1ST ROUND TABLE DISCUSSION ON STRATEGIC APPROACH TO INTERNATIONAL CHEMICAL MANAGEMENT (SAICM)

Date: 9th December 2019

IIT Madras

Acknowledgements: We thank the participants of this Round Table and the MoEFCC for their support.

INTRODUCTION

MoEF&CChas engaged IIT Madras to create a long-term relationship to comprehensively address issues related to coordination and implementation of SAICM. The objectives *inter alia* would cover the following: (i) To introduce and establish a programmatic approach to handling SAICM in MoEF&CC; (ii) To identify and develop long-term strategic partnerships to provide key technical, policy and strategic inputs to the Ministry in management of SAICM; (iii) To act as a repository of knowledge and create as well as maintain data base for SAICMrelated issues in the Country; and (iv) To assist and support MoEFCC during international/ national meetings on SAICM related matters.

The issues to be covered under partnership for SAICM shall include existing focus areas of SAICM as well as 'SAICM beyond 2020' agenda. The emerging policy issues under SAICM are: - lead in paints, chemicals in products, hazardous electricals, nano-technology, endocrine-disrupting chemicals and pharmaceutical pollutants. The scope of engagement shall also cover issues/ agenda under consideration of SAICM secretariat which are not covered above.

While firming up country's position, IIT Madras will assist the MoEF&CC by undertaking stakeholder consultations. The analysis of responses emerged from such consultations will be done in agreement with MoEF&CC to develop final views. The stakeholder consultations will form the basis of developing informed decisions with respect to negotiations during the COPs.

It is in this context that IIT Madras has organized the first one-day round table discussion at IIT Madras on 9th December 2019.The purpose of this round table discussion is to build acknowledge base on scientific/technical research undertaken by various Institutions/researchers in India, specifically in the areas of "lead in paints", "pharmaceutical pollutants", "endocrine disrupting chemicals", and nano-technologies; and to create a network of researchers working on topics related to it. Besides the IIT Madras team, experts from different academic institutions, representatives from Pollution Control Boards and professionals from health sector participated and contributed to discussions in this round table. The schedule of the round-table discussion and list of participants are provided in the Annexure-1 and the Annexure-2, respectively.

The Chair of the round table, Prof. V.R. Muraleedharan, IIT Madras welcomed the participants and informed them about the objectives and scope of IITM-SAICM project and the purpose of the round table. He emphasized that the first part of the work is to collect literatures and information relevant to SAICM in the Indian scenario. Second part involves helping the Government of India to develop informed decisions with respect to negotiations during the COPs, based on extensive stakeholder consultations, which involve researchers, professionals and Pollution Control Boards, Line Ministries/ Departments.

Before setting the context for the sessions, Prof. Ligy Philip, IIT Madras emphasized that all participants of the workshop are part of the IIT Madras – SAICM projectand their role in the project would not be ending with this round table discussion. All the participants would be engaged in discussions on a continuous basis, and that the lead and joint authorship of the white papers relevant to SAICM, to be provided to the Govt. of India, would be shared by all who are providing significant contribution.It was also emphasized that the IIT Madras team seeks participation from all the regions of the country and all efforts would be made in this direction in future.

Discussions were held in three sessions to focus on three themes, details of which are provided in this report. The programme schedule given in Appendix 1, and the names of participants are attached in Appendix 2.

SESSION - 1: EMERGING CONTAMINANTS

Moderator:

Prof. Ligy Philip, IIT Madras, Chennai

Panel Discussants:

1. Prof. T. Shashidhar, IIT Hyderabad
2. Dr.AvirajDatta, ICRISAT, Hyderabad
3. Mr. Manoharan, TNPCB, Chennai
4. Dr. Vijayalakshmi, Apollo Hospital, Chennai
5. Dr. J. Senthilnathan, IITM, Chennai

The session started with a brief presentation by Prof. Ligy Philip to set the context of first session on Emerging Contaminants. After providing a brief background on Endocrine Disrupting Chemicals (EDCs), she discussed the major sources of micro-constituents in different environmental compartments i.e., surface water bodies, groundwater (aquifers) etc. Environmentally persistent pharmaceutical pollutants, per fluorinated chemicals and highly hazardous pesticides are the major chemicals falling in this category of Emerging contaminants or Endocrine Disrupting Chemicals (EDCs). Several key questions were posed by the moderator, on which discussion was sought, first by Panel Discussants, and then reaction from the other participants. These questions and the ensuing discussions are presented as follows.

