राष्ट्रीय रोग नियंत्रण केन्द्र
NATIONAL CENTRE FOR DISEASE CONTROL
दिल्ली-११००५४

सत्यमेव जयते

STAKEHOLDER ENGAGEMENT WORKSHOP

NATIONAL BIOMONITORING PROGRAMME FOR CHEMICAL TOXICANTS

14 - 15 MARCH 2024

NATIONAL CENTRE FOR DISEASE CONTROL

Contents

Abbreviations

AcSIR	Academy of Scientific and Innovative Research
ADG	Additional Director General
AIIMS	All India Institute of Medical Sciences
ALAD	Aminolaevulinic Acid Dehydratase
BHU	Banaras Hindu University
BLL	Blood Lead Level
CDSCO	Central Drugs Standard Control Organization
CGWB	Central Ground Water Board
CHEB	Central Health Education Board
CMO	Chief Medical Officer
CPCB	Central Pollution Control Bureau
CSIR	Council of Scientific & Industrial Research
DAD	Deputy Assistant Director
DCPC	Department of Chemicals & Petrochemicals
DDG	Deputy Director General
DDW&S	Department for Drinking Water & Sanitation,
DGHS	Director General of Health Services
DPIIT	Department for Promotion of Industry and Internal Trade
Dte. GHS	Directorate General of Health Services
EIS	Epidemic Intelligence Service
EMR	Emergency Medical Relief
EPR	Extended Producer Responsibility
ESIC	Employees' State Insurance Corporation
FSSAI	Food Safety and Standards Authority of India
GC-MS/MS	Gas Chromatography- Mass Spectrometry/ Mass Spectrometry
GIS	Geographic Information System
GoI	Government of India
HoD	Head of Department
HQ	Headquarter
HR	Human Resource
ICH	International Council for Harmonization of Technical Pharmaceuticals for Human Use
ICMR	Indian Council of Medical Research
NIN	National Institute of Nutrition
NIOH	National Institute of Occupational Health
ICP-MS	Inductively Coupled Plasma - Mass Spectrometry
IDD	Iodine Deficiency Disorders
IDSP	Integrated Disease Surveillance Program
IEC	Information, Education, and Communication
IHIP	Integrated Health Information Platform
IISER	Indian Institute of Science Education and Research
IIT	Indian Institute of Technology
InSLAR	Indian Society for Lead Awareness and Research
LC-MS/MS	Liquid Chromatography -Mass Spectrometry/ Mass Spectrometry
LEAD-ER	Lead Educator Program on Prevention of Lead Poisoning

LHMC	Lady Hardinge Medical College
MAMC	Maulana Azad Medical College
MoA	Ministry of Agriculture
MoCF	Ministry of Chemicals & Fertilizers
MoCI	Ministry of Commerce and Industry
MoEFCC	Ministry of Environment, Forest, and Climate Change
MoFPI	Ministry of Food Processing Industries
MoHFW	Ministry of Health and Family Welfare
MoLE	Ministry of Labor and Employment
MoMSME	Ministry of Micro, Small & Medium Enterprises
MoRTH	Ministry of Road Transport & Highways
MoT	Ministry of Textiles
MoWR	Ministry of Water Resources
MoCF	Ministry of Chemicals & Fertilizers
MRLs	Maximum Residual Limits
NAMP	National Air Quality Monitoring Program
NCD	Non-Communicable Diseases
NCDC	National Centre for Disease Control
NDMA	National Disaster Management Authority
NGO	Non-Governmental Organization
NIPER	National Institute of Pharmaceutical Education and Research
NPPCF	National Program for Prevention and Control of Fluorosis
Nut. and IDD Cell	Central Nutrition and Iodine Deficiency Disorders Cell
NWQMP	National Water Quality Monitoring Program
OPD	Outpatient Department
OSD	Officer on Special Duty
Pb	Lead
PFAS	Per- and poly-Fluoro Alkyl Substances
PHP	Public Health Preparedness
Q3D(R1)	ICH harmonized - Guideline for Elemental Impurities
QPEC	Quality Playing Environment for Children
R&D	Research and Development
RML	Dr. Ram Manohar Lohia Hospital
RMS	Rapid Market Survey
ROHC	Regional Occupational Health Centre
SJH	Safdarjung Hospital
SMO	Senior Medical Officer
SOP	Standard Operating Procedures
SPCB	State Pollution Control Board
STEP	Science, Technology and Environment Policy
TERI	The Energy and Resources Institute
TSIP	Toxic Site Identification Program
UCMS	University College of Medical Sciences
UNICEF	United Nations Children's Fund
USP	US Pharmacopoeia
VMMC	Vardhman Mahavir Medical College
WHO	World Health Organization
WR	WHO Representative

Executive Summary

India is facing a significant public health problem owing to exposure of chemical toxicants, which include heavy metals/non-metals, viz., Lead, Arsenic, Mercury, Chromium, Cadmium, Fluoride, other hazardous chemicals, such as dioxins, phthalates, pesticides, PFAS, microplastics, etc. Developed countries like USA, Canada, and European Union, have a Human Biomonitoring Program for assessment of human exposure to toxic chemicals and public health management of the same. A series of expert group meetings were conducted chaired by **Prof. (Dr.) Atul Goel, DGHS, MoHFW** to address the problem of Lead poisoning in India. **A Technical Working Group** constituted under the leadership of **National Centre for Disease Control (NCDC)** of the Ministry of Health and Family Welfare (MoHFW) had, in 2023, proposed a **National Biomonitoring Program for Chemical Toxicants** and establishment of a **National Surveillance System** to assess and report exposure to environmental chemicals, including heavy metals.

A **Stakeholder Engagement Workshop**, held on **14 and 15 March, 2024** at **NCDC, Delhi** deliberated on devising an action plan for establishment of the National Surveillance System, encompassing selection of target populations for biomonitoring, creation of a regional laboratory network for heavy metal testing and development of a centralized database for heavy metal exposures in India. The workshop brought together a diverse array of stakeholders involved in monitoring of chemical toxicants, including **clinicians**, **academicians**, **researchers,** and **technical experts** from the concerned departments/ ministries of the Government of India, medical colleges, hospitals, research institutions and laboratories besides NGOs active in this area. A total of **62 participants**, including **44 external experts**, attended the workshop.

Chemical toxicants, including heavy metals, because of their persistent and bio-accumulative nature, have serious health effects on humans. These can cause death, temporary incapacitation or permanent harm to humans or animals through their action on life processes. The alarming situation of heavy metal toxicity in various parts of India calls for surveillance for chemical events (acute and chronic exposures), leveraging the existing IDSP-IHIP machinery and development of a national database for mapping risk, exposure and effects of chemical toxicants through a comprehensive national health program - **National Biomonitoring Program for Chemical Toxicants** - to provide crucial data to identify potential health risks, guide policy-making decisions and enable targeted interventions to mitigate the adverse effects of heavy metal and other chemical exposures in India.

Over 27.5 crore children in India have Blood Lead Levels more than 5 micrograms/dL, which is considered unsafe. Average Blood Lead Levels in 23 states are well above the safe limit. A surveillance

system can help regularly monitor human exposure to chemical toxicants through occupational and environmental sources, enabling timely action through mitigation measures to reduce environmental contamination and chelation therapy for affected persons.

There is a need for **stakeholder engagement** and **intersectoral coordination** involving various ministries, medical colleges/hospitals, laboratories, NGOs, and international partners. This calls for establishing a coordination group at MoHFW, setting up monitoring/surveillance systems, conducting source analysis, and increasing access to therapeutic care and interventions. Integrated Health Information Portal has the potential to be used for monitoring chemical toxicants data, with clearly defined objectives, data fiduciary, reporting units, primary responders, and dedicated resources. The **World Health Organization** supported NCDC's initiatives to tackle the public health effects of significant chemical toxicants, including heavy metals.

Government of India is tackling the issues of chemical contamination of ground and surface water from natural contaminants, such as **Arsenic** and **Fluoride**. The **National Program for Prevention and Control of Fluorosis** is aimed at collecting and assessing baseline survey data of Fluorosis, comprehensive management of Fluorosis in selected areas, and capacity building for prevention, diagnosis, and management of Fluorosis cases. Similarly, **Technical guidelines for the Detection, Prevention, and Management of Arsenicosis in India** have been prepared for the States affected by **Arsenicosis**.

Lead is a persistent environmental toxin with no physiological function. Lead exposure can cause various health issues, including developmental disorders, delayed puberty, anemia, and reduced vitamin D metabolism. It results in a loss of $237 billion in GDP per year, a loss of 5% in economic growth. A **systematic review and meta-analysis** by **ICMR's Regional Occupational Health Centre at Bengaluru** showed significant DNA damage, chromosomal aberrations, and oxidative DNA damage in individuals exposed to Lead compared to unexposed groups. Occupational Lead exposure was linked to lower sperm counts, poor sperm motility, and higher serum prolactin levels, indicating detrimental effects on male reproductive function.

Measures are being taken to strengthen the Lead inventory, manage, treat, and remediate Lead exposure. Monitoring of Lead levels in children and pregnant women, developing mechanisms for collecting Lead scrap in India, and implementing regulations for air quality parameters for smelting operations form the way forward.

The **Central Pollution Control Board (CPCB)** has a comprehensive array of initiatives aimed at mitigating the exposure of chemical toxicants, particularly toxic metals, to the environment. It has set national ambient air quality standards and effluent and emission standards for specific industries to control the discharge of toxic pollutants. Under the **Central Ground Water Board (CGWB)** of the

Ministry of Jal Shakti, 16 regional chemical laboratories meticulously analyze over thirty parameters in groundwater on a routine basis; groundwater quality is monitored through 17,000 stations, which analyze over 30 parameters. Under Indian Pharmacopoeia 2022, Chapter 5.10, there are specific limits for amounts of elemental impurities in drug products.

AIIMS, New Delhi, has an ongoing study involving **21 heavy metals** to study their long-term effects. It plans to establish a foundational benchmark for heavy metal exposure within the Indian populace. **ICMR's National Institute of Nutrition, Hyderabad,** has conducted research on Fluorosis and the presence of heavy metals in commonly consumed herbal medicines. **ICMR's National Institute of Occupational Health** proposed an Analytical Methodology for Biomonitoring involving a multidisciplinary team to effectively monitor heavy metal concentrations. **CSIR's Indian Institute of Toxicology Research**, **Lucknow,** is working on Per and Polyfluoroalkyl Substances (PFAS) chemicals, their applications, and adverse effects on human health. **NIPER- Hajipur** is utilizing the ICP-MS facility to develop a method for detecting multiple elements in food products and assessing neurotoxicity and cardiovascular risks associated with Arsenic exposure in HIV patients. The ICP-MS facility at **IIT Delhi** performs heavy metal testing on biological, food, and environmental samples received from Academia, R&D labs, and Industries. The Metallurgical Engineering department at **IIT Varanasi** is working on recycling and management of electronic waste, which is a rich source of heavy metals that can pose environmental and health risks. **FSSAI's laboratory network** has equipment - ICPMS, LC-MS/MS, GC-MS/MS - for surveillance of chemical toxicants in food articles. It is also working on Polychlorinated Biphenyls (PCBs), which are regarded as hazardous chemical contaminants in food.

Indian Society for Lead Awareness & Research (InSLAR), Bengaluru is working inter alia to establish **Centers of Excellence** dedicated to screening for Lead poisoning. **Pure Earth,** from preliminary cost analyses in collaboration with the World Bank, reported that Lead mitigation interventions (eliminating Lead in spices, regulating lead-based paints, lead-free pottery, contaminated site clean-up, etc.) are highly beneficial with a good payback. **Pahle India Foundation** had supported an India Working Group on Lead Poisoning, which held its inaugural meeting in September 2023. **The Energy and Resources Institute's** (**TERI's)** studies in Uddanam region of Andhra Pradesh, where chronic kidney disease of unknown etiology (CKDu) was reported, found dietary intake levels of certain metals like Chromium and Lead significantly higher than safe recommended levels. Analysis of groundwater quality revealed high levels of Silica and Lead, potential causative agents for CKDu. These NGOs supported the idea of forming a Consortium and building an evidence base to support a comprehensive national strategy for eliminating Lead poisoning in India by 2040.

The Workshop successfully mapped stakeholders and laboratory resources involved in testing chemical toxicants and heavy metals. It identified opportunities for linkages between existing initiatives and projects related to chemical toxicants and heavy metal surveillance across India. The Collaborative Group so formed will formulate close and effective future working arrangements to avert duplication of efforts, maintain standards of quality assurance and ensure the relevance and legitimacy of the joint efforts on health-related issues of chemical toxicants.

The future action tracks planned include establishment of national database and national surveillance system for reporting exposure to chemical toxicants (including heavy metals), requirement of stringent enforcement strategies for existing regulatory policies, development, and implementation of new policies for regulation of chemical exposures and interventions, advocacy, research and development, scope of multisectoral collaborations, community engagement and capacity building.

Background

The National Biomonitoring Program for Chemical Toxicants, spearheaded by the National Centre for Disease Control (NCDC), is a pioneering initiative of the Dte.GHS, MoHFW, GoI. The budding program seeks to comprehensively address the critical issue of chemical toxin exposure within the Indian population in a phased manner, with a current focus on the assessment and monitoring of heavy metals.

Fast urbanization and industrialization have subjected Indian population to toxic exposure of hazardous chemicals and heavy metals/non-metals, such as Lead, Mercury, Manganese, Chromium, Arsenic, Fluoride, pesticides, microplastics, etc. The consequences of such exposures on public health necessitate a systematic and collaborative approach for effective monitoring, assessment, and mitigation.

Govt. of India took strict cognizance of **Lead poisoning in India**, which was reported by **UNICEF/Pure Earth** in the year **2020** in their publication titled **"The Toxic Truth".** Subsequently, a group comprising NITI-Aayog and CSIR/NEERI was constituted to undertake an in-depth review of the report and the underlying data from the Institute of Health Metrics and Evaluation (IHME). NITI-Aayog-CSIR-NEERI, in concurrence with report of UNICEF/Pure Earth and Institute of Health Metrics and Evaluation (IHME), reported that 275 million children in India (out of 800 million globally or 1 in 3) have Blood Lead Levels that are abnormally high i.e., greater than 5 micrograms per deciliter (5 µg/dl).

