Mercury Human Bio-Monitoring Survey, India

Meeting on "Human Exposure to and Environment Concentration of Mercury Outcomes and lessons learnt in Global Environment Facility Project"
November 17, 2018
Geneva, Switzerland

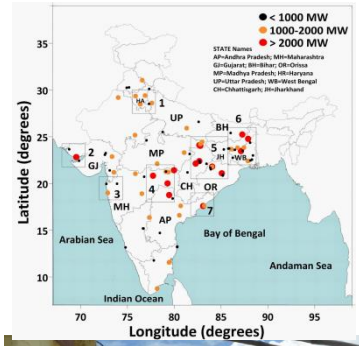
Dr. Krishnendu Mukhopadhyay
National Coordinator of the UNEP-WHO Mercury HBM Project (2016-17) in India
Professor, Dept. of Environmental Health Engineering, Faculty of Public Health,
Sri Ramachandra Institute of Higher Education and Research (SRIHER), Porur, Chennai, India

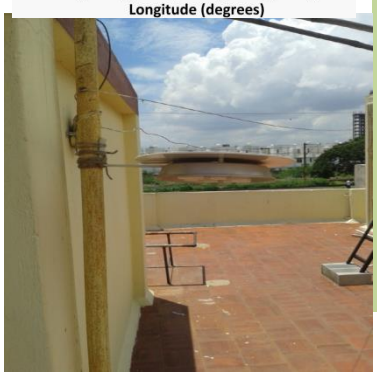
SRIHER (DU), CHENNAI, INDIA

SRI RAMACHANDRA MEDICAL CENTRE, CHENNAI, INDIA

GOVT. RSRM LYING IN HOSPITAL, CHENNAI, INDIA

OUTLINE OF PRESENTATION





- Exposure Monitoring
  - A. **Mercury Human Biomonitoring (Hg-HBM)**
    - Methodology
    - Results
  - B. **Passive Air Sampling (PAS)**
    - Methodology
    - Results
- Key learnings
- Recommendations and Next Steps

EXPOSURE MONITORING
A. MERCURY HUMAN BIOMONITORING

METHODOLOGY:

Administrative

- Ethical Committee Clearance: i. SRU – dated 30.11.2016 and ii. Stanley Medical College – dated 31.08.2016
- Training Conducted: i. SRU – dated 08.09.2016 and ii. RSRM – 07.09.2016.

Technical

Parameter	Cord blood	Hair	Urine
Samples collected	250	250	250
Sample storage	-20°C deep freezer	-20°C deep freezer	Room temperature
Sample analyzed	249	238	250
Analytical method	Ultrawave digestion followed by ICP-MS	Acid digestion followed by CV-AAS	Acid addition followed by ICP-MS
Limit of Detection	0.06 ng/g	0.2 ng/g	0.04 ng/g
QC sample	Seronorm level 1 and 2	IAEA-086	ClinCheck level 1
Place of analysis	JSI, Slovenia	JSI, Slovenia	JSI, Slovenia
Sample archived	Yes	No	Yes

RESULTS:

	Hospital 1 (n=100)	Hospital 2 (n=150)	Total
Cord blood (ng/g) [Guidance value 5 µg/L for blood-mercury , WHO 2015]			
Mean±SD	0.833±0.463	0.815±0.452	0.822±0.456
Range (min – max)	0.195 – 2.702	0.149 – 3.254	0.149 – 3.254
Geometric mean	0.732	0.722	0.726
Hair (ng/g) [FAO/WHO health based guideline value of 2.3 µg/g]			
Mean±SD	145±125	461±1370	262.7±856.3
Range (min – max)	8.6 – 1364	56.3 – 9515	8.6 – 9515
Geometric mean	122	226	151.8
Urine (ng/ml) [Guidance value 7 µg/L for mercury in urine, WHO 2015]			
Mean±SD	0.265±0.451	0.387±0.533	0.314±0.487
Range (min – max)	0.0 – 2.712	0.0 – 3.314	0.0 – 3.314
Geometric mean	0.154	0.236	0.184