1. **What are the complications/lacunae in identifying the occurrence and quantification of ECs in various environmental compartments in India?**

   It has been pointed out that it is a challenge to identify the occurrence of ECs in the environment because one does not have complete understanding of which compounds are coming into the environment. This is because of continuous change in compounds used in the industries due to changes in market demand and processes adopted. A large number of different antibiotic compounds are released into water bodies by pharmaceutical industry, and identifying these compounds is an issue due to lack of facilities for analyses. Most public and private laboratories lack facilities to identify and quantify the EDCs. Methods and protocols for the analysespose challenges as they vary with the aquatic systems. The analytical methods for ECs from various matrices are still in developmental stage. It is also opined that it is difficult to follow presently available standard methods because of complex nature of matriceswe have in India.The number of antibiotics used in animal husbandry is phenomenal, and monitoring of all these antibiotics is near impossible.About 209 hazardous chemicals have been imported to India in the past 67 years and it is important to study how they are being used and disposed in the environment. Attempts should be made to see if precision analysis is needed.

An interesting anecdote was recounted where the pollution level of Bellandur lake in Bangalore was found to be maximum during the night although very less number of industries operate during the night. This is because industries tend to discharge the effluents at a time when inspection is difficult to carry out. This points to the need for continuous monitoring, but that would increase the cost of monitoring exponentially. Based on observations of the data for past 10 -15 years, CPCB scientist expressed that sudden drastic change in concentration of certain chemicals such as heavy metals or pesticides will not occur and they require monitoring only once in a year, preferably in the lean period or month of March. Frequency of monitoring needs to be fixed based on site specific conditions.

The Central Pollution Control Board (CPCB) in association with State Pollution Control Boards (SPCBs) / Pollution Control Committees (PPCs) is monitoring the quality of water bodies at 2500 locations across the country under National Water Quality Monitoring Programme (NWQMP) where heavy metals and banned pesticides are monitored. The CPCB scientist expressed that good technicians and good understanding of the chemical are the priority need as monitoring is already in place. In addition, only few Centers of Excellence such as National Institute of Occupational Health Hyderabad, Indian Institute of Toxicology, Lucknow are involved in monitoring the hazardous pharmaceutically active and other EDCs. Thus, there is an urgent need to enhance regional capacities and do monitoring in a wider area, by involving more universities and institutes. International cooperation may be sought if required. Discussants opined that the Government could compel the companies which produce the hazardous pesticides, pharmaceuticals and other chemicals to provide support in establishing the infrastructure or high end instruments for monitoring compounds in the target community as it is not always possible for government labs alone to take this responsibility. However, it was recognized that industries will be able to monitor the presence of chemicals in the environment only if the Government can specify the parameters, analytical methods and instruments to be used. This is especially important because monitoring of these chemicals has to be carried out in the range of microgram or nanogram levels.

Given the above scenario of presence of a multitude of pharmaceutically active compounds in the environment, a risk based ranking is necessary to determine which compounds need to be monitored on a regular basis, and appropriate methods for monitoring them need to be specified. A common platform or database about all procedures and analytical facilities available in India (location of laboratory, instrument etc.) should be made so that identification and information sharing can be made easy.

2. **What are the current challenges in controlling and handling such pollutants?**

Most of the existing treatment plants are not equipped to treat any of the emerging contaminants. However, there is a possibility that removal of EC occurs while BOD and COD are removed in existing treatment plants. So, there is a need to make database for capacity evaluation of existing treatment plants.

It is difficult to control the sources of pharmaceutical compounds as only 20-50 % of the active compounds in the medicines are absorbed in the human body and the rest are excreted out through urine or faeces. The sustainable alternative is to encourage the chemical manufacturers to adopt cleaner production and follow pollution prevention policies.