The **NITI-Aayog-CSIR-NEERI, 2022 report** illustrated that the states of Bihar, Uttar Pradesh, Madhya Pradesh, Jharkhand, Chhattisgarh, and Andhra Pradesh account for 40% of India's population with average Blood Lead Levels of more than 7 µg/dL, which is a cause of concern. Lead intoxication is responsible for about 2.3 Lakh premature deaths in adults in India. Moreover, owing to Lead poisoning in children, India loses $236 billion in GDP per year, i.e., approximately 5% of economic growth.

Moreover, Parliamentary Questions on **'adverse health impacts of chemical contamination of drinking water in India'** sought answers on the **number of people exposed** to health hazards due to presence of **excess Lead, Arsenic, Fluoride, Iron, salinity and Nitrate contents etc.,** in ground water; steps taken/proposed to be taken by the Government to develop efficient systems to screen population for possible chemical toxicant exposure and to **promote early diagnosis of chemical toxicity**, whether the Government considers making **screenings mandatory** for people engaged in occupations most likely to cause chemical exposures and the steps taken/proposed to be taken by the Government to **raise public awareness** about chemical toxicant poisoning, etc.

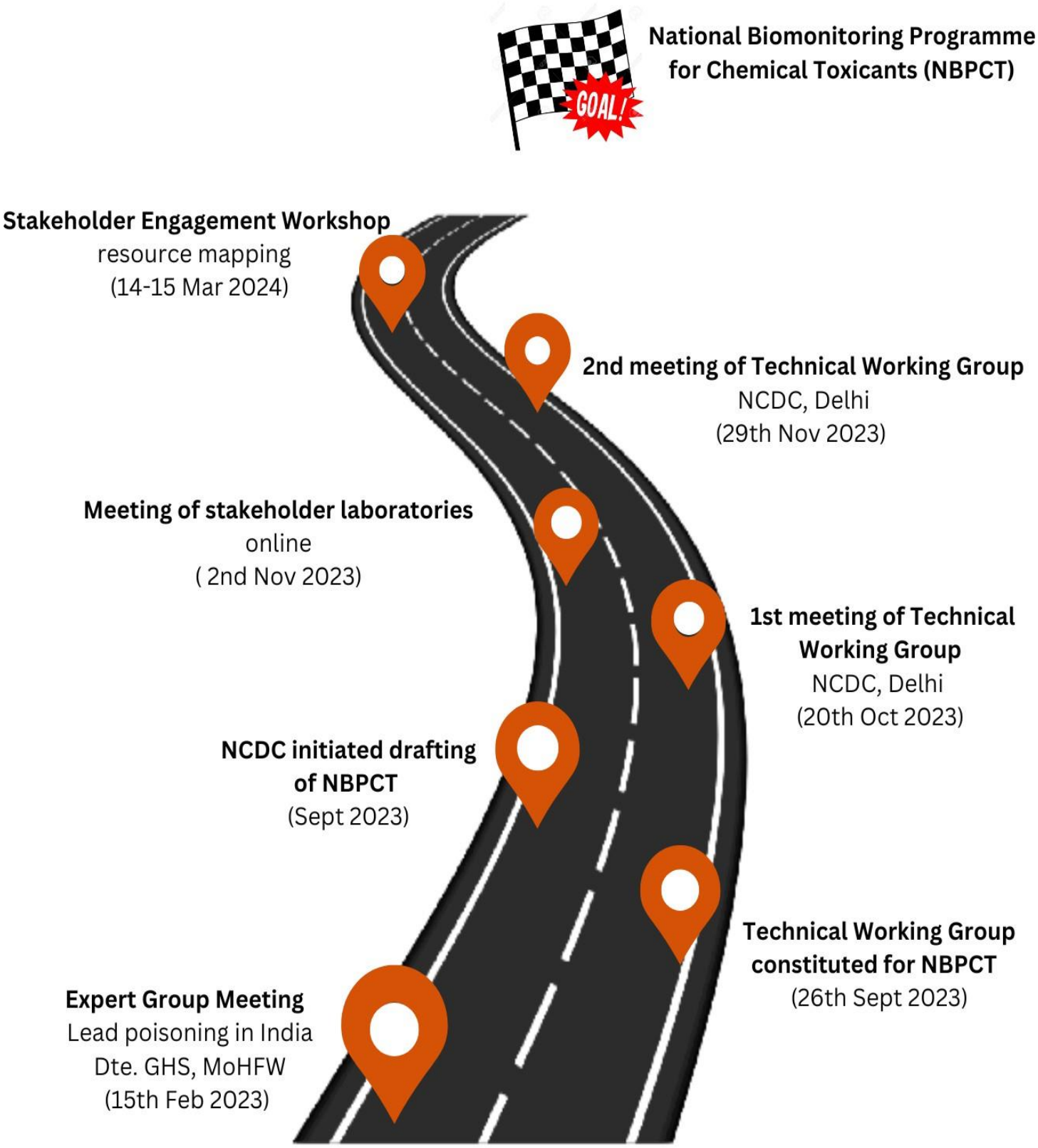
In line with countries like USA, Canada and European Union, which have a **Human Biomonitoring Program** for assessment of human exposure to toxic chemicals and public health management of the same, the current alarming situation of heavy metal toxicity in various parts of **India demands for surveillance for chemical events** (acute and chronic exposures), leveraging the existing IDSP-IHIP machinery and development of a **national database** for mapping risk, exposure and effects of chemical toxicants through a comprehensive national health program - **National Biomonitoring Program for Chemical Toxicants** to provide crucial data to identify potential health risks, guide policy-making decisions and enable targeted interventions to mitigate the adverse effects of heavy metal and other chemical exposures in India.

In above context, expert group meetings were conducted under the chairpersonship of **Prof. (Dr.) Atul Goel, DGHS, MoHFW** to address the problem of **Lead poisoning in India** followed by the constitution of a **Technical Working Group** for development and finalization of the National Program under the leadership of NCDC.

To review the initial draft of the **National Biomonitoring Program for Chemical Toxicants**, **two meetings** of the **Technical Working Group** were conducted at NCDC, Delhi in hybrid mode, including an **online meeting** with the **stakeholder heavy metal testing laboratories** for creation of a **Regional Laboratory Network**.

The 2-day **Stakeholder Engagement Workshop on the National Biomonitoring Program for Chemical Toxicants**, covered under the present report, was organized at Central Seminar Room, NCDC, Delhi from **14 - 15 March 2024** to explore opportunities for linkages between existing initiatives and projects related to chemical toxicants & heavy metal surveillance and to provide common platform for multi-sectoral stakeholder deliberations on the modalities of the **National Surveillance System** for assessing and reporting exposure to **chemical toxicants**.

PROGRESS SO FAR



Objectives

The Workshop was conducted with the following objectives:

- To map stakeholders and their areas of work in the field of chemical toxicants.
- To map laboratory resources available across different institutions involved in the testing of heavy metals and other chemical toxicants.
- To explore opportunities for linkages between existing initiatives and projects related to chemical toxicants, heavy metal surveillance, and to encourage open discussions on ongoing efforts, Challenges faced and lessons learned.

Expected Outcomes

The workshop was expected to achieve the following outcomes.

- Pan India mapping of multi-sectoral Government/ non- Government Stakeholders working towards monitoring, awareness, and management of chemical toxicants exposure.
- Pan India mapping of laboratory resources for testing heavy metals and other chemical toxicants.
- Exchange of information on existing body of work on surveillance/monitoring of heavy metals and other chemical toxicants and exploring the scope of collaborations.
- Knowledge sharing on initiatives under various Departments/Ministries of the Government of India and exploring the scope of inter-ministerial linkages

DAY 1

Inaugural Session

The **inaugural session** commenced with **Welcome Address** by **Dr. Meera Dhuria**, Joint Director, NCDC. She acknowledged the esteemed presence of **Dr. Rakesh Kumar**, OSD (Coordinator NET Zero, India), CSIR HQ and **Dr. L. Swasticharan**, Addl. DDG and Director, EMR, Dte.GHS, MoHFW, who had joined on behalf of **Prof. (Dr) Atul Goel**, DGHS, MoHFW and Director, NCDC.

The gracious presence of **Dr Anil Kumar**, Principal Advisor, NCDC**, Dr S. Venkatesh**, Former DGHS and Principal Advisor, NCDC, and representatives from EMR Division and Nutrition & IDD Cell, Dte.GHS, MoHFW, AIIMS Delhi, AIIMS Jodhpur, MAMC, LHMC, RML Hospital, Sir Ganga Ram Hospital, UCMS, CDSCO, ICMR, CSIR, NIPER, IISER, FSSAI, IIT Delhi, IIT-BHU, CPCB, CGWB, DDWS, ESIC, and non-Govt. Entities like the Indian Society for Lead Awareness and Research (INSLAR), Pure Earth, Pehle India Foundation, and The Energy and Resources Institute (TERI) were also acknowledged. The Welcome Address was followed by a brief round of introductions from the participants.

***Figure 1**. Welcome Address by Dr. Meera Dhuria, Joint Director and opening remarks by Dr. S. Venkatesh, Former DGHS & Principal Advisor, NCDC*

Inaugural Session was then addressed by **Dr. S. Venkatesh**, Former DGHS and Principal Advisor, NCDC who briefly talked about the glorious history of NCDC and its evolution as a public health institute of national importance from its inception in the British era to modern times.

Keynote address was delivered by **Dr Rakesh Kumar,** OSD (Coordinator NET Zero, India), CSIR HQ. He highlighted the significant problem of Lead exposure in India and discussed the findings of the **NITI-Aayog-CSIR-NEERI, 2022 report** on Lead toxicity in India. He stressed the fact that children absorb more Lead than adults, and there is a need for discussion on legal implications and policies for lead-acid battery manufacturers and recyclers. Dr Rakesh Kumar also emphasized that there is a requirement to develop and implement policies so that the use of Lead in paint, cosmetics, and medicines can be minimized or reduced. He concluded the address with the recommendation that there is a need to monitor Lead levels in children and pregnant women and to develop a mechanism for collecting data on the prevalence of Lead from the State and Central Pollution Control Boards, so that it can be utilized optimally.

Figure 2. *Keynote Address by Dr. Rakesh Kumar, OSD, CSIR followed by address by Dr. Anil Kumar, Principal Advisor, NCDC*

Dr. Anil Kumar, Principal Advisor, NCDC, stressed the need to develop a **National Surveillance System** for chemical toxicants in India. He called for the sharing of information and collective data generation on chemical toxicants involving all the stakeholders. He recommended stepwise execution of setting up the surveillance system, starting with cases of Lead intoxication. Once the surveillance system is established for Lead, it could be expanded to other chemical toxicants. He appreciated the efforts of the **Division of Public Health Preparedness and Non-Communicable Diseases**, NCDC, towards organizing the workshop and providing a common platform to diverse stakeholders to interact, deliberate, and act collectively towards the cause.

Dr. L. Swasticharan, Addl. DDG and Director, EMR, Dte.GHS, MoHFW delivered the inaugural address and discussed responsibilities in managing programmes related to Non-Communicable Diseases (NCDs). He stressed the importance of preventive measures for chronic conditions like diabetes and hypertension. He mentioned that despite challenges in motivating individuals for regular check-ups, efforts are being made

through community checklists and referrals to identify and treat those at risk. He highlighted the deceptive tactics by the tobacco industry, which use addictiveness, attractiveness, and toxicity of tobacco products to target vulnerable populations.

Figure 3. *Inaugural Address by Dr. L. Swasticharan, Addl. DDG and Director, EMR, Dte.GHS, MoHFW*

Dr. Swasticharan emphasized the need for public health specialists to counter these tactics with scientific evidence, proper interpretation, risk communication, and collaboration. He called for preparedness in hospitals and the provision of medical care for chronic diseases, including those of chemical origin, underscoring the need for collaboration and preparedness, and expressed a belief that the NCDC could play a pivotal role in surveillance, prevention, and management of such disease conditions.

A Vote of Thanks was proposed by **Dr Garima Srivastava,** Deputy Assistant Director, NCDC, Delhi.

Figure 4. *Group Photograph with all stakeholders of the National Biomonitoring Program for Chemical Toxicants*

Introductory Session: Why India needs National Biomonitoring Program for Chemical Toxicants?

❖ Overview of the National Biomonitoring Program for Chemical Toxicants: Opportunity for setting up a surveillance system for chemical toxicants

Dr. Meera Dhuria, Joint Director, NCDC, Delhi.

- **Background**: Highlighted the persistent and bio-accumulative nature of chemical toxicants, including heavy metals and their serious health effects on humans. Emphasized the need for regular monitoring of human exposure to chemical toxicants and mitigation measures to reduce environmental contamination.
- **Global and Indian Perspective**: Provided a global perspective on Lead exposure and its impact on public health. Mentioned that India has over 275 million children with Blood Lead Levels more than 5 micrograms/dL, which is considered unsafe.
- **Need for a Surveillance System**: Underscored the need for a surveillance system to monitor the population exposed to chemicals through occupational and environmental sources.
- **Existing Surveillance Systems**: Mentioned about globally existing surveillance systems, such as the National Biomonitoring Program by CDC, WHO Global Surveillance and Monitoring System, Environmental health (Lead) surveillance system in Georgia and Lead Exposure in Children Surveillance System (LEICSS) in the UK.
- **Way Forward**: Proposed the establishment of a coordination group at MoHFW, setting up monitoring/surveillance systems, conducting source analysis, increasing access to therapeutic care and interventions for contaminated spices, Lead-acid battery recycling, cookware, cosmetics, paints, herbal medicines, and toys.
- **Stakeholder Engagement**: Discussed the need for stakeholder engagement and intersectoral coordination involving various ministries, medical colleges/hospitals, laboratories, NGOs, and international partners.

***Figure 5**. Presentation of overview of the proposed National Biomonitoring Programme for Chemical Toxicants by Dr. Meera Dhuria, Joint Director, NCDC*

❖ National Program for Prevention and Control of Fluorosis (NPPCF) in India

Dr BS Charan ADG, Nut. & IDD Cell, Dte.GHS, MoHFW

- **Background**: Fluorosis is a public health problem caused by excess intake of Fluoride through drinking water, food products, and industrial pollutants over a long period. It results in major health disorders like Dental Fluorosis, Non-Skeletal Fluorosis, and Skeletal Fluorosis.
- **Goals and Objectives**: The NPPCF aims to prevent and control Fluorosis cases in the country. The objectives include collecting and assessing baseline survey data of Fluorosis, comprehensive management of Fluorosis in selected areas, and capacity building for prevention, diagnosis, and management of Fluorosis cases.
- **Strategy**: The strategy includes surveillance of Fluorosis in the community, capacity building, establishment of diagnostic facilities in hospitals, management of Fluorosis cases, including treatment, surgery, rehabilitation, and health education for prevention and control of Fluorosis cases.
- **Activities**: The activities include community diagnosis of Fluorosis, facility mapping, gap analysis in facilities, diagnosis of individual cases, and providing its management, behavior change by IEC, and training.
- **Assistance Provided to States**: The assistance provided to states includes strengthening manpower in endemic districts, purchase of equipment for labs, training at various levels, health education and publicity, treatment including reconstructive surgery and rehabilitation, and financial assistance for survey/resurvey of districts.

