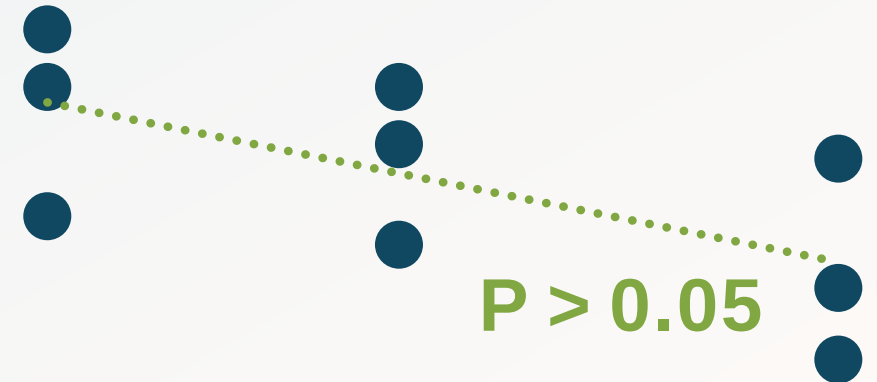


Variations in operator
techniques



Instrument drift

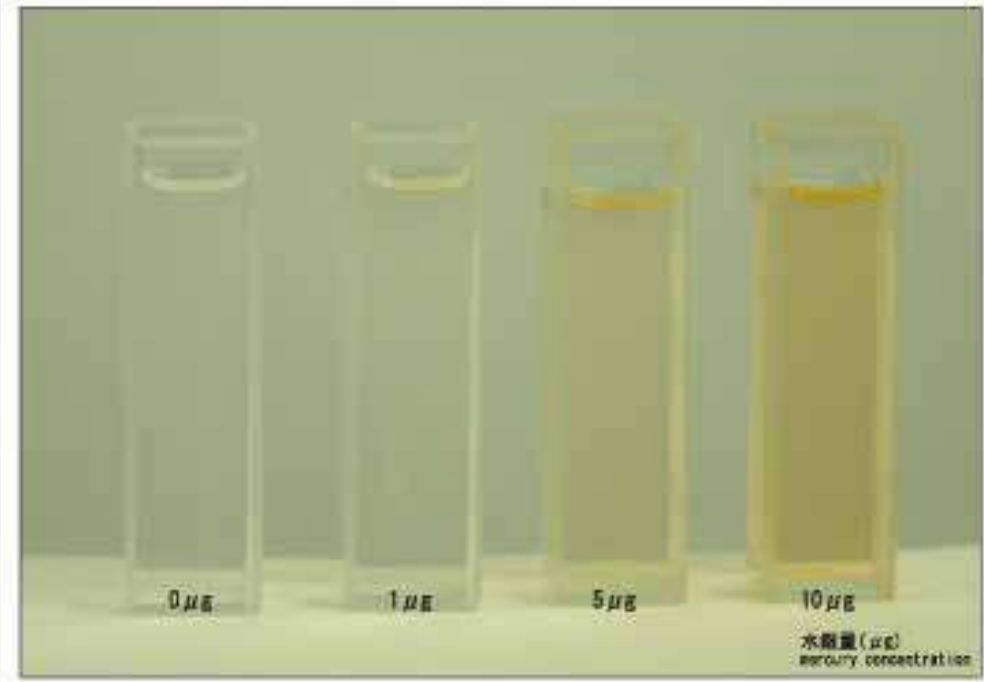
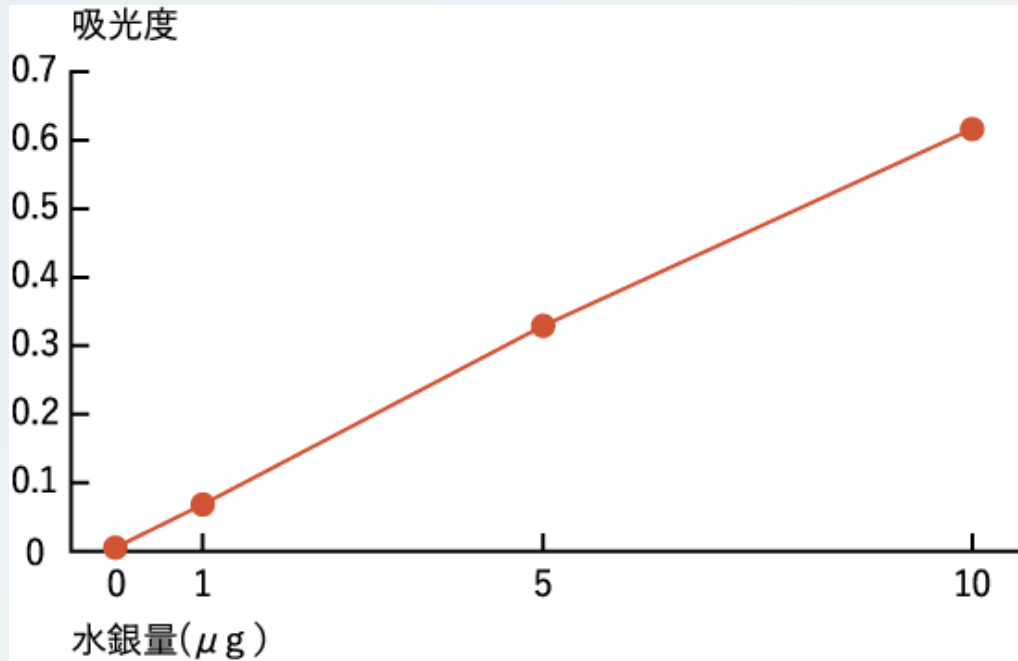
If results fluctuate too much,