60-65% of antibiotics are used in animal husbandry and not by human beings. They get mixed with fodder, rain and then find their way to the water bodies. It is extremely difficult to monitor and control these non-point sources.However they are monitored in rivers and lakes as there are no standards set for animal husbandry sources. India contributes about 50% of world export from slaughter houses. They are exported only after checking and ensuring absence of active pharma compounds, pesticides etc. Ensuring of export quality minimizes presence of such compounds. Products with high amounts of these compounds come back to India. Therefore, one should attempt to put in place control measures at those places where such slaughter houses are present.

3. Can the existing discharge standards address the issue of pollution?

It was stated by several discussants that occurrence of COD can be due to many compounds and setting a single COD standard would not take care of allowable limits of different chemical compounds. Therefore, development of separate standards for dye industries, pharmaceutical industries, domestic wastewater and others is the right way to move forward. It was informed that CPCB has already introduced industry specific standards which can be found in the Green Book. It specifies parameters to be monitored along with the limits set for each industry based on processes carried out at the industry. It is a good idea to revisit and revise the Green Book, if needed, based on the current knowledge.

Following are a few of the critical points that need to be kept in mind while carrying out the exercise of "setting standards":

- Bio-monitoring is important because chemical toxicity does not always give proper understanding.
- Simply setting standards does not help unless there is capacity and mechanism to identify, monitor and control the major sources for entry of ECs into to the atmosphere. This is especially relevant in the context of non-point sources like agricultural or domestic applications through which ECs are released into the environment.
- It was suggested that the regular monitoring can be initiated for three or four candidate contaminants at first, and then the list of compounds for monitoring can be expanded in phases (5-10 compounds in five years).
- The effluent discharge standards should take into account the availability of flows in the discharging body.
- A valid point is raised regarding whether there is a need for the standards for effluent discharge in the context of "imposition of zero liquid discharge norms for very many industries in several states". For example, TNPCB insists on zero liquid discharge for pharmaceutical industries where they are promoted to reuse water.

4. **Is the availability of technology a major challenge? Do enough knowledge and capacity exist in India to tackle this problem?**

Present commercially available treatment technologies are not sufficient for the removal of ECs. Several industries are using genetically engineered organisms for biological treatment of particular pharma compounds. This will increase the probability of antibiotic resistance. Technologies based on the electro chemical process arevery expensive and industries may not be willing to adopt them. It was also pointed out that the capacity of India is very bad with respect to people working and analytical facilities available in wastewater treatment plants. STPs are not there in most of the hospitals in India. Building STPs in hospitals with technologies to take care antibiotic resistant genes is a real challenge.It has been opined that though we have technologies, adopting those in all sewage treatment plants is going to be an uphill task because we are struggling to achieve the basic treatment itself.

It has been pointed out that several researchers from India have developed innovative technologies to remove emerging contaminants from water. But many of these technologies have remained at the laboratory level and have not been able to make a dent on public life, largely due to lack of adequate investment.

The design, implementation and operation of treatment plants should be flexible and based on possible changes in the nature of emerging pollutants over the life time of the treatment plant. It is challenging to predict what kind of EDCs will be arriving at the treatment plant along with wastewater in future.

5. **How can one draw up the standards, based on the cause of antimicrobial resistance, human health, LD50, etc., or measurable concentrations based on available technologies?**

All the discussants agreed that standards should be such that: (i) it is economical to ensure adherence to standards, (ii) they are measurable and (iii) technology is available for implementing the standards. Although all the factors such as LD50 and

AMR (anti microbial resistance) should be considered while setting the standards, consideration of AMR may lead to very stringent standards. Enough data on the concentration responsible for AMR is not available, though AMR is a major concern for India. Therefore, one can go with LD50 if ecological risk is foreseen; otherwise they can be based on reference dose for human health. However, it was expressed that enough data on human health risk associated with ECs is not available and acquiring such data is more important at this point of time.

All the discussants opined that an evaluation study should be carried out on the approaches taken by other countries while setting up standards. In this context, it was brought to the notice that Australia had already come up with standards for pharmaceuticals in drinking water based on LD50. However, this approach was strongly questioned. It was also suggested that caution may be exercised while adopting standards from other countries because they may not be applicable to India.