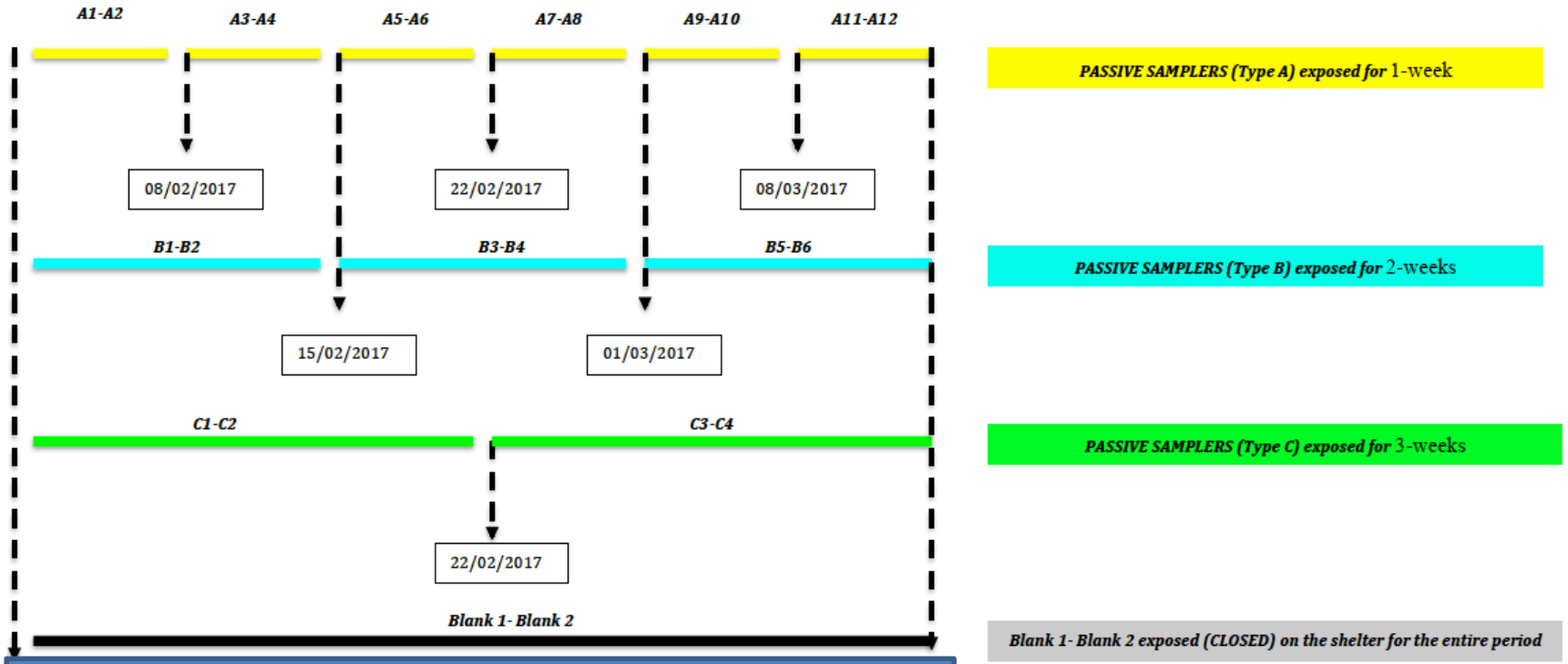
EXPOSURE BIOMONITORING
B.PASSIVE AIR SAMPLING (PAS)

METHODOLOGY:

2 Intensive Sampling Campaigns have been executed

First Phase: started in February 2017

Second Phase: started in September 2017

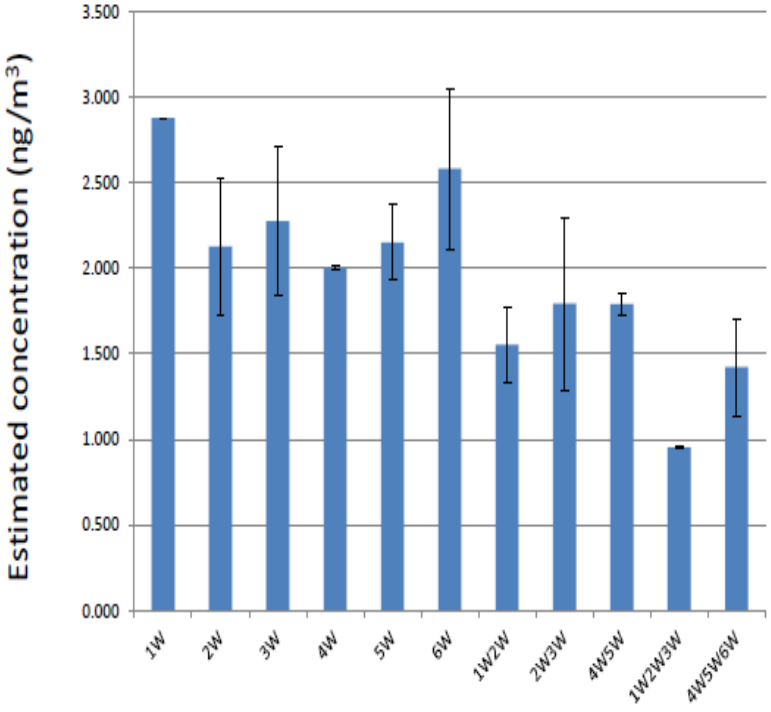


Monitoring scheme: an example

RESULTS:

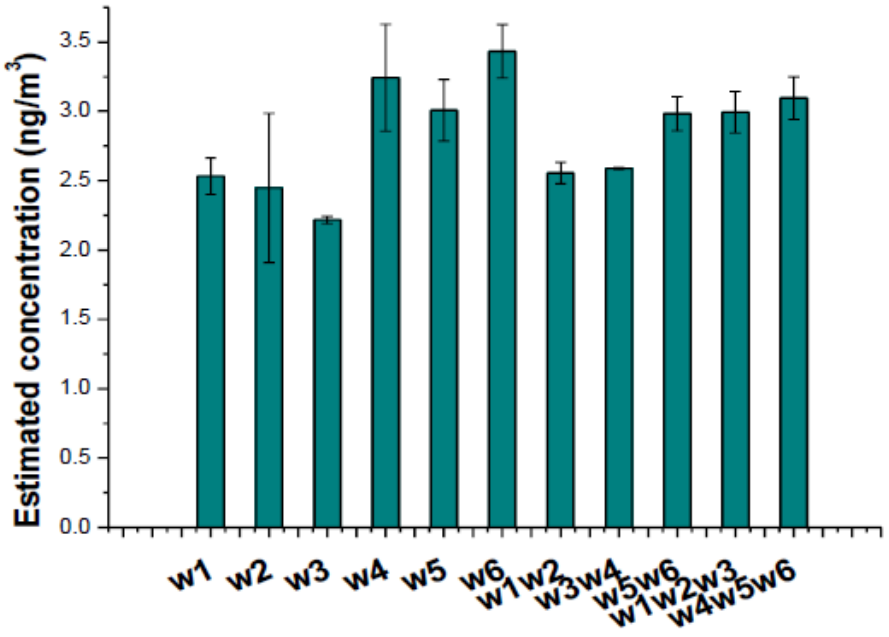
1° Monitoring Campaign

Mean Values: **1.864 S.D.: +/-0.237**



3° Monitoring Campaign

Mean Values: **2.827** S.D.: +/- **0.185**



RAW DATA FROM CNR-IIA PASs

KEY LEARNINGS

- Harmonised Trainings (such as what was provided through WHO workshops) and laboratory time at certified laboratories (such as offered by JSI, Slovenia; CNR Italy) may be critical for optimising the use of available in-country human and laboratory resources specifically for the implementation of The Minamata Convention including human Biomonitoring (Hg-HBM).

- Mapping of in-country institutional resources with the **willingness to partake in network activities using standardized protocols** may be necessary, to create the necessary infra-structure for routine surveillance. Public –private partnerships may be useful in sustaining such a network. Availability of technical competencies in bio-monitoring per se may not be sufficient for achieving implementation targets.

KEY LEARNINGS

- Sampling for human bio-specimens, storage and analyses require multiple special considerations including ethical considerations (such as associated with cultural taboos for hair samples and informed consent for cord blood) that require adequate levels of trainings not commonly available among health care facilities or across all academic institutions.

- Quality control issues including cross-contamination from reagents/digestion procedures can be very limiting in using standard analytical procedures especially for low level exposures in biological matrices.

- Methods for integration of bio-monitoring information with community/ household level information, in order to identify important determinants of Hg exposure is still in need of development/refinement.

RECOMMENDATIONS

- **SRIHER expertise in Hg-HBM may need to be replicated across multiple centers in the country to create a pool of human resources that can undertake routine population level monitoring**

- **A network of dedicated human biomonitoring laboratories that preferably rely on Direct Mercury Analysers (DMA) may be more efficient in addressing routine quality control issues. Existing Inductively Coupled Plasma Mass Spectrometry (ICPMS) based facilities can be co-opted but with dedicated allocation for Hg bio-monitoring.**

- **Pooling of information from source apportionment studies together with routine passive air sampling may be useful in identifying hot spots as well as monitoring effectiveness of emission reduction measures.**

- **Need to create a network of biorepositories so that samples can be archived for analyses in centralized facilities**

- **Organizational arrangements at the state level that involve State Pollution Control Boards and Directorate of Public Health are imminently needed for continuity of pilot efforts**

"MERCURY ELIMINATION" requires many actors!!!!!!!!!

SPECIAL THANKS

GEF, WHO SEARO, WHO EUROPE OFFICES

for providing resources for training and laboratory analyses

Dr. Milena Horvat (JSI)

for her extra-ordinary level of commitment for training and generous laboratory support

Dr. Nicola Pirrone & Dr. Alessandra Fino (IIA-CNR, Italy)

for making us involved in ambient mercury monitoring with passive air samplers (PASs) and organizing sample analysis in their lab facilities

Personnel at participating hospitals (RSRM, SRIHER, Chennai)

for their keen involvement and assistance with enrolling and following pregnant women

Study Participants

for their willingness to readily provide bio-specimens