trends become unclear

Policy decisions may then be based on
noise, not real changes.

Analytical quality isn't just a technical issue, it has shaped global health policies.

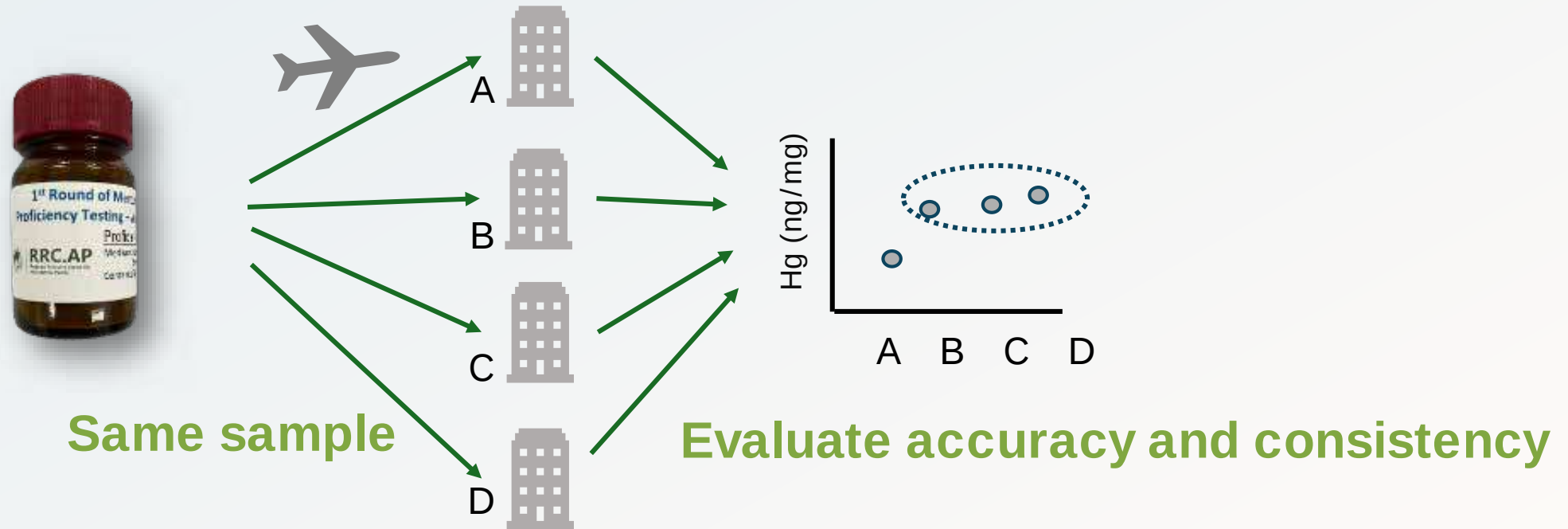


Case Study: Niigata Minamata Disease

- 1965: **52 ppm** established as a health threshold from patient data.
 - 1976: WHO guidelines adopted **50 ppm** for adults.
 - 1978: Re-analysis raised threshold to **82.6 ppm**.
- 60% higher

Initial underestimation led to stricter global exposure limits.
This shows how analytical bias can influence policy decisions.