Summary:

Major points that emerged out of discussion during Session-1 can be summarized as follows:

- A national depository is needed for:(i) all the data and information collected; (ii) sophisticated instruments available in the country; (iii) methods and protocols for the analyses and (iv) processes developed in India for the treatment.
- There is an urgent need for capacity building; existence of one or two major centres of excellence is not sufficient. Regional centres of excellence are essential.
- Industry specific effluent discharge standards are available;howevermuch work needs to be carried out for handling non-point sources.
- Though technologies are available, adapting high end technologies is not feasible in India. Paradigm of "prevention is better than control" should be adopted.
- In-depth evaluation study should be carried out on the approaches taken by other countries while setting up effluent discharge standards for various EDCs.

Although the issues related to the knowledge and policy gaps on the use, transport, handling and disposal of ECs were flagged for discussions, they were inconclusive and will be taken up again in the next round table.

SESSION - 2: NANO PARTICLES & OTHER CONTAMINANTS

Moderator:

Prof. Rams S. Verma, IIT Madras, Chennai

Panel Discussants:

1. Prof.Arun Kumar, IIT Delhi
2. Prof. Ravindra Khaiwal, PGIMER, Chandigarh
3. Prof. Kurian Joseph, Anna University, Chennai
4. Dr. N. C. Ghosh, Scientist-G (Retd.), NIH Roorkee
   Presently Principal, BIT Kolkata

The session started with a brief presentation by Prof. Rama S. Verma. He stressed the emerging importance of usage of nanoparticles (NPs) in our daily lives and about existing knowledge gap on the amount and risk of dispersal of NPs in the environment. He discussed the anthropogenic release of NPs and public exposure to NPs through personal care products, food and beverage industries, biomedical applications such as drug delivery, antimicrobial applications, cell targeted therapies and tissue engineering, and occupational exposure

through laboratories, industries and mines. He added that pollution was basically through combustion of fossil fuels and incinerators and the NPs from the atmosphere can be absorbed by the plants and the environment which could lead to subsequent uptake into the soil, air and water leading to the health hazards through inhalation, ingestion, injection and permeation. The absorbed NPs enter in to the cell and interfere with the cell cycle and develop several kinds of diseases. The moderator also gave an overview on the existing NPs in various application sectors. He also pointed out about oxidative stress-based DNA damage and apoptosis, actin filament integrity for cell integration, blood brain barrier (BBB) for CNS related diseases and alteration of gene expression which can lead to array of diseases. Also, the health impacts caused by NPs to humans such as hematological toxicity, nephrotoxicity, hepatotoxicity, splenic and pulmonary toxicity was given a special focus. NPs toxicity is significant and the penetrative capabilities of NPs are 1000 fold higher than any other chemical or drug molecules which can cross the barriers, enter the cell at ease and exert their effects.

Several key questions were posed by the moderator, on which discussion was sought, first by Panel Discussants, and then reaction from the other participants. These questions and the ensuing discussions are presented as follows.

1. **Is the presence of NPs in different environmental matrices a real concern in India?**

   It was clear from the discussions that research, in India, on the effects of nano particles on the environment and human health is in its nascent stage, and is being carried out in pockets. This was evident from the discussion on what constitutes a nano particle and how NPs are different from Particulate Matter (PM). It was made clear that a particle is classified as a nano particle when at least one dimension is in the nano meter (nm) range; in water they are referred as NPs and in air they are referred as ultrafine particles. Particulate Matter (PM) size is restricted to 1µm in size and particles further down in size are referred to as ultrafine particles. It was opined that checking for the particles in the range of 20 nm is important. The particles should be filtered so that the measurable parameters could be quantified for the contents such

as carbon content and metal content. These particles could be subjected to surface electron microscopy to analyze the exact type of matter they contain.

Many NPs occur naturally in our environment and without which life cannot exist, as most of microorganisms including bacteria, virus and pollens are in the size range of NPs. It is obvious that these naturally occurring NPs do have an adverse effect on human health. Therefore, it is expected that release of synthetic and engineered NPs into atmosphere can be highly detrimental to humans. Research in other countries has clearly established that several diseases can occur due to exposure to nano particles. Thus, presence of NPs in different environmental compartments should be a concern in India, if not in the immediate future, but surely in near future.It is pertinent to note here that NPs (including activated charcoals and cosmetics) are used in our day to day life and are simply dispersing into the environment.

2. **What are the sampling methods for nano particles?**

   It was suggested that air sample can be sucked from atmosphere in the range of metric ton or cubic ton and then NPs could be absorbed in the filter paper.Further analysis could be carried out using TEM and SEM.