Figure 6. *Dr. B S Charan, ADG delivered talk on initiatives of GoI against Arsenicosis and Fluorosis*

❖ Assessment of Lead Impact on Humans and India's Response

Dr Rakesh Kumar, OSD (Coordinator, NET Zero, India), CSIR HQ, Delhi

- **Lead Exposure**: Highlighted the persistent and bio-accumulative nature of Lead, its presence in various sources like industries, household products, recycling, and potteries. Emphasized the health impacts of Lead exposure, particularly on children and pregnant women, with a significant percentage showing elevated Blood Lead Levels.

- **Health Impacts**: Lead exposure can cause various health issues, including developmental disorders, delayed puberty, anemia, and reduced vitamin D metabolism. He also mentioned that India loses $237 billion in GDP per year, which accounts for a loss of 5% in economic growth due to Lead exposure.

- **Sources and Linkages to Exposure**: Discussed the various sources of Lead exposure and their linkages, including industries, domestic products, recycling, and potteries. Talked about the bioaccumulation of Lead in food, air, soil, and water bodies.

- **Way Forward**: Proposed several steps to strengthen the Lead inventory, manage, treat, and remediate Lead exposure. He strongly recommended monitoring of Lead levels in children and pregnant women, developing mechanisms for collecting Lead scrap in India, and implementing regulations for air quality parameters for smelting operations.

Figure 7. *Dr. Rakesh Kumar, OSD, CSIR presented on "Assessment of Lead Impact on Humans and India's Response"*

Suggested Action Points

Introductory Session

- A finer understanding of policies is needed for Lead (Pb)-acid batteries manufacturers and recyclers [New Battery Waste Management Rules, 2022]
- Discussion is needed to address laws and policy for informal recycling sectors.
- Enforce legislation regulating E-waste recycling and proper formal recycling.
- Develop and implement policies to exclude the use of Pb in paints, ceramic potteries, cosmetics, and medicines.
- Implement regulations for air quality parameters for smelting operations.
- Pb parameters are to be included in national drinking water quality standards.
- Steps for effective management to minimize the negative impact of Pb.
- Education and awareness among the public to understand Pb toxicity and its human health impact.
- Remediation of Pb-contaminated areas/sites, installing cloth barriers.
- Encourage the usage of non-Pb composites in paint production.
- Assessments at the local level to identify the source of Pb exposure.
- Pregnant women should avoid residing in a living space undergoing renovation.
- Regular hand wash to avoid penetration of clogged or accumulated Pb through skin tissues.
- To flush drinking water pipelines for 15-20 seconds to minimize Pb exposure
- Need to monitor Pb levels in children and pregnant women, which will determine the main sources of Pb causing high exposures and then ensure its management.
- To develop mechanisms for collecting Pb scrap in India for scientific reprocessing in an eco-friendly manner.
- Developing cost-effective and long-lasting technologies for recycling activities.
- Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs) to organize awareness programs for Pb recyclers.
- Practice of using pollution controlling equipment and environmentally pleasant processes (advanced novel smelting processes) by Pb recyclers.
- To take other control measures like air quality improvement methods, health inspection, equipment protection, and excellent hygienic practices.
- To introduce the concept of life cycle assessment (cradle to grave) before the implementation of the project.
- Field-scale mitigation and precautionary measures need to be taken.

Technical Session 1: Chemical toxicants- Surveillance, health effects and strategies for mitigation

Chaired by Dr. Anil Kumar, Principal Advisor, NCDC
Co-chaired by Dr. AK Sharma, Director Professor, Community Medicine, UCMS, Delhi

❖ Clinicians' perspective of Adult Exposure of Lead

Prof. (Dr.) Anil Arora, Chairman, Institute of Liver Gastroenterology & Pancreatic - Biliary Sciences, Sir Ganga Ram Hospital Delhi delivered his talk on role of Lead and other heavy metals in disease etiology. He talked about various sources of Lead, such as soil, bullets, fishing sinkers, stainless glass windows, toys, jewelry, etc. He also discussed pathophysiology of Lead, activities leading Lead exposure, including occupational exposures. He further mentioned clinical symptoms of Lead toxicity and effects of Lead on various tissues of the body and its management.

Key Points:

- Lead is a persistent environmental toxin with no physiological function.
- Lead exposure can cause a range of health issues, including developmental disorders, delayed puberty, anemia, and reduced vitamin D metabolism. It is particularly harmful to children and pregnant women.
- Provided a brief account of cases of suspected heavy metal toxicity presented in the OPDs and the main symptoms of such cases.
- Proposed several steps to manage and remediate Lead exposure, including monitoring Lead levels in children and pregnant women, developing mechanisms for collecting Lead scrap in India and implementing regulations for air quality parameters for smelting operations.

Figure 8. *Dr. Anil Arora, Professor, Sir Ganga Ram Hospital, Delhi*

❖ Clinicians' perspective of Pediatric Exposure of Lead

Dr. Sheffali Gulati, Professor, Child Neurology, AIIMS New Delhi delivered a talk on 'Role of Lead and other heavy metals in disease etiology: Clinicians perspective of Pediatric Exposure'. She mentioned various studies that are being carried out in India on heavy metals and human disease. She mentioned that the prevalence of Cancer, Autism and Dementia is increasing in the country and long-term effects of heavy metals are not known. Ongoing study involving 21 heavy metals in AIIMS, Delhi will further enhance the knowledge in the field in coming days.

Key Points:

- Lead is affecting both children and adults.
- Various studies on heavy metals and human disease are being carried out.
- The prevalence of cancer, autism and dementia is increasing in children.

***Figure 9**. Dr. Sheffali Gulati, Professor Child Neurology, AIIMS New Delhi*

❖ Toxic chemicals- induced diseases: preparedness and management

Dr. Lokesh Sharma, Associate Professor, Biochemistry, Dr. RML Hospital, Delhi delivered a presentation on 'Toxic chemicals- induced diseases: preparedness and management'. He presented a case report on suspected Mercury poisoning from the department of Nephrology.

Key Points:

- **Case Report**: A case of suspected Mercury poisoning was reported by the Department of Nephrology. The patient was taking Ayurvedic Medicines for some illness and presented with chronic kidney disease.

- **Heavy Metal Poisoning**: Mentioned that the commonly encountered heavy metal poisonings are related to Lead, Mercury, Arsenic and Cadmium. Confirming the diagnosis of elemental/heavy metal toxicity is difficult because signs and symptoms are like those of many non-elemental diseases however there is no central registry for such cases in their institute.
- **Analytical Method**: Inductively coupled plasma- mass spectrometry (ICP-MS) is the method of choice for estimation of chemical toxicants in the sample.
- **Treatment**: Discussed the treatment of chronic Lead poisoning, chronic metal exposure, chronic Mercury poisoning, chronic Arsenic poisoning, and Cadmium poisoning. Chelation therapy with various agents is recommended for treatment.

Figure 10. *Dr. Lokesh Sharma, Associate Professor, Dr. R.M.L Hospital, Delhi*

Dr Sujata Sarabahi, Professor, Consultant and Head, Department of Burns and Plastic Surgery, VMMC and Safdarjung Hospital, New Delhi in her talk mentioned various cases of accidental exposure to chemical toxins. She mentioned about the explicit use of various chemicals, including acids, alkalis, organic and inorganic compounds across various industries and its consequences amongst exposed individuals.

Key Points:

- **Toxic Chemicals**: Defined toxic chemicals as any chemical, which can cause death, temporary incapacitation or permanent harm to humans or animals through its action on life processes.
- **Accidental Disasters**: Discussed the exposure to toxic chemicals through accidental means, such as industries, laboratories, domestic use, and use of firecrackers.
- **Impact of Chemical Disasters**: Highlighted the impact of chemical disasters, including loss of life, impact on livestock, flora and fauna and environment.
- **Uses of Chemicals**: Listed the uses of various types of chemicals including acids, alkalis, organic compounds, and inorganic agents.

- **Degree of Damage**: Explained that the degree of damage caused by chemical exposure depends on the concentration, duration of contact and mechanism of action.
- **First Aid and Hospital Management**: Provided guidelines for first aid and hospital management for chemical exposure, including washing with water, removing clothes, and taking the patient to the hospital.
- **Prevention of Chemical Burns**: Discussed the general precautions for preventing chemical burns, such as safe storage, protective clothing, banning unauthorized sale of chemicals and banning firecrackers sale to individuals.
- **Manmade Disasters**: Discussed the Standard Operating Procedure (SOP) for Management of Chemical Disaster.

Figure 11. *Dr Sujata Sarabahi, Consultant, VMMC and Safdarjung Hospital, New Delhi*

Dr. Preeti Chauhan, Professor, Biochemistry, LHMC, Delhi elaborated on various media reports on heavy metals that have come out in the recent past.

Key Points

- **Heavy Metal Toxicity**: Defined heavy metal poisoning as the accumulation of heavy metals, in toxic amounts, in the soft tissues of the body. The heavy metals most associated with the poisoning of humans are Lead, Mercury, Arsenic and Cadmium.
- **Health Impacts**: Heavy metal poisoning can cause a range of health issues, including developmental disorders, delayed puberty, anemia and reduced vitamin D metabolism. It is particularly harmful to children and pregnant women.
- **Sources of Exposure**: Discussed various sources of exposure to heavy metals, including industries, household products, recycling, and potteries.

- **Treatment**: Discussed the treatment of chronic Lead poisoning, chronic Mercury poisoning, chronic Arsenic poisoning and Cadmium poisoning by use of chelation therapy with various agents.

Figure 12. *Dr. Preeti Chauhan, Professor Biochemistry, LHMC, Delhi*

❖ Opportunities for integrating chemical toxicity surveillance data into the Integrated Disease Surveillance Program (IDSP) and Integrated Health Information Platform (IHIP) in India

Dr Himanshu Chauhan Joint Director NCDC delivered his talk on the requirement of chemical toxicity surveillance data and its integration into the Integrated Disease Surveillance Program (IDSP) and Integrated Health Information Platform (IHIP).

- **Integrated Health Information Platform (IHIP)**: IHIP is a health information system that offers real-time, case-based information, integrated analytics, AI tools integration capability, advanced visualization capability, auto-generated reports for programmatic action and integrate information from multiple sources.
- **National Health Programmes on IHIP**: Mentioned that several national health programmes integrated into IHIP, including Integrated Disease Surveillance Program, Guinea Worm Eradication Program, National One Health Program for Prevention & Control of Zoonoses, National Malaria Elimination Program, Kala Azar Control Program and National Filaria Control Program.
- **Challenges**: Discussed several challenges in using IHIP for chemical toxicants data, including clearly defined objectives, data fiduciary, reporting units, primary responders, and dedicated resources.

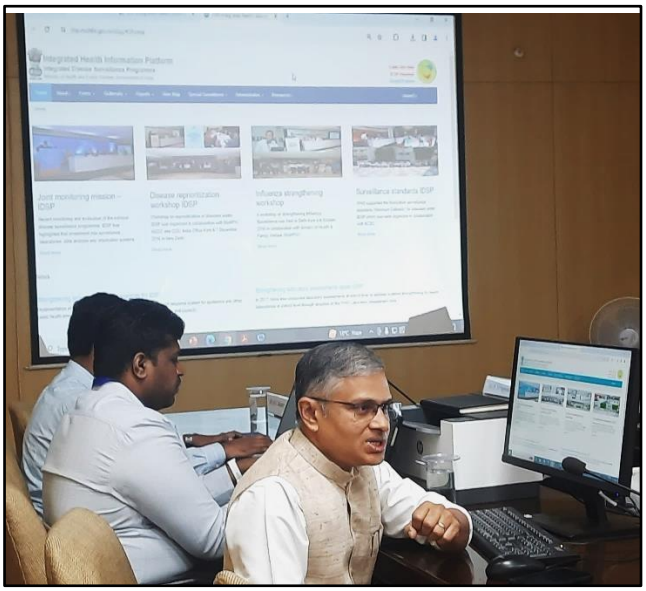


Figure 13. *Dr. Himanshu Chauhan, Joint Director, NCDC*

❖ Strategies to control heavy metal contamination in pharmaceuticals: Significance for human health:

Mr. Sunil Kulshrestha, Deputy Drugs Controller (India), CDSCO in his presentation mentioned various Central and States responsibilities under 'Drugs and Cosmetics Act and Rules'. He further elaborated that under Indian Pharmacopoeia 2022, Chapter 5.10 there are specific limits for amounts of elemental impurities in drug products.

Key Points:

- **Drugs and Cosmetics Act and Rules**: The objective of the Act and Rules is to ensure safety, efficacy and quality of drugs, biologicals, medical devices, cosmetics and veterinary drugs.
- **Elemental Impurities in Pharmaceuticals**: Elemental impurities in drug products may arise from several sources; they may be residual catalysts that were added intentionally in synthesis or may be present as impurities.
- **Drugs & Cosmetics Act & Rules**: Discussed the standards for drugs as per the Drugs & Cosmetics Act & Rules. The standards for identity, purity and strength shall be those as may be specified in the edition of the Indian Pharmacopoeia for the time being in force.
- **IP 2022**: As per General Tests, Chapter 5.10 for Elemental impurities specify limits for amounts of elemental impurities in drug products. Compliance with the limits specified is required for all drug products.
- **ICH Harmonized guideline for elemental impurities Q3D(R1)**: The elements included in this guideline have been placed into three classes based on their toxicity and likelihood of occurrence in the drug product.
- **USP 39**: It mentions USP 39 which includes Elemental Impurities Limits, Elemental Impurities-Procedures, Aluminum, Arsenic, Lead and Mercury.
- **Cosmetics Rules, 2020**: It specifies the standards of cosmetics, and the permitted synthetic organic colors and natural organic colors used in cosmetic products.