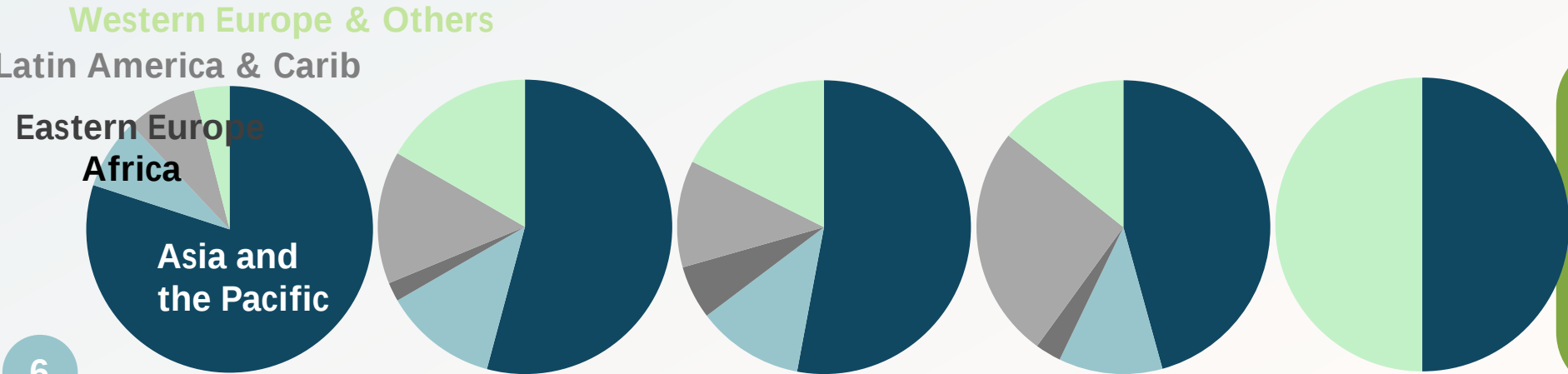
Proficiency Testing (PT) is an external quality assessment program



- Until 2018, PT for mercury was scarce
- Euro UNEP PT and HBM4EU harmonized methods, but PT remained limited in recent years
- Labs relied on interlaboratory comparisons or CRM studies
- To fill this gap, we launched our PT program in 2022

Expanding Our Proficiency Testing Program

Round	1 (2022)	2 (2023)	3 (2024)	Inter-laboratory (2024)	4 (2025)	
Sample Type	Hair	Fish	Sediment	Gold amalgamation trap	Urine	
Target	THg	THg	MeHg	THg	MeHg	THg
Participants	24 Labs	48 Labs	17 Labs	35 Labs	4 Labs	6 Labs
Registration 53 Labs						



Over 60 laboratories from 30 countries/regions participated.

Announcing PT5 – Expanding to Hair THg and MeHg Analysis

**Collaborating with the
Ministry of Climate Change,
Environment and Energy in
the Maldives—a region with
high fish consumption and
significant mercury
exposure considerations**

Target Timeline:



early 2026



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graph TD; A[Step 1: Register] --> B[Step 2: Receive Sample]; B --> C[Step 3: Perform Testing]; C --> D[Step 4: Submit Results];
```

Step 1: Register

Step 2: Receive Sample

Step 3: Perform Testing

Step 4: Submit Results



<http://nimd.env.go.jp/>

<https://forms.gle/61JDNXfB3GHqVayB6>

Call for
expression
of
interest

LABORATORY PROFICIENCY TESTING FOR
MERCURY 2024-25 (FOURTH ROUND)

National Institute for Minamata Disease (NIMD), in collaboration with United Nations Environment Programme (UNEP), will laboratories that undertake mercury analysis for monitoring, survey, or research to participate in the "Proficiency Testing" for assessing their analytical capability.

OBJECTIVE

The Proficiency Testing (PT) aims at evaluating the performance of mercury analyses conducted by the laboratories. It provides their individual proficiency levels and collective mercury monitoring capacity in the region.

LABORATORIES SUBJECT TO THE PT

Public laboratories, NGOs, and laboratories in universities that undertake mercury for monitoring, survey, or research purposes are welcomed to participate in the proficiency testing.

OUTLINE AND SCHEDULE

Target parameter: total mercury

Specimen: Urine

Timeframe	2024				2025								
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
			Registration		Distribution of questionnaires		Mercury analysis		Statistical analysis		Report back, IRF results		

ARRANGEMENT

NIIMD: responsible for overall IT design and compiles and prepares the report.

UNEP: supervises project implementation.

AIT BRCA1: organises laboratory engagement and sample distribution.

Copyright and Permissions

For the laboratories interested in the PT www.terra.bio/2017/07/17/pt-2018/, an register yourselves through the www.terra.bio/2017/07/17/pt-2018/ any query, including eligibility, can be communicated through world@terra.bio.

Step 1: Fill out the Registration Form



Step 1: Register



Step 2: Receive Sample



Step 3: Perform Testing



Step 4: Submit Results

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Promoting the implementation x Registration Form x +

docs.google.com/forms/d/e/1FAIpQLSdhiZXT5jl20bHLtnkgHMFQbglCRM87sZown7aIGPZ5ioO1UA/vie... ☆ K

Registration Form

Free participation !

Laboratory Proficiency Testing for Mercury 2024-25 (Fourth round)

The **Proficiency Testing (PT)** aims at evaluating the performance of mercury analyses conducted by the laboratories. It provides their individual proficiency levels and collective mercury monitoring capacity in the region. **Public laboratories** and **laboratories in universities** that undertake mercury for monitoring, survey, or research purposes are welcomed to participate in the proficiency testing.

For the laboratories interested in the PT, please fill out this form to **register**. For any additional query, including eligibility, please reach out to us at warm@rrcap.ait.ac.th. After submission of this registration form, we will send you an email to confirm your participation.

☁

* 必須の質問です

メールアドレス *

メールアドレス

Laboratory Name: *

回答を入力

- Lab's name
- Shipping address
- A contact person

Step 2: Receive Test Samples



Step 1: Register