3. **What are the lacunae in the knowledge about the nano particles and the environment and human health?**

   It was pointed out that we do not have much data on toxicity of NPs either in cells, in plants or in small animals, which should be widely carried out in several laboratories at different places. It was suggested that toxicity study and lethal dose analysis for NPs should be carried out at firsthandin order to classify them as malevolent. Toxic studies are essential to fix the criteria for the NPs usage at the right dose without which we cannot develop any kind of further measurements.

   Pharmaceutical NPs could become more dangerous than other NPs because of the way the capsules are made using NPs for the treatment purpose. NPs that are used in the pharmaceuticals for the drug delivery is of high concern. Lot of diagnostic imaging techniques such as CT scans use NPs as contrasting agents, thus, their usage and disposal should be monitored. It is suggested that the Central Pollution Control

Board should take initiative to monitor the use of NPs in imaging technologies.Some NPs that are used in imaging techniques such as CT scans are highly stable and not degraded by any bacteria and viruses.Therefore they stay in the environment for a long time. Clinicians are unsure about the NPs safety and the container of the NPs used for CT scan does not contain any labelling. Labelling of these NPs should be made mandatory for containing information such as half-life or shelf life and amount of active ingredients.

Many environmental pollutants have the national inventory, which maintains the data on the amount of materials manufactured, consumed and disposed to the environment. A concern was raised whether we can establish such type of inventory for NMs /NPs, since many NMs are highly unstable under different environmental conditions. It was informed by the discussants that, as far as India is concerned, only risk assessment studies for nano particles are being carried out using the experimental methods.

All discussants opined that a dedicated round table discussion, involving more experts drawn from different institutions, is necessary to get further insights on the presence of nano particles in our environment.

4. **How should the e-waste be managed? What are e-waste management policies, regulations, and existing laws in India?**

All discussants agreed that e-waste is a serious concern and there has been a focus on e- waste from 2012 for the policies. Management of e-waste has become a major concern because it is a potential resource. Only few people are aware of its value and even lesser number of people are awareabout hazardous risk.

Regulatory policies for e-waste management are available in India. However, there should be a framework that everyone should return the e-waste, should go through formal recycling facilities where values are recovered and hazardous waste is safely managed. Parts of electronic goods such as circuits, conductors, switches and the plastics contains are hazardous substances and are flame retardance.Major chemical culprit in the e-waste is phenolic compounds, which has not been addressed so far.

It was informed that anyone who would like to start e-waste based business can approach “e-parisaraa, Bangalore” to get excellent formal training. The list of e-waste recyclers at CPCB can also be availed for recycling. It has been brought to the notice that very few recyclers allow people to visit the recycling process and transparency is lacking.

It was suggested that manufacturers should come forward to collect their used products as e-waste and recycle them either in their product or manage. They are the best people to know what material is used in their products and how to effectively manage that. Policies should be made that the manufacturers should collect the used products which could be recycled close to 90%.

5. **What should be the role of informal sector in the e-waste management?**

   Informal sector has been collecting e-waste for generations and several NGOs feel that informal sector should be engaged in the e-waste management. However, several discussants opined that if e-waste goes through informal sector, there would be some resource recovery, and after that it is discarded into the environment without concern for the hazardous substances in the e-waste. To the suggestions that informal sectorcould be trained properly and then there could be a combination of informal and formal sectors for the e-waste management, concerns were raised and it was pointed out that informal sector would take all the valuables and then the formal sector would have to invest on the hazardous materials management. This will discourage formal sector to come with investment.

Summary

Major points that emerged out of discussion during Session-2 can be summarized as follows:

- Toxicity and activity of the synthetic and manufactured NPs are to be studied carefully.
- Monitoring the manufacturing facilities of NPs by CPCB and establishment of inventory on NPs based pharmaceutical and cosmetic products is important.
- Methods for the quantification of NPs produced should be developed.
- As the policies are already existing to avoid lead in paints, smaller paint industries should also be monitored.Battery recycling industries should be monitored closely.

- Policies and guideline are existing for the e-waste management and it is unanimously agreed that recycling is the only way and these policies are to be reinforced and implemented in a better way.