***Figure 14**. Mr. Sunil Kulshrestha, Deputy Drugs Controller (India), CDSCO*

Dr. AK Sharma, Director Professor, Community Medicine, UCMS, and Delhi co-chair summarized the Technical Session 1 by mentioning the importance of data generation and the need for central coordinating agency and common dashboard for chemical toxicants and the need for development of integrated surveillance mechanism.

***Figure 15**. Dr. AK Sharma, Director Professor, Community Medicine, UCMS, Delhi*

Suggested Action Points

Technical Session 1

- Sharing data from society of gastroenterologists to NCDC, for the creation of a database on heavy metals.
- Leveraging professional bodies for cross sharing of data.
- Cord blood and early childhood blood can be studied to find out baseline Lead level.
- Study to find out Lead level from hair can also be planned to find out chronic Lead exposure as long term effects of heavy metals are not known.
- Safe storage of chemicals to minimize exposures to humans.
- Protective clothing while handling the chemicals.
- To ban unauthorized sale of chemicals and firecrackers to individuals.
- IEC activities among workers and families working in chemically exposed environment.
- Formulation of decontamination zones and Preparedness about chemical disaster in hospital including Decontamination zone.
- Establishment of testing facility at medical college like LHMC for estimating heavy metals.
- The use of Lead and Arsenic compounds for the purpose of coloring cosmetics to be prohibited.
- There should be limited use of cosmetics to prevent Lead exposure.
- Screening method for detection of Lead can also be used.
- ICP-MS is the method of choice for estimation of chemical toxicants like Lead.
- Establishment of ICP-MS machine for detection of heavy metals at hospitals.
- Other heavy metals like Arsenic, Mercury, Cadmium can also be measured as limited availability of chelating agent.
- **Need for Surveillance System**: Highlighted the need to develop a facility for estimation of toxic elements, a central registry for reporting and documentation. At least, tertiary care centers should have chelating agents readily available for management of toxicity.
- **Using IHIP for Chemical Toxicants Data**: Proposed using IHIP for chemical toxicants data through a special surveillance module, data from patients, food items, material, environment, repository of information & resources, public information dashboards, joint trainings, simulations & response, event-based surveillance and integration of data from multiple sources.

Technical Session 2: Initiatives undertaken by pertinent organizations in tackling chemical toxicants and creating awareness thereof

Chaired by Dr. Sunil Kumar, Principal Consultant, NCDC
Co-chaired by Ms. Payden, Deputy WR, WCO, India

❖ WHO's perspective on Lead: Remarks from the Co-chair

Ms. Payden, Deputy WR, WCO, India delved into the topic of WHO's perspective on Lead and embraced the initiative of the National Centre for Disease Control (NCDC) to tackle the public health effects of significant chemical toxicants, including heavy metals. She congratulated NCDC for taking this important initiative and reiterated WHO's commitment to work with NCDC to take the agenda forward.

Key Points

- **Identification of hotspots:** Setting up surveillance for Lead exposure starting with vulnerable groups by utilizing appropriate screening methods.
- **Advocacy:** For limiting Lead pollution with key stakeholders.
- **Health system preparedness:** Consider adding more antidotes (currently only one) for Lead poisoning in the national essential medicines list.
- **Laboratory capacity:** Augmenting existing laboratory resources for testing for BLL.
- **Strengthening of poison centers:** To support Lead-related acute health events. Study visits to Thailand poison centers can be explored if needed.
- **Data integration in IHIP:** WHO shall support the integration of data available with multiple agencies.

Figure 16. *Ms. Payden, Deputy WR, WCO, India presented WHO's perspective on Lead toxicity*

❖ Ongoing efforts of InSLAR and its partners to achieve Lead safe environment

Dr Venkatesh Thuppil, Chairman, (InSLAR), Bengaluru, explained about Blood Lead levels among children in India for the past 24 years, shedding light on the critical issue of childhood Lead exposure.

Key Points

- **Health Impacts**: Lead exposure can cause various health issues, including developmental disorders, delayed puberty, anemia and reduced vitamin D metabolism.
- **Sources and Linkages to Exposure**: Discussed the various sources of Lead exposure and their linkages, including industries, domestic products, recycling, and potteries.
- **Steps Taken at InSLAR**: The session provided valuable insights into the issue of Blood Lead levels among children in India over the past 24 years, emphasizing the significance of projects initiated by InSLAR, such as **Project 797, Project LEAD-ER, Project QPEC and Project STEP.**
- **Economic Damage**: Estimated reduced cognitive potentials (loss of IQ points) due to preventable childhood Lead exposure equal to 98.2 million points in Africa, 283.6 million in Asia and 24.4 million in Latin America/Caribbean, which translate into economic losses equal to $134.7, $699.9, and $142.3 billion annually.

Figure 17. *Dr. Venkatesh Thuppil, Chairman, (InSLAR), Bengaluru presented on ongoing efforts to achieve Lead safe environment*

Dr Praveen Sharma, President, Ex-Prof. Biochemistry, AIIMS Jodhpur presented his topic on 'Ongoing efforts of InSLAR' and its partners to achieve Lead safe environment. During his presentation, Dr. Sharma elaborated on the mission and objectives of the Institute for Sustainable Lead Abatement and Remediation (InSLAR).

Key Points

- **InSLAR's Mission and Goal**: InSLAR aims to disseminate relevant information on toxic metals, particularly Lead poisoning, to government authorities, NGOs, clinicians and other concerned

institutions. It also aims to create awareness among the public through education, documentation and media communication.

- **InSLAR's Objectives**: InSLAR plans to establish centers of excellence dedicated to screening for Lead poisoning, provide information to clinicians treating Lead poisoning cases, organize training programs, recommend policies to protect Lead-based industries and its employees and create public awareness through media, publications, and outreach programs.
- **InSLAR's Activities**: InSLAR conducts Lead awareness/advocacy programs in communities, colleges, and schools. It also organizes workshops and conferences and has developed a Lead awareness pamphlet for schools.
- **Facilities for Screening and Research**: InSLAR provides facilities for blood Lead estimation by Lead Care II analyzer and atomic absorption spectrometry at AIIMS Jodhpur.
- **Research Undertaken**: Several research studies have been conducted on Lead toxicity, its impact on health and its presence in the environment.

Figure 18. *Dr Praveen Sharma President, Ex-Prof. Biochemistry, AIIMS Jodhpur*

Dr Girdhar J Gyani, DG, Association of Health Care Provider, articulated the ongoing endeavors of InSLAR and its collaborative partners towards the attainment of a Lead-safe environment during his discourse.

Key Points

- He underscored the imperative for stringent regulatory measures and robust enforcement mechanisms concerning Lead levels in commodities such as toys, cosmetics and paints.
- Moreover, he emphasized the criticality of investing in infrastructure devoid of Lead and advocated for extensive public health awareness initiatives aimed at educating communities about the perils associated with Lead exposure and empowering them with actionable steps to mitigate risks effectively.
- He concluded by advocating for the implementation of Extended Producer Responsibility (EPR) Programs, which would entail manufacturers assuming accountability for the entire lifecycle of their products, encompassing responsible disposal practices.

Figure 19. *Dr. Girdhar J Gyani, DG, Association of Health Care Providers*

❖ Measures undertaken by prominent NGOs to promote safety and awareness against Lead and other heavy metals.

Mr. Sandeep Dahiya, Director Advocacy & Communications, Pure Earth, during the ongoing session on the concerted efforts of the International Lead Poisoning Prevention Awareness and Response (InSLAR) initiative and its collaborative partners towards achieving a Lead-safe environment.

Key Points

- **Lead Contamination**: Discussed major sources of Lead contamination, such as adulterated spices, informal battery recycling and non-compliant formal recyclers. It emphasizes the need for surveillance and reporting exposure to toxic chemicals to local health departments and NGOs.
- **Safety and Awareness**: Strategies to promote safety and awareness against chemical poisoning include Lead remediation projects, diverse communication channels like comic books and social media and stakeholder engagement workshops.
- **Intervention Cost-Effectiveness**: Preliminary cost analyses conducted by Pure Earth and the World Bank suggest that Lead mitigation interventions (eliminating Lead in spices, regulating Lead based paints, lead free pottery, contaminated site clean-up, etc.) are highly beneficial with a good payback. Outlined a five-step solution strategy by Pure Earth for addressing Lead contamination:
  - *Set up a Lead Consortium:* This involves bringing together key actors who can contribute to the solution. The consortium could include experts from various fields, government representatives, non-governmental organizations, and community leaders.
  - *Bolster Programs with Sufficient BLL Data*: Blood Lead Level (BLL) data is crucial for understanding the extent of Lead exposure in a community. By collecting and analyzing this data, programs can be designed and implemented more effectively.
  - *Source Analysis*: This involves identifying the sources of Lead contamination. It mentions the use of tools like the health-Based Intervention Assessment (HBIA), Rapid Market Survey (RMS) and Toxic Site Identification Program (TSIP) for this purpose.

- *Strengthening Stakeholder Capacity*: This step focuses on enhancing the ability of both governmental and non-governmental stakeholders to tackle the issue. This could involve training, resource allocation and policy development.
- *Develop Cost-Effective Risk Mitigation Interventions*: The final step is to design and implement interventions that can mitigate the risk of Lead exposure in a cost-effective manner. This could involve remediation projects, awareness campaigns and policy changes.

Figure 20. *Mr. Sandeep Dahiya, Pure Earth*

Dr. Ravi Pokharna, Executive Director, Pehle India Foundation in his talk mentioned the first 'High Level Roundtable on A World Free of Lead Poisoning' which was held in April 2023, chaired by Shri Rajesh Bhushan, the Health Secretary, saw the establishment of the India Working Group on Lead Poisoning, marking a significant step towards addressing this pressing issue. Subsequently, the inaugural meeting of this working group took place on September 13, 2023.

Key Points

- **Lead Poisoning in India**: Presentation reported that 51% of Indian children have high Blood Lead Levels (BLLs), with average BLLs in 23 states well above the safe limit. It compares this to only 2.5% of children in the US with elevated BLLs.
- **Sources of Contamination:** Common sources of Lead poisoning in India, including adulterated spices, cosmetics, Ayurvedic medicines, ceramic glazes, Leaded paint and unsafe battery recycling sites.
- **Stakeholder Engagement**: A high-level roundtable and the formation of the India Working Group on Lead Poisoning, emphasizing the need for collaboration among various stakeholders to address the issue.
- **Strategic Actions** Outlined key strategic actions, such as awareness surveys, pilot workshops and research studies aimed at building an evidence base to support a comprehensive national strategy for eliminating Lead poisoning in India by 2040.

Figure 21. *Dr. Ravi Pokharna, Pahle India Foundation*

Dr. Varada Madge, The Energy and Resources Institute elaborated on several key findings derived from TERI's study on heavy metal presence in Srikakulam district of Andhra Pradesh. In addition to outlining these findings, she underscored several crucial recommendations put forth by TERI.

Key Points

- **Uddanam Nephropathy**: Discussed the high prevalence of chronic kidney disease of unknown etiology (CKDu) in the Uddanam region, Andhra Pradesh, affecting 40-60% of agricultural workers.
- **Heavy Metal Contamination**: Highlighted heavy metals like Chromium, Lead and Manganese as suspected causes of CKDu, entering the food chain through contaminated irrigation water, industrial effluents, and pesticides.
- **Dietary Intake Study**: TERI conducted studies assessing heavy metal intake via diet in the Uddanam region, finding intake levels of certain metals like Chromium and Lead significantly higher than safe recommended levels.
- **Groundwater Analysis**: Another study under the STOP CKDu project analyzed groundwater quality, revealing high levels of silica and Lead, which are potential causative agents for CKDu.

Figure 22. *Dr. Varada Madge, The Energy and Resources Institute*

Suggested Action Points

Technical Session 2

- **Identification and Surveillance:**
  - Identify Lead exposure hotspots and prioritize screening for vulnerable groups.
  - Augment labs for testing Blood Lead Levels (BLL).
  - Strengthen poison centers and consider study visits to learn from others.
- **Data Integration and Utilization:**
  - Support data integration in relevant systems.
  - Utilize portable devices for Lead content determination in surveillance activities.
- **Information Dissemination:**
  - Establish a dedicated online platform for InSLAR's initiatives and research findings.
  - Host periodic webinars or seminars for broader stakeholder engagement.
- **Regulation and Enforcement:**
  - Enhance regulations to monitor and control Lead levels in consumer products.
  - Implement stringent enforcement mechanisms, including inspections and penalties for non-compliance.
  - Encourage investment in Lead-free infrastructure development.
- **Awareness and Advocacy:**
  - Launch comprehensive awareness campaigns targeting communities.
  - Advocate for Extended Producer Responsibility (EPR) programs.
  - Advocate for policy reforms and stricter regulation of Lead-containing products and industries.
- **Collaboration and Capacity Building:**
  - Encourage interdisciplinary collaboration among stakeholders.
  - Facilitate community engagement initiatives.
  - Strengthen healthcare professionals' and policymakers' capacity through training programs.
- **Research and Development (R&D):**
  - Allocate resources towards R&D of Lead detection and remediation technologies.
  - Prioritize biomarker assessments to gauge environmental contaminant levels.
  - Promote customized agricultural practices and diversification of crops to minimize contamination pathways.
- **International Cooperation:**
  - Foster international cooperation and exchange of best practices.
  - Develop comprehensive maps to identify high-risk geographical areas.

Technical Session 3: Initiatives under various Departments/Ministries, GoI and scope of inter-ministerial linkages for management of exposure to chemical toxicants

Chair: Dr. Anil Kumar, Principal Advisor, NCDC

Co-chair: Dr. Aakash Shrivastava, Additional Director, NCDC

❖ Central Pollution Control Board (CPCB), Ministry of Environment, Forest & Climate Change

Mr. B. K. Jena, Scientist D, Instrumentation Laboratory, CPCB, Delhi delineated a comprehensive array of initiatives aimed at mitigating the exposure of chemical toxicants, particularly toxic metals, to the environment.

Key Points

- **CPCB's Role**: The Central Pollution Control Board (CPCB) is a statutory organization under The Water (Prevention and Control of Pollution) Act, 1974, with extended functions under The Air (Prevention and Control of Pollution) Act, 1981. It serves multiple roles including regulatory, technical advisory, coordination, leadership and as an information source.
- **Initiatives**: CPCB has undertaken various initiatives to curb exposure to chemical toxicants, including sector-specific standards for industries, extensive monitoring networks, river basin studies like the Ganga Action Plan and implementation of the National Clean Air Program (NCAP).
- **Standards and Rules**: List national ambient air quality standards and effluent and emission standards for specific industries, such as dye and dye intermediate industry, petroleum oil refinery and electroplating industries, to control the discharge of toxic pollutants.
- **Drinking Water Standards**: Include drinking water standards as per IS 10500:2012, detailing acceptable limits for various toxic heavy metals like Lead, Arsenic, Mercury, and Chromium.