Step 2: Receive Sample



Step 3: Perform Testing



Step 4: Submit Results

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Test Sample

- Homogeneous and stable
- Gamma sterilized
- Clear of COVID-19 antigens (as applicable)

3rd Round of Mercury Laboratory Proficiency Testing

Instruction for Proficiency Testing (Total Mercury)

- 1. Proficiency testing provider**
Provider
Name: National Institute for Minamata Disease (NIMD)
Address: 4058-18 Hama, Minamata City, Kumamoto 867-0008, Japan
Collaborator
Name: United Nations Environmental Programme, Regional Office for Asia and the Pacific (UNEP-ROAP)
Address: 2nd Floor, United Nations Building Rajdamnern Nok Avenue, Bangkok 10200, Thailand
- 2. Type of test item**
Test item (sample): 1 marine bottom sediment (around 5g distributed).
Test item is the marine bottom sediment which is dried at room temperature, finely powdered and sieved.
After receiving the test item, it should be stored in a cool, dry place.
- 3. Target parameter**
• Total mercury
• (Moisture)
The participant should analyze the test item and report the result. (Analysis of moisture is not the subject of this proficiency testing.)
- 4. Criteria**
Laboratory which meets the following criteria will be eligible for participation:
• Lower detection limit



SOS-M5-PT3-DryH2
Date: August 2, 2024

Safety Data Sheet for Marine Sediment

1. Identification of the Substance/Mixture and the Supplier

1.1 Product identifiers

Product name: Sterilized Marine Sediment (Gamma Ray)
Product description: Marine sediment for analytical proficiency testing
Substance/Mixture: Sediment in Minamata Bay, Japan

1.2 Identified uses

Proficiency testing for laboratories conducting mercury analysis

1.3 Details of the supplier of the safety data sheet

Supplier: National Institute for Minamata Disease (NIMD)
4058-18 Hama, Minamata, Kumamoto, 867-0008 JAPAN
Person in charge: Koichi HARAGUCHI
Telephone: 81 (966) 63-3111
Fax: 81 (966) 61-1145

1.4 Emergency telephone

Emergency Phone Number: Same as above

2. Hazards Identification

Safety Data Sheet (SDS) Instruction Manual

- Prepared under ISO/IEC 17043:2023 compliance
- Compliance with transport regulations
- Smooth customs clearance

Step 3: Conduct Measurements



Step 1: Register



Step 2: Receive Sample



Step 3: Perform Testing



Step 4: Submit Results

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Follow your lab's methods
and guidelines to ensure
comparable results for PT

Step 4: Submit Results



Step 1: Register



Step 2: Receive Sample



Step 3: Perform Testing



Step 4: Submit Results

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The 2nd Round of Mercury Proficiency Testing

(Total Mercury)

Report Form

Participant Code:
Name of Participating Institute:
Name of Reporter:
Contact e-mail Address:

Proficiency Testing Item

Item Code:
Date Received: Feb. 13 2023

Chemical Analysis

Total mercury

	Try 1	Try 2	Try 3
Date Analyzed:	Apr. 12	Apr. 12	Apr. 12
Used Item Weight (g):	0.00545	0.00546	0.005485

Total Mercury ^{*1} (mg/kg)	4.02	4.04	4.05
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Moisture ^{*2} (%)	4.33
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Additional Information