SESSION - 3: POLICY

Moderator:

Prof. V. R. Muraleedharan, IIT Madras, Chennai

Panel Discussants:

1. Dr.Radheshyam Balaji, CPCB, Bangalore
2. Dr. Aditi Roy, Center for Environmental Health (CEH), Gurgoan
3. Mr. Rohith Kamath, National Law School of India University, Bangalore

Prof. Muraleedharan set the context for discussions during the Session-3 and emphasized that this session would focus on policy and regulatory aspects of the chemical waste management at a deeper level and the discussion would revolve around a few key questions. He further clarified that this session would also revisit the policy discussion that happened in the first two sessions regarding nanomaterials and lead in paints.

1. **What is the state of green manufacturing technologies in India? Are there any existing laws regarding it?**

   A few of the recent success stories in green manufacturing were discussed in detail. Earlier, bleaching in textile industry was being carried out using chlorinated compounds. At present, most of the industries are using the ozone compounds for bleaching. The use of ozone has reduced the load on effluent treatment plants significantly. Also, the oxygen is helpful when the product goes for extended aeration. Many of the micro bleaching units in Tirupur areause bleaching powder for cotton clothes. They were reluctant to adopt ozone process because of high cost. These industries were then penalised and asked to pay a fine of Rs. five lakhs, when the total worth of the industry is only Rs. two lakhs. The issue was resolved by having a common ozone facility where several smallindustries can bleach the clothes by paying a small amount. Traders pay hourly charges to get their clothes bleached. The problems faced by the industries such as compensations for those exposed to pollution were also brought out during discussions.

   There are several other examples of green technologies:

   (i) The Supreme Court has recently passed a judgement in which the use of heavy metals like arsenic is bannedin order to reduce the smoke emissions by 30-50%.

   (ii) Paper industry is encouraged to use its own waste materials for the generation of new products instead of raw pulp. This also leads to the reduction of the waste produced by the industry.

   (iii) Research into the use of the hazardous chemical waste produced by one industry as the raw material for a downstream chemical industry will eventually reduce the amount of chemical waste to be disposed. For example, sludge from the dyeing wastewater treatment plant is now used by the cement industry.

   (iv) An initiative for adopting alternative green technology has come from the Pharma Association, which approached the CPCB for recommendations and suggestions regarding what they can do. In response to this, CPCB is encouraging the use of atom-based

technology which has been successfully used in some other countries. However, this technology is very new and expensive.

It must be pointed out that although there are several initiatives towards adopting green technologies, we need more proactive policies to promote wider adoption and diffusion of such technologies.

2. **What is the scope of existing laws and regulations regarding hazardous chemical waste management (particular focus to pharmaceuticals, EDCs, lead, nanotechnology)**

The importance of health in all policies especially in environmental policies was stressed. For example, in the Pesticide Management Bill of 2017 which has replaced the Insecticides Act, there is ample amount of emphasis on human health and safety against the exposure of pesticides in the act. This targets the safety of farmers as well as the workers involved in the manufacturing of pesticides. The importance that is accorded to health in the acts and policies should be appreciated.In a similar way, health issues should be considered seriously in the other acts and laws, related to SAICM.

There should be listing of all component ingredients on the packaging of the product so that chemicals like lead in paint can be controlled. There is already a Legal Metrology Act in place, which was adopted in 2009 and under this act there are packaging and labelling rules. These rules provide for the display of ingredients used in manufacturing of the product and they are mandatory for every manufacturer. If these rules are not followed, then the Legal Metrology inspector can be informed and appropriate actions will be taken as per the criminal procedure. However, there are some loopholes in the acts with respect to the current labelling. While recognizing that labelling requirement is different for each specific industry, for issues regarding health, the public health should be given priority.

<u>It is pertinent to note that the Master Chemical Action Plan proposed by CPCB is already available in the public domain for public comment.</u>

Some discussants raised a fundamental question whether policy concerns on EDC or nano waste materials are of great concern to India when we do not even have proper waste water treatment facilities (around 75% of domestic wastewater is not treated). However, it is argued that one need not wait until the problem becomes insurmountable. We should formulate policies and acts in anticipation and to prevent escalation of the problem.Rising diabetes in rural India is an example of what could result due to lack of effective programmatic interventions. Evolution of drug resistant superbugs in India is another example. Several discussants raised questions regarding the scope, sufficiency and modifications of laws covering Endocrine Disruptive Chemicals.Antimicrobial resistance in animal husbandry in India is not controlled. There is lack of policy regulations and stringent laws to control the increasing use of antibiotics, growth hormones etc. in the country.