Figure 23. *Mr. B. K. Jena, Scientist D, CPCB*

❖ Central Ground Water Board (CGWB), Ministry of Jal Shakti

Mr. DN Mondal, Scientist D, Central Ground Water Board, Ministry of Jal Shakti, in his discussion pertained to the diverse array of regional chemical laboratories under the purview of the Central Ground Water Board (CGWB), strategically dispersed throughout the nation. It was noted that these facilities meticulously analyze over thirty parameters in groundwater on a routine basis. Furthermore, there was deliberation on the prospect of facilitating data exchange between CGWB and the National Centre for Disease Control (NCDC) specifically concerning groundwater contamination by heavy metals. Key points highlighted in the presentation mentioned below:

- **CGWB's Role**: The Central Ground Water Board (CGWB) operates under the Ministry of Jal Shakti and has 16 Regional Chemical Laboratories across India, with 11 being NABL accredited. These labs are equipped with various instruments to analyze groundwater quality.
- **Groundwater Monitoring**: CGWB conducts groundwater quality monitoring through 17,000 stations, analyzing over 30 parameters including pH, EC, TDS, major ions, trace and radioactive elements. Special monitoring is done for areas with contaminants like Arsenic, Uranium, Lead, etc.
- **Data Sharing**: Groundwater quality reports are shared annually in the public domain and with authorities for corrective action. The data includes trend analysis and details of sampling points.
- **Contaminant Impact and Management**: Discussed the health and ecological impacts of Arsenic, iron and Uranium in groundwater and outlined management options like alternative water sources, removal processes and public awareness programs.

***Figure 24**. Mr. DN Mondal, Scientist D, presenting his talk on Central Ground Water Board's initiatives*

Suggested Action Points

Technical Session 3

- **Public Awareness Campaigns:**
  - Bolster public awareness campaigns regarding the importance of compliance with environmental regulations to enhance the efficacy of CPCB's initiatives.
- **Technological Investment:**
  - Invest in cutting-edge technologies for real-time monitoring and data analysis to bolster CPCB's ability to promptly address emerging environmental challenges.
- **Collaboration and Innovation:**
  - Foster collaboration with academic institutions and industry stakeholders to facilitate the development of innovative solutions for sustainable environmental management.
- **Groundwater Management and Monitoring:**
  - Prioritize the optimization of data sharing mechanisms with NCDC to enhance the efficacy of groundwater management and monitoring by CGWB.
  - Augment the capacities of regional laboratories to encompass comprehensive testing protocols for heavy metals, fortifying the nation's capabilities in identifying and addressing groundwater quality concerns.
  - Foster a culture of cross-institutional collaboration and data sharing among relevant stakeholders to promote synergy and holistic approaches to groundwater resource management.

DAY 2

Technical Session 4: Scope of collaboration with stakeholder laboratories

Dr. Anil Kumar, Principal Advisor, NCDC
Co-chair: Dr. Venkatesh Thuppil, Chairman, (InSLAR), Bengaluru

❖ ICMR (Lead poisoning in India: Insights from systemic review and meta-analysis)

Dr. B. Ravichandran, Scientist E, Regional Occupational Health Centre (ROHC), Indian Council of Medical Research (ICMR), in his presentation titled "Insights from Systematic Review and Meta-Analysis highlighted the following:

- **Lead Poisoning in Indian Children**: A systematic review and meta-analysis revealed a pooled mean Blood Lead Level (BLL) of 10.7 µg/dL among Indian children, with a noted decline over the last three decades.
- **Genotoxicity from Lead Exposure**: Studies included in a systematic review and meta-analysis showed significant DNA damage, chromosomal aberrations and oxidative DNA damage in individuals exposed to Lead compared to unexposed groups.
- **Lead Exposure and Immunotoxicity**: Occupational Lead Exposure was associated with altered immunological markers, including a marginal decrease in lymphocyte count and changes in cytokine levels.
- **Impact on Male Reproductive Health**: Occupational Lead exposure was linked to lower sperm counts, poor sperm motility and higher serum prolactin levels, indicating detrimental effects on male reproductive function.
- **Tribal Fishermen's Blood Metal Levels**: A study assessing blood Lead and metal levels in tribal fishermen in Tamil Nadu found significantly higher levels of various metals, including Lead, in those involved in fish net making.

Figure 25. *Dr. B. Ravichandran, Scientist E, ROHC, ICMR*

Dr Javed A Quadri, Assistant Professor AIIMS, New Delhi

Key Points:

- **Ongoing research**: Pertaining to heavy metal analysis within the institution including methodologies employed for sample acquisition from diverse peripheral centers, as well as the intricate logistical processes involved in sample processing at AIIMS.
- **Baseline for heavy metals exposure:** He highlighted the collaborative efforts with the National Centre for Disease Control (NCDC) aimed at establishing a foundational benchmark for heavy metal exposure within the Indian populace.
- **SOPs for sample collection:** Dr. Quadri underscored the imperative of formulating Standard Operating Procedures (SOPs) for sample collection and transportation, drawing inspiration from the established protocols at AIIMS, thereby ensuring uniformity and reliability across similar initiatives.

Figure 26. *Dr Javed A Quadri, Assistant Professor AIIMS, New Delhi*

Dr. Dinesh Kumar, Ex-Scientist G, ICMR - National Institute of Nutrition, Hyderabad

In his presentation on Lead toxicity, Dr. Dinesh Kumar, Ex-Scientist G, ICMR - National Institute of Nutrition, elucidated several studies conducted by the ICMR.

Key Points

- **Toxicity in Toys**: Reported the quantitative detection of heavy metals and phthalates in toys, highlighting the health hazards of Lead and Cadmium toxicity in cheap toys in India.
- **Stakeholder Engagement**: Emphasized on the engagement of various stakeholders, including national institutes, regional occupational health centers and international agencies like the IAEA.
- **Evaluation of Metal Ion Concentration**: Outlined the procedures for evaluating metal ion concentration in children and pregnant women, focusing on nutritional, demographic, clinical profiles and metal ions like Lead, Cadmium and Mercury.

Figure 27. *Dinesh Kumar, Ex-Scientist G, ICMR - National Institute of Nutrition*

Dr. Vakdevi Validandi, Scientist-D, Food Safety Division, ICMR-National Institute of Nutrition, Hyderabad

Key Points

- **Research initiatives:** Discussed various research initiatives undertaken by ICMR-National Institute of Nutrition, Hyderabad on Fluorosis and on the presence of heavy metals in commonly consumed herbal medicines.
- **Lead Care II:** She advocated for the adoption of Lead Care II as a practical tool for initial screening in the field, followed by confirmation utilizing ICPMS methodology.

Figure 28*. Vakdevi Validandi, Scientist-D, Food Safety Division, ICMR-NIN*

Dr. P.Sivaperumal, Scientist E, Chemical Sciences, ICMR - National Institute of Occupational Health

Provided comprehensive 'Overview of Analytical Methodology for Biomonitoring', emphasizing the imperative for a multidisciplinary team to effectively monitor heavy metal concentrations.

Key Points

- **Biomonitoring**: Outlined the process of biomonitoring, which assesses human exposure to chemicals by measuring them or their metabolites in human specimens like blood or urine. It's a key pillar for public health tracking.
- **Sources of Toxic Metals**: Identified various sources of toxic metal exposure, including agrochemicals, sewage, domestic waste and specific industries like rubber manufacturing and electroplating.
- **Regulatory and Accreditation Agencies**: Detailed the role of regulatory agencies like the FDA, EMA and FSSAI in monitoring and evaluating herbal medicinal products and dietary supplements. He also mentioned accreditation agencies like NABL ISO/IEC 17025:2017.
- **Sample Analysis**: Presented a general scheme for sample analysis, including steps like sampling, sample preparation, analysis, and data interpretation. Emphasized on the importance of method validation and proficiency testing programs for accurate results.

***Figure 29**. Dr. Sivaperumal, Scientist E, Chemical Sciences, ICMR – NIOH, Ahmedabad*

Dr Devendra Kumar Patel, Scientist G and Professor (AcSIR), Systems Toxicology & Health Risk Assessment, CSIR-Indian Institute of Toxicology Research, Lucknow

Key Points

- **R&D initiatives:** Provided comprehensive insights into the diverse range of Research and Development (R&D) initiatives spearheaded by the Council of Scientific and Industrial Research (CSIR), elucidating on the analytical facilities both established and in development within CSIR.
- **PFAS chemicals:** Furthermore, he enlightened the audience on per- and polyfluoroalkyl substances (PFAS) chemicals, encompassing their applications, adverse effects on human health and the regulatory frameworks governing their usage.

Figure 30. *Dr Devendra Kumar Patel, Chief Scientist, CSIR-Indian Institute of Toxicology Research.*

Dr. Ramalingam P, Associate Professor, Pharmaceutical Analysis, NIPER- Hajipur

Key Points

- **NIPER-Hajipur**: Detailed the journey of NIPER-Hajipur since its establishment in 2007, highlighting its recognition as an Institute of National importance and the programs it offers, including postgraduate and Ph.D. degrees in various pharmaceutical disciplines.
- **Research Focus**: Outlined the core research areas of the institution, such as genetic interventions, biomarkers for diseases, nanotechnology, and preclinical toxicity studies, among others.
- **Instrumentation Facility**: Described the Central Instrumentation Facility at NIPER-Hajipur, equipped with high-end analytical equipment like LC-HRMS, LC-ICP-MS and GC-MS/MS for chemical toxicant analysis.
- **ICP-MS Projects**: Presented ongoing projects utilizing the ICP-MS facility, including method development for detecting multiple elements in food products and assessing neurotoxicity and cardiovascular risks associated with Arsenic exposure in HIV patients.

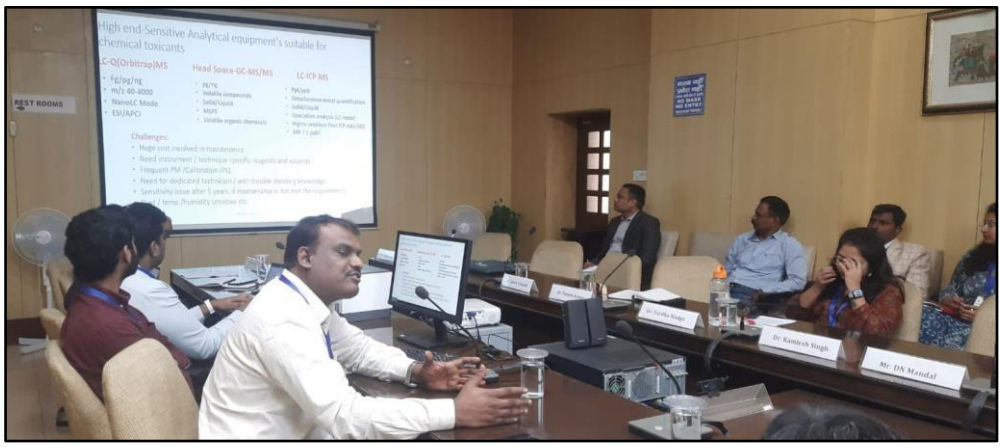


Figure 31. *Dr. Ramalingam providing a comprehensive overview of the evolution of NIPER Hajipur*

Dr Shaikh Ziauddin, Professor, Biochemical Engineering & Biotechnology, IIT Delhi

Key Points

- **ICP-MS Facility at IIT Delhi**: Introduced the Inductively Coupled Plasma - Mass Spectrometry (ICP-MS) facility at the Indian Institute of Technology Delhi, coordinated by Professor Shaikh Ziauddin Ahammad.
- **Lead Analysis**: Detailed the capability of the Agilent 7900 ICP-MS to measure elements in drinking water, meeting international standards for detection limits and recovery requirements.
- **Blood Lead Level Testing**: Outlined the protocols for evaluating Blood Lead Levels (BLLs) in adults and children, including initial screening and confirmatory venous BLLs based on CDC guidelines.
- **Sample Collection and Testing**: Discussed the process of sample collection from various organizations for testing Lead and other heavy metals, emphasizing the precision and storage of biological samples before testing.

Figure 32: *Dr Shaikh Ziauddin Ahammad, Professor, Indian Institute of Technology, Delhi*

Dr. Kamlesh Singh, Professor, Metallurgical Engineering, IIT - BHU, Varanasi

Key Points

- **e-Waste:** Explained about various compositions of electronic waste, how the e-waste is recycled and disposed.
- **Recycling of e-waste:** Lifecycle of electronics from manufacturer to recycle and case of urban mining with focus on Waste Electronic and Electrical Equipment (WEEE) was elucidated.
- **Printed Circuit Boards:** Discussed that electronic items like circuit boards **c**ontain heavy metals and hazardous organic compounds and their disposal through landfilling pollutes the environment and creates health problems.

***Figure 33**. Dr. Kamlesh Singh, Professor, IIT - BHU, Varanasi*

Mr. Balasubramanian K, Joint Director, Quality Assurance, Food Safety and Standards Authority of India (FSSAI)

Key Points

- **FSSAI:** Highlighted about FSS Act 2006 and its regulations.
- **Crop contaminants:** Sensitized about crop contaminants, Residues (restriction on the use of insecticides), MRLs.
- **Polychlorinated biphenyls (PCBs)** are regarded as hazardous chemical contaminants of food. These groups of substances are not uniform; they include numerous compounds differing in their chemical structures.
- **Lab network:** Mentioned about laboratory network of FSSAI across India and the equipment available in these labs- ICPMS, LC MS/MS, GC MS/MS for surveillance of chemical toxicants in food articles.

***Figure 34.** Mr. Balasubramanian K, Food Safety and Standards Authority of India (FSSAI)*

Dr. Gyana Ranjan Tripathi, Associate Professor, Earth & Climate Sciences, Indian Institute of Science Education and Research (IISER) - Pune

Key Points

- **Geochemical Research**: Mentioned about the Geochemical Research for Aquatic and Sedimentary Processes (GRASP) Lab at IISER Pune, which is equipped with state-of-the-art geochemistry facilities.
- **Trace Elements Study**: The lab focusses on study of trace elements in river and coastal waters, their sources and their impact on the environment and human health.
- **Analytical Techniques**: The lab utilizes advanced analytical techniques like Q-ICP MS, Ion Chromatograph and Isotope Ratio Mass Spectrometer for elemental concentration analyses.
- **Research Findings**: Presented findings on elemental concentration in different environments, such as the Bay of Bengal and discussed the implications for biomonitoring of chemical toxicants.