(They are for reference. There is no disadvantage if these columns aren't Filled):

Total mercury
LOD (mg/kg)
Estimated uncertainty (mg/kg)

Notes

*1: Please report the concentration as mercury based.
Please report the concentration "without" correction by the moisture of the item (wet base).
Please report the concentration with 3 significant figures.

*2: Please measure the moisture by following procedure:
-Take test item (more than 100 mg) other than it used for mercury analysis, measure its weight correctly.
-Dry at 100 degree C for 2 hours.
-Measure the item's weight after dry and calculate the moisture from the

ical Analysis

EPA Method 7473

Preparation (such as direct measurement by thermal decomposition blank)

weighing item	Min	0.01
	Max	120,000

N/A

N/A

Thermal Decomposition CVAAS

ype of

ibration

etail of

HgCl2

Submit your results using
the provided Excel
template within 2 months

Your Individual Report

Receive your **z-scores** to evaluate your lab's performance.



Laboratory PT #2

Mercury laboratory proficiency testing

Results and performance evaluation: total mercury

Results of total mercury

Participant ID:

ID	Results submitted (mg/kg)			Average
	1	2	3	
Participants' statistics (mg/kg)				z score obtained
Median		NIQR		
4.046		0.279		-0.032

Performance of the result is classified by z score as follows:

- $|z| \leq 2$: Performance is **satisfactory (satisfactory)**
- $2 < |z| < 3$: Performance is **questionable (caution)**
- $|z| \geq 3$: Performance is **unsatisfactory (action)**

Benchmark your performance

Your data is kept confidential and used solely for performance improvement.

Benchmark your lab with global standards



The numbers of laboratories disaggregated for each z score range are shown in Table 4.

Table 4 Number of the laboratories in the range of z score (total mercury)

As described in 8.1, IQR of reported results was relatively small. Therefore, satisfactory range of the result (median was the best) was observed. The results had z-score of 0.00, which means that the analytical procedure was satisfactory.

Number of laboratories per country and the performance of the PT are shown in Fig. 1.



8.5. Analysis methods and results

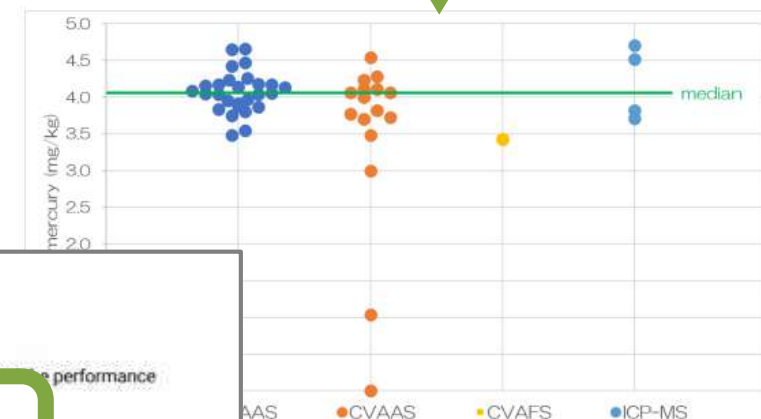
The method of analysis was not specified for the PT and the participants performed analysis by the method that they usually used in their routine analysis, or they were planning to use in the future.

The participants performed analysis of total mercury by the following methods:

- analysis method and performance

analysis method and performance

The distribution of the results from participants by analysis method is shown in Fig. 5.



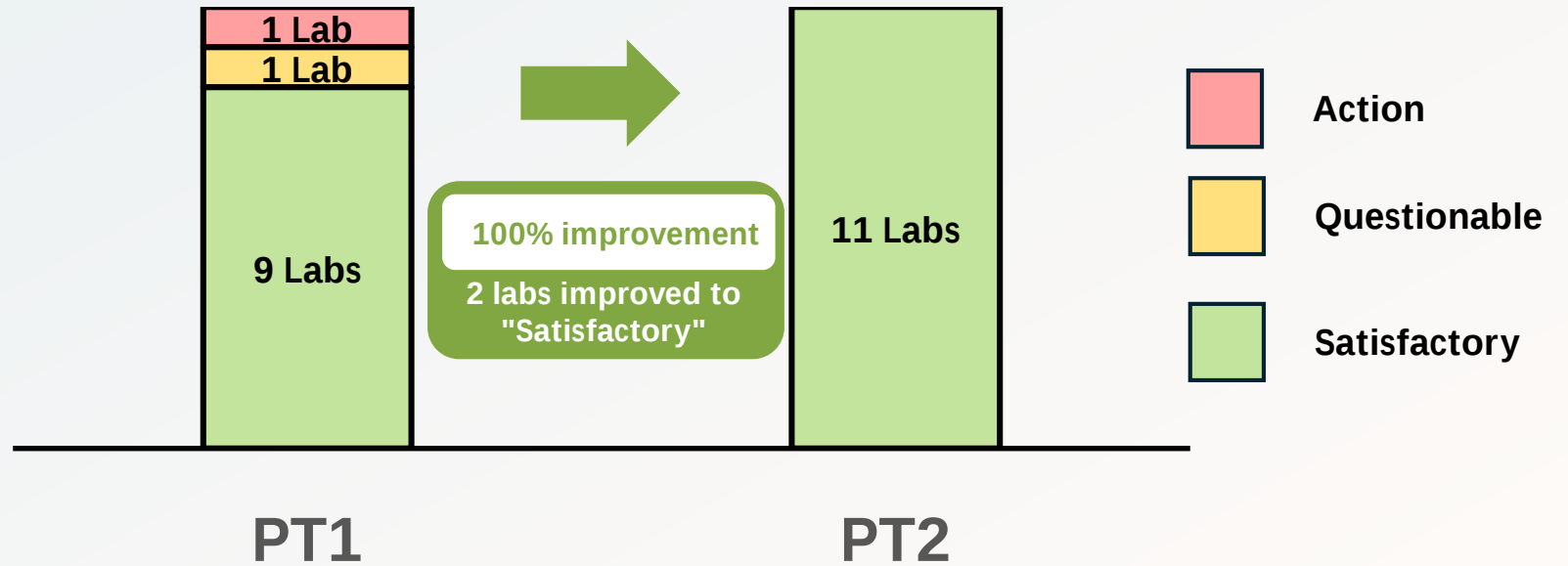
tion of the report data by analysis method (total mercury)

found among the analysis methods employed (Kruskal-Wallis one-). However, several data measured by CVAAS, which were significantly different from the other methods, indicate that it is possible that errors in the data calculation process caused the differences. These errors could not be related to the analysis method. On the other hand, TDAAS and CVAAS obtained the highest number of results. This can be attributed to the fact that TDAAS is a method designed for mercury analysis, which requires no chemical digestion, while CVAAS is a chemical analysis procedure. Therefore, only a few parameters need to be