The importance of how a policy on one aspect can lead to adverse impacts on other fronts has been brought out. For example, encouragement of construction of toilets on a large scale underSwachh Bharat Abhiyan, without attendant policy on appropriate waste treatment, could lead to large scale contamination of surface and groundwater resources due to leachate from soak pits. It is noted that although urban local bodies are coming out with plans and system for treatment of sewage, these are not implemented on large scale.

Although not directly related to SAICM, concern was raised about the BT Cotton and the use of DNA technology in creation of pest resistance grains. Creation of pest resistance crops will remove the insects and thus in the long run will impact the balance of the forest ecosystem. It was pointed out that Biodiversity Act of 2002 deals with these types of concerns. On similar lines, the quarantine measures regarding import of seeds from other countries have been noted. The importance of documentation and characterization of the products including pharmaceuticals when they are imported into Indian markets is noted. Recently, a Chinese delegation was denied permission to work on Indian sand as sand is considered as biological product and comes under the purview of National Biological Diversity Act. However, the

need for more stringent laws to tackle these issues is emphasized. Also, whether Biodiversity act deals with issues of concern to SAICM needs to be discussed further.

3. **Are the policies, laws and regulations regarding waste chemical management implemented strictly? What are the mechanisms and policy initiatives that can be adopted for the wider adoption of these regulations?**

   It was pointed that even though no strict policy or regulation is available, both MoEF&CC and State Pollution Control Boards enforce their conditions at the time of clearance of projects. However, it appears that there is a major impediment in making further progress due to lack of faithful implementation of the laws and schemes (despite their weaknesses). This applies to all domains like Environmental Acts, Food Safety Acts and the chemicals that are in question.

   Related to problems in the enforcement of ban on the use of Bisphenol A in baby feeding bottles, it is noted that although BPA free bottles are available in urban areas, there is more circulation of bottles and cans made from secondary plastic in rural areas. Regulations are in place in urban areas but there is still lack of policies and schemes that target rural areas in particular.

   Organisations handling laws and regulations regarding chemicals can be categorised into three levels: (i) ministerial level, (ii) departmental level and (iii) statutory level. Besides, business and non-governmental organisations also play an important role. The fragmented structure of government bodies results in incoherence, lack of coordination and repetition of work. There is a need for a more central approach with proper coordination among government bodies to achieve convergence of various ministries and departments.The mandates provided by one ministry can be circulated to other ministries and industries.

   In this context, it has been emphasized by several discussants that adoption of top down approach, as compared to the bottom-up approach, can lead to failure in India as the social structures and social engineering systems are very different from countries like US, UK and Canada. There has to be significant emphasis on awareness systems regarding e-waste, nanoparticles etc., as part of policies.

NEXT FEW STEPS

Following steps will be taken in the immediate future to achieve the goals of the project:

1. There will be a long-standing and continuous engagement in IIT Madras activities regarding subjects relevant to SAICM. The MoEF&CC requires a knowledge base collected from people across the country and not by just few people working in a particular institute. Collective engagement and idea sharing is expected from the participants.
2. The IIT Madras team would like to increase the network of people who can be relied upon for obtaining information and cooperation.For this reason, each participant in the 1st Round Table of discussions was requested to provide the contact details of five other scientists / administrators / professionals who are carrying out work related to SAICM.
3. A draft outline of the outcome of the 1st Round Table discussions will be shared with all the participants and their feedback will be sought.
4. Authorship of the reports will be given to all who are engaged in contributing and not just to the team members from IIT Madras. Expenditure incurred for contributing towards the project will be met by IIT Madras.

5. Outline of the report already made on pharmaceutical pollutants will be shared with all the participants so that they can get an idea on what is to considered while preparing reports for other chemical compounds.
6. Following Table provides information on knowledge domains in which the participants have kindly agreed to contribute.