Figure 35. *Dr. Gyana Ranjan Tripathi, Associate Professor, IISER, Pune*

Suggested Action Points

Technical session 4

- The prioritization of high-risk occupational groups for biomonitoring of chemical toxicants as an initial step towards mitigating health risks associated with occupational exposures.
- Collaboration between different academic institutions, research organizations and governmental bodies to foster a more comprehensive understanding of heavy metal exposure and its implications on public health.
- Invest in advanced technologies and methodologies for more accurate and efficient heavy metal analysis.
- Imperative for implementing Standard Operating Procedures (SOPs) for sample preparation and the establishment of Indigenous matrix standards to address the present needs effectively.
- Fostering collaboration with the ICMR-NIN to further advance research efforts and enhance the efficacy of interventions pertaining to Lead toxicity.
- Advocacy for policy reforms aimed at enhancing environmental monitoring and enforcement mechanisms to curb sources of Lead pollution and safeguard public health.
- Strengthening regulatory frameworks to enforce stringent safety standards for consumer products, particularly toys, to mitigate the risk of Lead contamination.
- Foster collaboration with the Indian Council of Medical Research-National Institute of Occupational Health (ICMR-NIOH) to enhance the capacity building of program staff.
- Strategic utilization of equipment available at the Academy of Scientific and Innovative Research (AcSIR) for the meticulous analysis of various sample types.
- Promote awareness campaigns and educational programs to inform the public about the risks associated with PFAS chemicals and advocate for sustainable alternatives.

WAY FORWARD

Action tracks, activities, and timeline

The following figure enlists the categories (action tracks) suggested by experts during the Stakeholder Engagement Workshop for National Biomonitoring Program for Chemical Toxicants

Figure 36: *Action tracks for biomonitoring of chemical toxicants*

The following table describes the action tracks and individual activities identified for the same.

Table 1: Activities suggested during the Stakeholder Workshop for Biomonitoring of Chemical Toxicants

Action track	Activities	On-going	Mid term	Long term
1	**Knowledge Management and Information Sharing** **Responsible organisation/s**: NCDC			
1.1	Establish Technical Working Group responsible for developing a repository of chemical toxicants by pooling data from various sources.	✓		
1.2	Develop a **repository** of existing resources and information related to chemical toxicants in India.	✓		
1.3	The collaborative group to conduct or foster research and compile information as an input to the assessments or **horizon scanning.**		✓	
1.4	Map institutions and ongoing activities being undertaken for identification and estimation of chemical toxicants in various specimens (biological and environmental).	✓		
1.5	Develop SOPs for collation of data from various sources and integration with Integrated Health Information Platform.		✓	
1.6	Map high-risk regions for exposure to chemical toxicants.		✓	
2	**Establish Surveillance:** Establish a national-level bio-monitoring programme/ surveillance system for various chemical toxicants in India **Responsible organisation/s**: NCDC, NFHS			
2.1	Establish technical working group for setting up surveillance for chemical toxicants in India (*Lead surveillance to be taken up as first step*).		✓	
2.2	Establish surveillance mechanisms for estimation of chemical toxicants (especially elevated Blood Lead Level) in children, pregnant women, and high-risk occupational groups.		✓	
2.3	Establish surveillance mechanisms for estimation of chemical toxicants (including heavy metals, pesticides and microplastics) in biological and environmental reservoirs.			✓
2.4	Develop special surveillance module on Integrated Health Information Platform for chemical toxicants (*focus on Lead and heavy metals which are currently under testing*).		✓	
2.5	Develop SOPs for screening of chemical toxicants using field-based devices.		✓	

Action track	Activities	On-going	Mid term	Long term
3	**Build capacity:** Augment laboratory and workforce capacity to prevent, detect and respond to various health issues caused by chemical toxicants **Responsible organization/s:** MoHFW			
3.1	Constitute a technical working group for augmentation of laboratory capacity for estimation of heavy metals and other chemical toxicants.		✓	
3.2	Augment the capacities of regional laboratories for comprehensive testing of heavy metals and other chemical toxicants.			✓
3.3	Enhance the capacity for heavy metal estimation at tertiary hospitals by linking ICP-MS facilities from the existing laboratory network.		✓	
3.4	Develop SOPs for sample preparation and establish indigenous matrix standards.		✓	
3.5	Develop training modules for healthcare workers, laboratory professionals and policy makers.		✓	
3.6	Develop SOPs for strengthening poison information centers (visit to Thailand Poison Centers may be planned).		✓	
3.7	Invest in advanced technologies and methodologies for more accurate and efficient heavy metal analysis.	✓		
4	**Risk communication and community engagement:** Carry out targeted risk communication activities for prevention of exposure to chemical toxicants **Responsible organization/s**: NCDC, CHEB, CPCB and SPCB, NGOs			
4.1	Conduct awareness and behavior change communication activities for public regarding: • Lead and other heavy metal intoxication • Microplastics • PFAS		✓	
4.2	Conduct awareness and behavior change communication activities for high-risk groups such as children, pregnant women, workers occupationally exposed to chemical toxicants (*utilize provisions under Corporate Social Responsibility*).		✓	
4.3	Conduct community engagement activities among the battery manufacturers and recyclers to raise awareness regarding battery waste management rules 2022. (*Utilize provisions under Corporate Social Responsibility*)		✓	
4.4	Advocate for the prevention of heavy metal pollution with stakeholders: • Promote pollution controlling equipment and processes (novel smelting practices) by Lead recyclers. • Promote adoption of non-Lead composites in paint production. • Encourage investment in Lead-free infrastructure. • Boost Extended Producer Responsibility (EPR) programs. • Recommend policy reforms and stricter regulations for industries involved in production of Lead-containing products.	✓		

Action track	Activities	On-going	Mid term	Long term
4.5	Promote customized agricultural practices and diversification of crops to minimize contamination pathways.	✓		
4.6	Advocate for investment in technologies for monitoring and data analysis to bolster the ability of stakeholders to address environmental challenges arising from chemical toxicants.	✓		
4.7	Advocate for remediation of groundwater and food chain pollution with microplastics.	✓		
4.8	Promote investment in development of PFAS alternatives.	✓		
5	**Research & Development:** Conduct clinic-epidemiological and implementational research pertaining to chemical toxicants **Responsible organization/s**: NCDC, ICMR-NIN, ICMR-NIOH, AcSIR and academic institutions			
5.1	Constitute a technical working group to prioritize and oversee research activities in the field of chemical toxicants.		✓	
5.2	Conduct a desk review to prioritize biomarkers for assessment of chemical contamination.		✓	
5.3	Conduct **clinic-epidemiological research** to build evidence on exposure and impact of chemical toxicants on human populations: • Identify sources of Lead exposure in the community and high-risk occupation groups. • Identify long-term effects of heavy metal exposure on humans.		✓	
5.4	Conduct **implementation research** to understand the most effective methods to prevent and mitigate effects of chemical toxicants: • Challenges in implementation of legislation for minimizing heavy metal exposure in formal and informal recycling industries. • Challenges in setting up air quality parameters for smelting operations.		✓	
6	**Establish institutional mechanisms:** Develop policies for the prevention and management of chemical toxicants in India **Responsible organisation/s:** MoHFW, MoLE, MoMSME, MoEFCC, MoRTH, MoHIPE, MoT, MoA, MoFPI, MoJS, MoWR, MoCF, MoCI, NDMA, CPCB, CGWB, DPIIT			
6.1	Propose draft policies to minimize and regulate the use of chemical toxicants (including heavy metals) in paints and dyes, firecrackers, toys, textiles, cookware, potteries, cosmetics, food, medicine, and other commercial products. AND Implement stringent enforcement mechanisms, including inspections and penalties for non-compliance.			✓
6.2	Propose amendment in existing laws and policies for stringent regulation of electronics and battery recycling industries (including unorganized sector) to prevent environmental contamination.	✓		
6.3	Develop mechanisms for collection, recycling and environmentally safe disposal of household, commercial and industrial scraps contaminated with chemical toxicants.			✓
6.4	Define acceptable levels of heavy metal and microplastics contamination under national drinking water quality standards.		✓	

Action track	Activities	On-going	Mid term	Long term
6.5	Abolish the sale of toxic chemicals to unauthorized individuals.		✓	
6.6	Enhance hospital-based preparedness for management of chemical disasters: • Develop decontamination zones in identified healthcare institutions. • SOPs and mock drills to prepare for disaster events.		✓	
6.7	Include antidotes and chelating agents for heavy metal toxicants in national essential drug list.		✓	
7	**Collaborate with sectors:** Foster international, multi-sectoral and inter-disciplinary collaborations to consolidate the efforts of various organizations working to reduce health impacts of chemical toxicants **Responsible organisation/s**: All concerned stakeholders with NCDC, MoHFW			
7.1	Initiate dialogues with academic institutions, research organizations, professional societies, and government bodies to collaborate for research, testing and training activities.	✓		
7.2	Develop mechanisms to collate data pertaining to chemical toxicants from various sources.			✓
7.3	Establish channels for dissemination of best practices in the field at national and international level.		✓	
7.4	Dissemination of information among collaborators, Central and State Governments and public.			

*Please refer to list of abbreviations on page no 3

Annex 1

Agenda

Dates: 14- 15 March 2024

Venue: Central Seminar Room, NCDC, Delhi

Day 1 **14th March, 2024**		
09:00 – 10:30 AM	**Registration, Inauguration, Group Photograph and High Tea**	
Introductory Session: Why India Needs a National Biomonitoring Program for Chemical Toxicants?		
10:30 – 10:45 AM	Overview of the National Biomonitoring Program for Chemical Toxicants: Current concerns & strategic approach	Dr. Meera Dhuria, Joint Director and Head, PHP & NCD, NCDC
10:45 – 11:00 AM	Mitigation Strategies of the GoI for Fluorosis and Arsenicosis	Dr. BS Charan, ADG, Nut. & IDD Cell, Dte.GHS, MoHFW
11:00 – 11:15 AM	India's response to Lead toxicity: Current challenges and future perspectives	Dr. Rakesh Kumar, CSIR OSD (Coordinator NET Zero, India)
Technical Session 1: Chemical toxicants- Surveillance, health effects and strategies for mitigation		
Chair: Dr. Anil Kumar, Principal Advisor, NCDC **Co-chair: Dr. AK Sharma, Director Professor, Community Medicine, UCMS, Delhi**		**Moderator: Dr. Garima Srivastava, DAD, NCDC** **Rapporteur: Dr. Bharath J**
11:15 – 11:30 AM	Role of Lead and other heavy metals in disease etiology: Clinicians' perspective of Adult Exposure	Prof. (Dr.) Anil Arora, Chairman, Institute of Liver Gastroenterology & Pancreatic - Biliary Sciences, Sir Ganga Ram Hospital
11:30 – 11:45 AM	Role of Lead and other heavy metals in disease etiology: Clinicians' perspective of Pediatric Exposure	Dr. Sheffali Gulati, Professor, Child Neurology, AIIMS, Delhi
11:45 – 12:30 PM (15 min each)	Toxic chemicals-induced diseases: Preparedness and management	• Dr. Lokesh Sharma, Associate Professor, Biochemistry, RML, Delhi • Dr. Sujata Sarabahi, Consultant-Professor, Dept. of Burns & Plastic Surgery, SJH, Delhi • Dr. Preeti Chauhan, Professor, Biochemistry, LHMC, Delhi
12:30 – 12:45 PM	Chemical Toxicants exposure in India - Surveillance strategy	Dr. Arun Kumar Sharma, Director Professor, Community Medicine, UCMS, Delhi

12:45 – 01:00 PM	Chemical toxicity surveillance data: Opportunities for integration into the IHIP-IDSP portal	Dr. Himanshu Chauhan, Joint Director, IDSP, NCDC
01:00 – 01:15 PM	Strategies to control heavy metal contamination in pharmaceuticals: Significance for human health	Mr. Sunil Kulshrestha, Deputy Drugs Controller (India), CDSCO
01:15 – 02:15 PM	**Lunch Break**	
Technical Session 2: Initiatives undertaken by pertinent organisations in tackling chemical toxicants and creating awareness thereof		
Chair: Dr. Sunil Gupta, Principal Consultant, NCDC **Co-chair: Ms. Payden, Deputy WR, WCO, India**		**Moderator: Dr. Priyanka Kundra, SMO, NCDC** **Rapporteur: Dr. Dharmesh Arya, EIS Officer**
02:15 – 02:30 PM	WHO's perspective on Lead: Remarks from the Co-chair	Ms. Payden, Deputy WR, WCO, India
02:30 – 03:15 PM (15 min each)	Ongoing efforts of the Indian Society for Lead Awareness & Research (InSLAR) and its partners to achieve Lead safe environment	• Dr. Venkatesh Thuppil, Chairman, (InSLAR), Bengaluru • Dr Praveen Sharma, Ex-Prof. Biochemistry, AIIMS Jodhpur • Dr. Girdhar J Gyani, DG, Association of Health Care Providers
03:15 – 03:30 PM	**Tea Break**	
03:30 – 04:15 PM (15 min each)	Measures undertaken by prominent NGOs to promote safety and awareness against Lead and other heavy metals	• Mr. Sandeep Dahiya, Director, Advocacy & Communications, Pure Earth • Dr. Ravi Pokharna, Executive Director, Pahle India Foundation • Dr. Varada Madge, The Energy and Resources Institute (TERI)
Technical Session 3: Initiatives under various Departments/Ministries, GoI and scope of inter-ministerial linkages for management of exposure to chemical toxicants		
Chair: Dr. Anil Kumar, Principal Advisor, NCDC **Co-chair: Dr. Aakash Shrivastava, Additional Director, NCDC**		**Moderator: Dr. Garima Srivastava, DAD, NCDC** **Rapporteur: Dr. Bharath J**
04:15 – 05:15 PM (15 min each)	• Central Pollution Control Board, Ministry of Environment, Forest & Climate Change • Central Ground Water Board, Ministry of Jal Shakti • Department for Drinking Water & Sanitation, Ministry of Jal Shakti • Employees' State Insurance Corporation, Ministry of Labour & Employment	• Mr. BK Jena, Scientist D, Instrumentation Laboratory • Mr. DN Mondal, Scientist D • Mr. Ashish Pandey, Deputy Advisor, DDW&S • Dr. Sujay Pradhan, CMO, ESIC