Improving Lab Performance Through PT

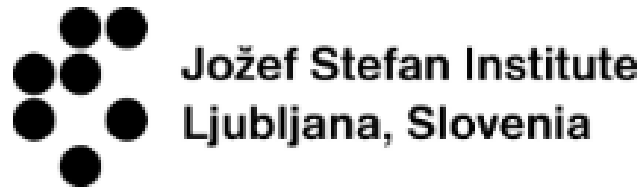
Evidence of Performance Improvement in PT

Results based on 11 consistently participating labs



Continuous participation drives better accuracy

CRMs: Global Collaboration with Leading Research Institutions



National
Institute for
Environmental
Studies, Japan



What makes our CRMs special?

Freely provided to participating laboratories

No cost shipping, fully covered by Japan's Ministry of the Environment

Stable at room temperature, ensuring easy transport



CRMs for HBM Studies – Available for Order



NIMD - 01 Human Hair

Analyte	Certified value (mg/kg)
Methylmercury	0.634 ± 0.071
Total mercury	0.794 ± 0.050
Copper	12.8 ± 1.4
Zinc	234 ± 29
Selenium	1.52 ± 0.29
Arsenic	$0.17 \pm 0.03^{**}$

^{**}Indicative value



NIMD - 04 Human Whole Blood

Analyte	Certified value
Methylmercury	$5.46 \pm 0.50 \mu\text{g/L}$
Total mercury	$6.16 \pm 0.62 \mu\text{g/L}$
Lead	$6.76 \pm 0.60 \mu\text{g/L}$
Selenium	$0.182 \pm 0.028 \text{ mg/L}$
Copper	$0.667 \pm 0.090 \text{ mg/L}$
Zinc	$4.82 \pm 0.55 \text{ mg/L}$
Cadmium	$0.88 \pm 0.13 \mu\text{g/L}^{**}$
Manganese	$18 \pm 8.5 \mu\text{g/L}^{**}$
Arsenic	$3.4 \pm 0.58 \mu\text{g/L}^{**}$

^{**}Indicative value

NIMD - 02 and 03 Human Urine

NIMD - 02 (low)

Analyte	Certified value (mg/kg)
Total mercury	0.292 ± 0.057
Cadmium	0.154 ± 0.030

NIMD - 03 (high)

Analyte	Certified value (mg/kg)
Total mercury	4.80 ± 0.56



The screenshot shows the NIMD website interface. At the top, there is a navigation bar with links: 'About NIMD', 'Activities of NIMD', 'Research showcase', 'Information disclosure', 'Information on publications', and 'Access'. Below this is a section titled 'Supply of certified reference materials'. Underneath, there is a sub-section 'Certified reference materials (CRM)'. The text in this section states: 'Pursuant to ISO Guide 35 (JIS Q 0035), we have produced hair, urine, and blood CRMs. They can be used for the purpose of validating the appropriateness of an analysis method or analysis equipment, or managing analytical preciseness in the process of quantitative analysis of trace elements. These products are registered with RMInfo (Reference Materials Total Information Services of Japan) and in the COMAR Certified Reference Materials database and can be searched and accessed for viewing as well.' To the right of the text is an image showing several vials and a bottle of CRMs.

We welcome your suggestions for future samples

Mercury Analysis Training: Major Activities & Experiences



Bhadrika Bhattarai, Chemist

Ashmita Oli, Chemist

Ministry of Forests and Environment

Government of Nepal

24 April, 2025



Background

- Mercury (Hg)-One of the top 10 chemicals of major public health concern: WHO
- Reduction of mercury pollution is an urgent need.
- Measurement of mercury: Air, Water, Soil, Hair, Urine
- Mercury Analysis: Public Health and Environmental Concern
- Sampling is conducted, but no mercury analysis facility in Nepal yet.