No.	Name of the Contributor	Domain
1.	Dr.Arun Kumar, IIT Delhi	(i) Risk assessment of EDCs (ii) Nanoparticles
2.	Dr. Rama ShankerVerma, IIT Madras	Nanoparticles
3.	Dr. Kurian Joseph, Anna University	E-waste Management
4.	Dr. Suneel Pandey, TERI	E-waste Management
5.	Dr. Ravindra Khaiwal, PGIMER, Chandigarh	Health effects of pesticides
6.	Dr.AvirajDatta, ICRISAT	Emerging Contaminants and Livestock
7.	Dr.Vijayalaskhmi, Appolo Hospital	Antimicrobial Resistance
8.	Dr. T. Sashidhar, IIT Hyderabd	Antimicrobial Resistance
9.	Dr. Aditi Roy, CEH, Gurgoan	(i) Lead in paints: Risk assessment & Policy issues

7. The second Round Table discussion will focus on nanomaterials as there is a significant lack of knowledge in that field.

Annexure 1 - Programme Schedule

Introduction Session	
09:30 – 10:00	Coffee/Tea & Ice Breaking Session
10:00 - 10:15	• Invocation • Welcome/context setting
Session 1 - Emerging Contaminants (EDCs/EPPPs/Pesticides)	
10:15 – 11:30 5 - 7 min for each speaker	Themes: • What are the complications/lacuna in identifying the occurrence and quantification of ECs in various environmental compartments in India? • What are the current challenges in controlling and handling such pollutants? • Is the availability of technology a major challenge? • Whether enough knowledge and capacity are existing in India to tackle this problem? • Whether the existing discharge standards can take care of the pollution? • How can one fix up the standards? Based on cause of antimicrobial resistance, Human health, LD50, etc., or achievable concentrations based on available technologies? • What are the knowledge gaps and policy gaps on use, transport, handling and disposal of ECs
	Moderator 1. Prof. Ligy Philip, IITM
	Panel Discussants 1. Prof. Shashidhar, IIT Hyderabad 2. Dr.Aviraj Datta, ICRISAT 3. Mr.Manoharan, TNPCB 4. Dr. Vijayalakshmi, Apollo Hospital 5. Dr.Senthilnathan, IITM
	Open discussion and Q&A
11:30 – 11:45	Coffee Break
Session 2 – Nanoparticles and other contaminants (Lead, e-waste, chemicals in products)	
11:45 – 13:00 5 - 7 min for each speaker	Theme: • Are the nanomaterials in different environmental matrices is the real concern in India? • Nanomaterials manufacturing industries: Safe transport, guidelines for handling/storage, safe disposal, existing laws, and regulation. • What are the environmental concerns and policy issues for lead in paint? • What is e-waste, and why is it important? How do we manage e-waste? • What are e-waste management, policies, regulations, and existing

	laws in India? • What are the major recommendations to strengthen the existing e-waste management and laws in India?
	Moderator 1. Prof. Rama S Verma, IITM
	Panel Discussants 1. Prof. Arun Kumar, IIT Delhi 2. Prof. Ravindra Khaiwal, School of Public Health 3. Prof. Kurian Joseph, Anna University 4. Dr. N. C. Ghosh, NIH Roorkee 5. Dr. Sharad K. Jain, NIH Roorkee
	Open discussion and Q&A
13:00 – 14:00	Lunch
Session 3 – Policies	
14:00 – 15:15 5 - 7 min for each speaker	Theme: • What is the scope of existing laws and regulations regarding hazardous chemical waste management (particular focus to pharmaceuticals, EDCs, lead, nanotechnology)? • How do we address the loopholes in the regulatory mechanism that requires urgent redressal? • To what extent can we adopt the chemical waste management mechanism of developed countries like the USA, Canada, and the EU? • What is the state of green manufacturing technologies in India? Are there any existing laws regarding it? • Suggest some major recommendations to strengthen the existing regulatory mechanisms governing chemical waste management?
	Moderator 1. Prof. Muraleedharan, IITM
	Panel Discussants 1. Dr.Radheshyam Balaji, CPCB 2. Dr. Kavitha Rajsekar, DHR 3. Dr. Aditi Roy, PHFI 4. Mr. Rohith Kamath, NLS 5. Prof. Sairam Bhat, NLS
	Open discussion and Q&A
Closing Session	
15:15 – 15:30	Way Forward

Annexure 2: List of Participants

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