Day 2 15th March, 2024		
09:30 – 09:45 AM	Recap	Dr. Garima Srivastava, DAD, NCDC
Technical Session 4: Scope of collaboration with stakeholder laboratories		
Chair: Dr. Anil Kumar, Principal Advisor, NCDC **Co-chair: Dr. Venkatesh Thuppil, Chairman, (InSLAR), Bengaluru**		**Moderator: Dr. Garima Srivastava, DAD, NCDC** **Rapporteur: Dr. Bharath J**
09:45 – 11:30 AM (15 min each)	• ICMR (Lead poisoning in India: Insights from systemic review and meta-analysis) • AIIMS, New Delhi • ICMR - National Institute of Nutrition • ICMR - National Institute of Nutrition • ICMR - National Institute of Occupational Health • CSIR - Indian Institute of Toxicology Research • NIPER- Hajipur	• Dr. B. Ravichandran, Scientist E, ROHC • Dr. Javed A Quadri, Assistant Professor, Clinical Ecotoxicology • Dr. Dinesh Kumar, Ex-Scientist G, Drug Safety • Vakdevi Validandi, Scientist-D, Food Safety Division • Dr. P. Sivaperumal, Scientist E, Chemical Sciences • Dr. Devendra Kumar Patel, Scientist G, Systems Toxicology & Health Risk Assessment • Dr. Ramalingam P., Associate Professor, Pharmaceutical Analysis
11:30 – 11:45 AM	**Tea break**	
Technical Session 4 contd…		
11:45 - 12:45 PM (15 mins each)	• IIT- Delhi • IIT - BHU, Varanasi • Food Safety and Standards Authority of India (FSSAI) • Indian Institute of Science Education and Research (IISER) - Pune	• Dr. Shaikh Ziauddin, Professor, Biochemical Engineering & Biotechnology • Dr. Kamlesh Singh, Professor, Metallurgical Engineering • Mr. Balasubramanian K, Joint Director, Quality Assurance • Dr. Gyana Ranjan Tripathi, Associate Professor, Earth & Climate Sciences
12:45 – 02:00 PM	Way Forward	All stakeholders
02:00 PM onwards	**Lunch Break and End of Workshop**	

Annex 2

List of Participants

S.No.	Name & Designation	Organisation
1	Dr. L. Swasticharan, Addl. DDG and Director, EMR	Dte. GHS, Ministry of Health and Family Welfare
2	Dr. Rakesh Kumar, Officer on Special Duty (Coordinator Net Zero India)	CSIR HQ, Delhi
3	Dr. Anil Kumar, Principal Advisor	NCDC, Delhi, Dte. GHS, Ministry of Health and Family Welfare
4	Dr. Sunil Gupta, Principal Consultant	NCDC, Delhi, Dte. GHS, Ministry of Health and Family Welfare
5	Dr. S. Venkatesh, Former DGHS and Principal Advisor	NCDC, Delhi, Dte. GHS, Ministry of Health and Family Welfare
6	Dr. Aakash Shrivastava, Addl. Director	Centre for Environmental & Occupational Health, Climate Change & Health, NCDC Delhi
7	Dr. Meera Dhuria, Joint Director	Public Health Preparedness & NCD, Biochemistry and Toxicology, NCDC
8	Dr. Bhagwan Singh Charan, ADG	Nutrition & IDD Cell, Dte. GHS, Ministry of Health and Family Welfare
9	Dr. Anil Arora, Senior Consultant	Institute of Liver Gastroenterology & Pancreatico Biliary Sciences, Sir Ganga Ram Hospital, Delhi
10	Dr. Sheffali Gulati, Professor	Child Neurology Division, Dept. of Pediatrics AIIMS, Delhi
11	Dr. Lokesh Sharma, Associate Professor	Dept of Biochemistry, Dr. RML Hospital, Delhi
12	Dr. Sujata Sarabahi, Consultant-Professor	Dept. of Burns & Plastic Surgery, Safdarjung Hospital, Delhi,
13	Dr. Preeti Chauhan, Professor	Dept of Biochemistry, LHMC and associated hospitals, Delhi
14	Dr. Arun Kumar Sharma, Director Professor	Dept. of Community Medicine, University College of Medical Sciences, Delhi
15	Dr. Himanshu Chauhan, Joint Director	IDSP, NCDC, Dte. GHS, Ministry of Health and Family Welfare
16	Mr. Sunil Kulshrestha, Deputy Drugs Controller (India)	CDSCO HQ, Delhi
17	Ms. Shraddha Srivastava	CDSCO HQ, Delhi
18	Ms. Payden, Deputy WR, India	WHO, India
19	Dr. Venkatesh Thuppil, National Chairman	Indian Society for Lead Awareness & Research, Dept. of Biochemistry, St. John's Medical College, Bengaluru
20	Dr. Girdhar J Gyani, DG	Association of Healthcare Providers, Delhi
21	Dr. Praveen Sharma, Ex-Professor	Dept. of Biochemistry, AIIMS Jodhpur
22	Mr. Sandeep Dahiya, Director, Advocacy and Communications	Pure Earth
23	Ms. Debanjana Chowdhary, Member	Pure Earth
24	Dr. Ravi Pokharna, Executive Director	Pahle India Foundation
25	Dr. Ankita Srivastava, Member	Pahle India Foundation
26	Mr. Jaydev Dubey, Member	Pahle India Foundation
27	Dr. Varada Madge, Member	TERI
28	Dr. Sandeep Thacker, Consultant	Climate Change and Human Health, UNICEF
29	Mr. BK Jena, Scientist D	Central Pollution Control Board, MoEF&CC
30	Mr. DN Mandal, Scientist D	Central Ground Water Board, Ministry of Jal Shakti
31	Mr. Ashish Pandey, Deputy Advisor	Department of Drinking Water and Sanitation, Ministry of Jal Shakti
32	Dr. Sujay Pradhan, Chief Medical Officer	ESIC, Ministry of Labor & Employment
33	Dr. B. Ravichandran, Scientist E	ICMR- ROHC, Bengaluru
34	Dr. Javed A Quadri, Assistant Professor	Clinical Ecotoxicology, AIIMS Delhi

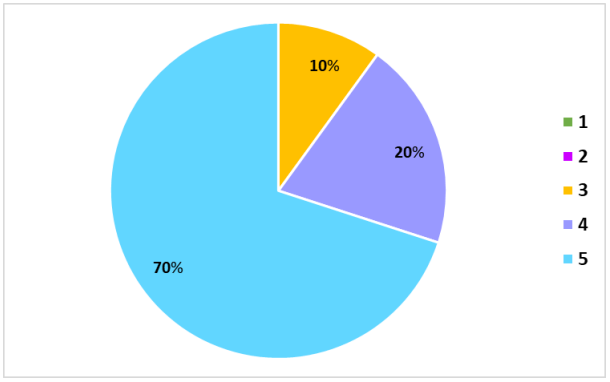
35	Dr. Dinesh Kumar, Ex- Scientist G	Drug Safety Division, ICMR - National Institute of Nutrition, Hyderabad
36	Dr. Vakdevi Validandi, Scientist-D	Food Safety Division, ICMR - National Institute of Nutrition, Hyderabad
37	Dr. P. Sivaperumal, Scientist E	Chemical Sciences, ICMR-National Institute of Occupational Health (NIOH), Ahmedabad
38	Dr. Devendra Kumar Patel, Scientist G	Systems Toxicology & Health Risk Assessment, CSIR - Indian Institute of Toxicology Research (IITR), Lucknow
39	Dr. P. Ramalingam, Associate Professor	Pharmaceutical Analysis, NIPER, Hajipur
40	Dr. Shaikh Ziauddin, Professor	Department of Biochemical Engineering, IIT – Delhi
41	Dr. Kamlesh Singh, Professor	Metallurgical Engineering, IIT- BHU, Varanasi
42	Mr. Balasubramanian, Joint Director	Quality Assurance, FSSAI
43	Dr. Gyana Ranjan Tripathi, Associate Professor	Earth & Climate Sciences, IISER, Pune
44	Dr. Geetika Yadav, Scientist E	Environmental Hygiene & Occupational Health, ICMR HQ, Delhi
45	Dr. B C Koner, Director Professor	Dept of Biochemistry, Maulana Azad Medical College, Delhi
46	Dr. Subhash C Sonker, Scientist C	Dept of Biochemistry, Maulana Azad Medical College, Delhi
47	Dr. Navin Verma, Deputy Director	EMR Division, Dte.GHS, MoHFW
48	Dr. Garima Srivastava, Deputy Assistant Director	Public Health Preparedness & NCD, Biochemistry and Toxicology, NCDC
49	Dr. Priyanka Kundra, Senior Medical Officer	Public Health Preparedness & NCD, NCDC, Delhi
50	Dr. Ashish Kumar Goyal, Assistant Director	Public Health Preparedness & NCD, NCDC, Delhi
51	Dr. Aniket Chowdhary, Assistant Director	Centre for Environmental & Occupational Health, Climate Change & Health, NCDC Delhi
52	Mr. Manish Jha	Maulana Azad Medical College, Delhi
53	Dr. Bhavesh, Medical Epidemiologist	Public Health Preparedness & NCD, NCDC, Delhi
54	Dr. Dharmesh Arya, EIS Officer	Public Health Preparedness & NCD, NCDC, Delhi
55	Dr. Bharath J, Consultant	WHO, India
56	Dr. Amrita Gupta, Public Health Expert	IQVIA team, Public Health Preparedness & NCD, NCDC, Delhi
57	Mr. Shubhanshu Kaalia, Project Coordinator	IQVIA team, Public Health Preparedness & NCD, NCDC, Delhi
58	Dr. Ramkesh Choudhary, EIS Officer	Public Health Preparedness & NCD, NCDC, Delhi
59	Mr. Lalit Kumar Tyagi, Technician	Biochemistry and Toxicology, NCDC, Delhi
60	Mr. Satyam Verma, Technician	Biochemistry and Toxicology, NCDC, Delhi
61	Ms. Hema, Program Assistant	Public Health Preparedness & NCD, NCDC, Delhi
62	Ms. Rachna Mishra, Intern	Public Health Preparedness & NCD, NCDC, Delhi

Annex 3

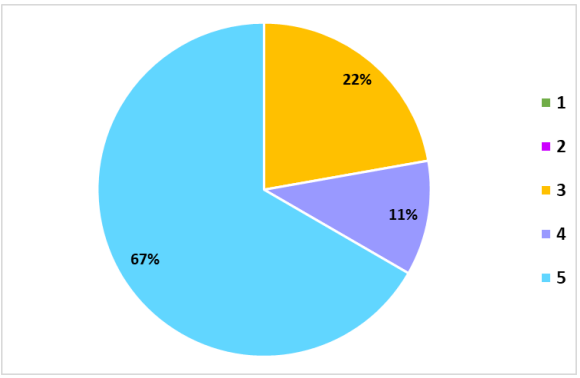
Evaluation of Feedback from the Participants

The responses were graded on the scale of 1-5, as depicted in the legend. The percentage of participants opting for a particular response is depicted in the pie chart. The following are the results of the feedback analysis:

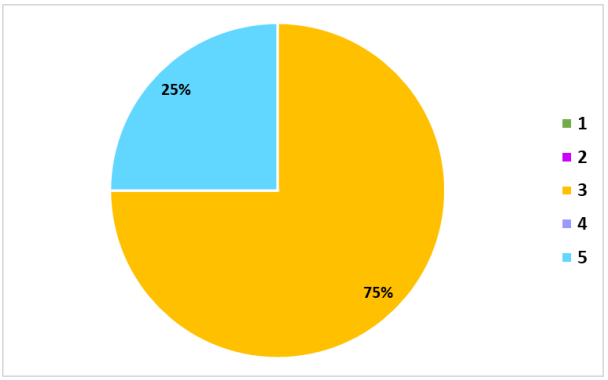
1. How satisfied were you with the workshop?



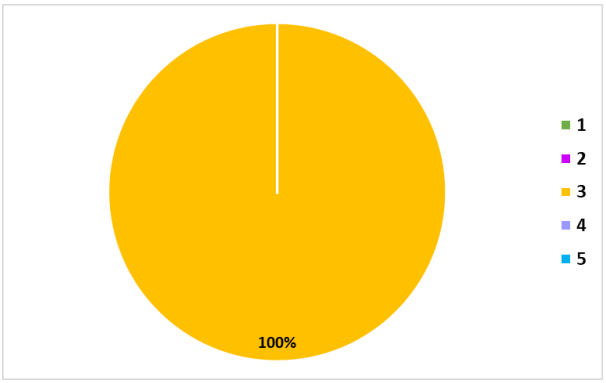
2. How satisfied were you with the communication emails?



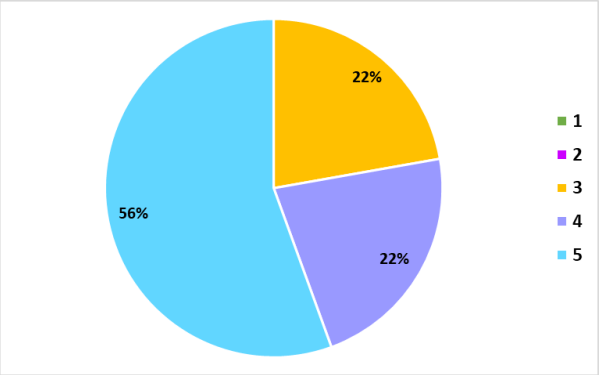
3. How satisfied were you with accommodation?



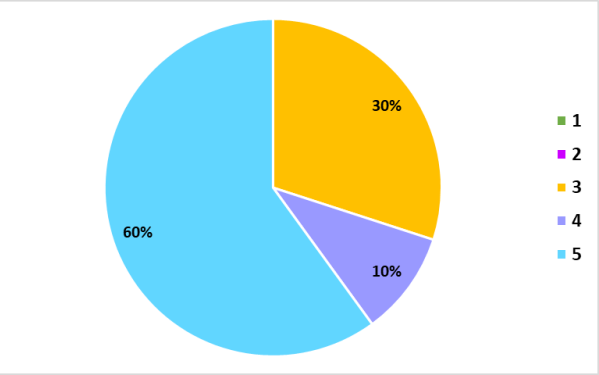
4. How satisfied were you with transportation?