- Lack of laboratory facilities and technical expertise to analyze mercury in Nepal.
- Need for mercury analysis training for laboratory personnel in Nepal.



Mercury Monitoring Activities in Nepal

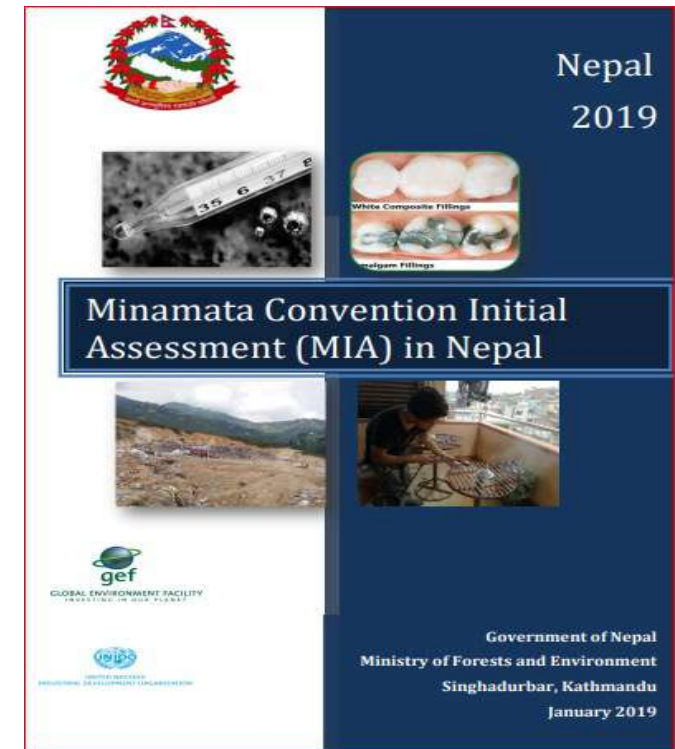
- Ministry of Forests and Environment (MoFE) is responsible body for the management of hazardous wastes and control of environmental pollution.
- MoFE is the National Focal Ministry for Minamata Convention and the lead institution to implement the Minamata Convention.
- Department of Environment (DoEnv) under the MoFE has a laboratory for the analysis and monitoring of environmental pollutants (water, soil and air)
- Analysis of different heavy metal parameters such as Cu, Fe, Cd, Zn, Ni, Co, Pb, Cr etc. in industrial effluents, river water and Pb in paints is conducted.
- Establishment of dry and wet deposition instruments for Hg in DoEnv for collection of air and rainwater sample.
- Sampling is conducted from different sites such as cement industries (clinker-based industries), landfill site, urban area, crematoria area and gold plating workshop etc.





Mercury Sources in Nepal

- Nepal submitted MIA in 2019.
 - The Government of Nepal signed the Minamata Convention on October 10, 2013.
 - Nepal is in the process of ratifying the Minamata Convention.
- The gold plating (gold-mercury amalgam) is the highest contributor to the release of mercury in Nepal.
- Total release of mercury in Nepal for the base year 2016/17 was estimated to be **19615 Kg Hg/y**.
- Different source categories (UNEP toolkits): **6790 Kg/y (34.6%)**
- Gold plating sector: **12825 Kg/y (65.4%)**





Introduction of Training Program

- Japan funded UNEP Project
- Collaborative study between MOFE, UNEP, PUK and NIMD
- Main objective – to evaluate the current mercury situation in and around the gold plating facilities and capacity enhancement
- Project Duration: 2 years (2023 March- 2025 March)
- Mainly focused on the gold plating sector in Nepal
- Analysis of Hg in soil dust, dog hair, human hair and human urine
- Evaluation of environmental and human health risk





Training Activities

- One-month training in the laboratory of PUK
- Introduction to different methods and operation of the mercury analyzer
- Preparation of standard solution and reagent
- Pre-treatment and dilution of pretreated sample
- Analysis of CRM and PT sample for the recovery test by thermal decomposition and reducing aeration method
- Analysis of solid and liquid samples by both TH and RA method
- Visited NIMD laboratory and Minamata Museum





Lesson Learned

- Technical skills to operate mercury analyzer (MA3000): RA and TH
- Proper sample preparation and pre-treatment methods for high Hg concentration samples
- Importance of calibration curve to ensure accuracy
- Application of blank tests, recovery tests and control samples for quality assurance
- Cleaning and handling of glassware and other accessories



Way forward

- Ratification of Minamata Convention
- Reduction of mercury emissions from gold plating sector
- Development of mercury capture system in the gold plating sector
- Development of alternative technology for gold plating
- Institutional strengthening and capacity enhancement of laboratory personnel





Thank you!