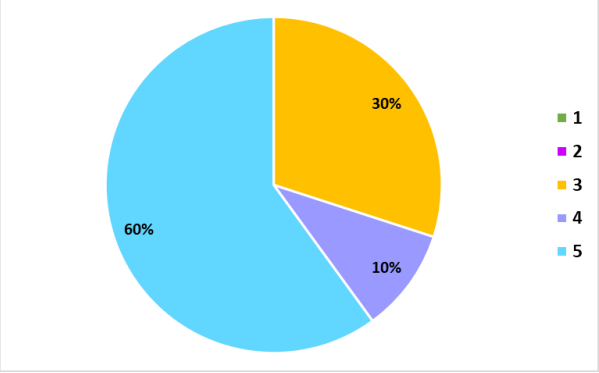
5. How satisfied were you with the delegate kit?



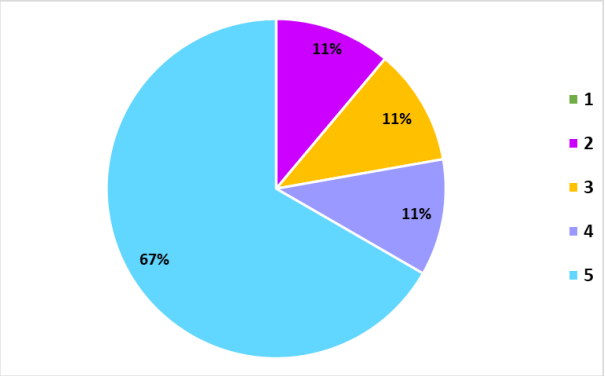
6. How satisfied were you with the activities in the workshop?



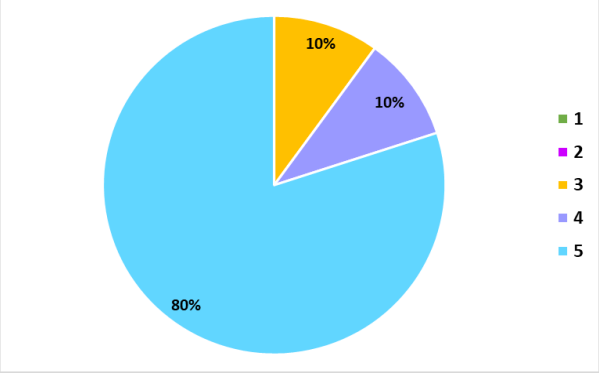
7. How satisfied were you with the venue?



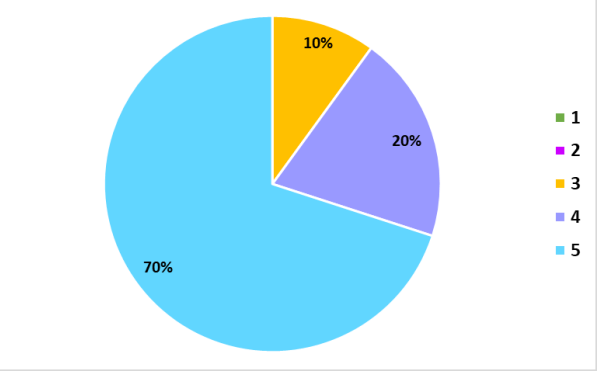
8. How satisfied were you with the food at the event?



9. Were the discussion and information shared during the workshop relevant to your current work profile?



10. Were the deliberations held during the workshop enriching and motivating?

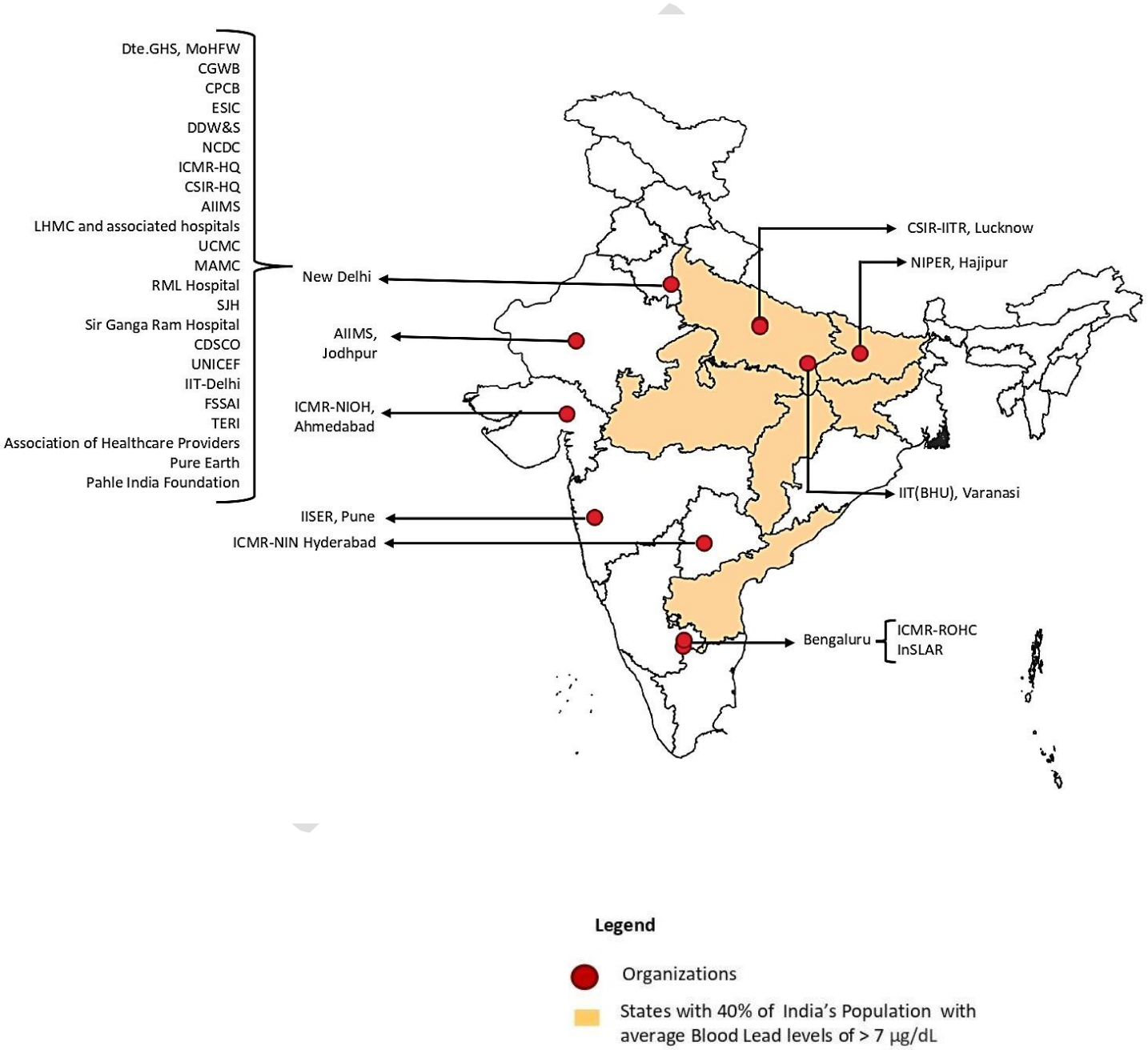


Annex 4

Photo-Gallery

Annex 5

Organisations Represented in the Stakeholder Engagement Workshop



ANNEX 6

Pan India Mapping of Stakeholders and Laboratory Resources for National Biomonitoring Programme for Chemical Toxicants

S.No.	STAKEHOLDERS/LABORATORY RESOURCES	City, State
	MEDICAL COLLEGES/HOSPITALS UNDERTAKING LEAD TESTING	
1.	AIIMS - Bhopal	Bhopal, Madhya Pradesh
2.	AIIMS - Jodhpur	Jodhpur, Rajasthan
3.	AIIMS - Nagpur	Nagpur, Maharashtra,
4.	AIIMS - New Delhi	New Delhi
5.	AIIMS - Patna	Bihar, Patna
6.	Aligarh Muslim University	Aligarh, Uttar Pradesh
7.	Bangalore Baptist Hospital	Bengaluru, Karnataka
8.	Kasturba Medical College	Manipal, Karnataka
9.	King George's Medical University (KGMU)	Lucknow, Uttar Pradesh
10.	Kokilabain Hospital	Mumbai, Maharashtra
11.	Krishna Institute of Medical Sciences Deemed University	Karad, Maharashtra
12.	Mahatma Gandhi Institute of Medical Sciences	Wardha, Maharashtra
13.	Sir Gangaram Hospital	New Delhi
14.	Sree Chitra Tirunal Institute of Medical Science and Technology	Thiruvananthapuram, Kerela
15.	St. John's Medical College, Department of Biochemistry	Bengaluru, Karnataka
	MEDICAL COLLEGES/ HOSPITALS (TECHNICAL WORKING GROUP)	
16.	Dr. RML Hospital	New Delhi
17.	LHMC and Associated Hospitals	New Delhi
18.	Safdarjung Hospital	New Delhi
19.	University College of Medical Sciences	New Delhi
	LABORATORY RESOURCES (ICP-MS FACILITIES) FOR HEAVY METAL TESTING	
•	**Indian Council of Medical Research (ICMR)**	
20.	ICMR - National Institute of Nutrition (NIN)	Hyderabad, Telangana
21.	ICMR - National Institute for Implementation Research on NCDs (NIIR-NCD)	Jodhpur, Rajasthan
22.	ICMR - National Institute of Occupational Health (NIOH)	Ahmedabad, Gujarat
23.	ICMR - Regional Occupational Health Centre (ROHC)	Bengaluru, Karnataka
•	**Council of Scientific & Industrial Research (CSIR)**	
24.	CSIR - Central Institute of Mining and Fuel Research (CIMFR)	Dhanbad, Jharkhand
25.	CSIR - Central Salt and Marine Chemicals Research Institute (CSMCRI)	Bhavnagar, Gujarat

26.	CSIR - Indian Institute of Toxicology Research (IITR)	Lucknow, Uttar Pradesh
27.	CSIR - National Environmental Engineering Research Institute (NEERI)	Nagpur, Maharashtra
28.	CSIR - National Institute for Interdisciplinary Science & Technology (CSIR-NIIST)	Thiruvananthapuram, Kerala
29.	CSIR - National Metallurgical Laboratory (CSIR-NML)	Jamshedpur, Jharkhand
•	**National Institute of Pharmaceutical Education and Research (NIPER)**	
30.	NIPER - Guwahati	Guwahati, Assam
31.	NIPER - Hajipur	Hajipur, Bihar
32.	NIPER - Hyderabad	Hyderabad, Telangana
•	**All India Institute of Medical Sciences (AIIMS)**	
33.	AIIMS - Nagpur	Nagpur, Maharashtra
34.	AIIMS - New Delhi	New Delhi
35.	AIIMS - Patna	Patna, Bihar
•	**Indian Institute of Technology (IIT)**	
36.	IIT - Bombay	Mumbai, Maharashtra
37.	IIT - Delhi	New Delhi
38.	IIT - Dhanbad	Dhanbad, Jharkhand
39.	IIT - Gandhinagar	Gandhinagar, Gujarat
40.	IIT- Madras	Chennai, Tamil Nadu
41.	IIT- Roorkee	Roorkee, Uttarakhand
42.	IIT - Varanasi	Varanasi, Uttar Pradesh
•	**Indian Institute of Science Education and Research (IISER)**	
43.	IISER - Bhopal	Bhopal, Madhya Pradesh
44.	IISER - Pune	Pune, Maharashtra
•	**Food Safety and Standards Authority of India (FSSAI)**	
45.	Combined Food and Drug Laboratory, Pasteur Institute	Shillong, Meghalaya
46.	Food and Drugs Laboratory	Goa
47.	Food and Drugs Laboratory	Vadodara, Gujarat
48.	Food Laboratory, Department of Food Safety	New Delhi
49.	Government Public Analyst Laboratory	Lucknow, Uttar Pradesh
50.	Karnataka State Food Laboratory	Bengaluru, Karnataka
51.	National Food Laboratory	Navi Mumbai, Maharashtra
52.	National Food Laboratory	Kolkata, West Bengal
53.	National Food Laboratory	Ghaziabad, Uttar Pradesh
54.	National Food Laboratory in PPP with NCML	Chennai, Tamil Nadu
55.	Public Health Laboratory	Patoli, Jammu & Kashmir
56.	Regional Analytical Laboratory	Kozhikode, Kerela
57.	Regional Food Laboratory	Rajkot, Gujarat
58.	State Food Laboratory	Kharar, Punjab
59.	State Food Laboratory	Hyderabad, Telangana
60.	State Food Laboratory	Kolkata, West Bengal
61.	State Public Health Food Testing Laboratory	Lamphel, Manipur

62.	State Public Health laboratory	Guwahati, Assam
63.	State Public Health laboratory	Kohima, Nagaland
MINISTRIES/DEPARTMENTS/GOI ORGANIZATIONS		
64.	Central Drugs Standard Control Organization, MoHFW	
65.	Ministry of Agriculture and Farmers Welfare	
66.	Ministry of Chemicals and Fertilizers • Department of Chemical and Petrochemicals	
67.	Ministry of Commerce and Industry • Department for Promotion of Industry and Internal Trade	
68.	Ministry of Environment, Forest and Climate Change • Hazardous Substances Management Division • Central Pollution Control Board	
69.	Ministry of Food Processing Industries	
70.	Ministry of Micro, Small & Medium Enterprises	
71.	Ministry of Mines • Department of Mines and Minerals	
72.	Ministry of Labor and Employment	
73.	Ministry of Road Transport & Highways	
74.	Ministry of Textiles	
75.	Ministry of Water Resources • Department of Drinking water and Sanitation • Central Ground Water Board	
INTERNATIONAL AGENCIES		
76.	CDC, India	
77.	United Nations Office for Project Services (UNOPS), India	
78.	UNICEF, India	
79.	US Agency for International development (USAID), India	
80.	WHO, India	
NON-GOVERNMENTAL ORGANIZATIONS		
81.	Association of Healthcare Providers	New Delhi
82.	Indian Society for Lead Awareness & Research (InSLAR)	Bengaluru, Karnataka
83.	M.S. Swaminathan Research Foundation	Chennai, Tamil Nadu
84.	Pehle India Foundation	New Delhi
85.	Pure Earth	New Delhi Chennai, Tamil Nadu
86.	The Energy and Resources Institute (TERI)	New Delhi
87.	Trisakha Foundation	Chennai, Tamil Nadu