Draft Final Report on

Implementation of Circular Economy in Toxic and Hazardous Industrial Waste

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1. Introduction

The need for protection and conservation of environment and sustainable use of natural resources is reflected in the constitutional framework of India and also in the international commitments of India. The Constitution under Part IVA (Art 51A-Fundamental Duties) casts a duty on every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures. Further, the Constitution of India under Part IV (Art 48A-Directive Principles of State Policies) stipulates that the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country. Hon'ble Supreme court of India has already held that a right to clean environment is part of the right to life guaranteed under Article 21 of the Constitution and has explained the precautionary principle and the principle of sustainable development in Vellore Citizens Welfare Forum v. Union of India & Ors. [(1996) 5 SCC 647], and other several judgments.

India with industrialisation particularly in Drugs & Pharmaceuticals, Textile, Chemical and Petrochemicals sectors, generate significant quantities of Toxic and Hazardous Industrial Wastes. Examples of processes generating Toxic and Hazardous Industrial Wastes are:

- Petrochemical processes
- Crude oil & Natural gas production
- Production of Cu, Zn, Pb, Al
- Production of paints, synthetic dyes & pigments
- Drugs/pharmaceutical production
- Cement production

This will further enhance with the `aatmanirbhar Bharat abhiyan' where several new types of large industries are expected to cater to the demands of not only Indian market but for promoting global exports. Toxic and Hazardous Industrial Wastes belong to the category of special wastes having constituents of chemicals, metals and other compounds which can cause environmental

pollution. In order to regulate and ensure environmentally sound management of the hazardous wastes, the Govt. of India notified the Hazardous Wastes (Management & Handling) Rules, 1989 under the Environment (Protection) Act, 1986. The Government of India has ratified the Basel Convention on the control of transboundary movement of hazardous wastes and their disposal (under the aegis of UNEP). Provisions and certain decisions of the Basel Convention will have to be harmonised within the domestic legislation according to the India's commitment to the Convention. These will have implications on the Indian industry and environment. Disposal of the hazardous waste necessitate proper management and handling in an environmentally sound manner. The Basel Convention calls for international co-operation between parties in the environmentally sound management of hazardous wastes and the improvement of national capabilities to manage hazardous wastes in an environmentally sound manner.

India is also signatory to four International Conventions viz. Basel Convention on Control of transboundary movement of Hazardous waste and their disposal; Rotterdam Convention on Prior Informed Consent Procedure for certain Chemicals and Pesticides in International trade; Stockholm Convention on Persistent Organic Pollutants, the Minamata Convention on Mercury besides Strategic Approach to International Chemicals Management, which are the guiding framework for the Hazardous waste management and legislative framework in India.

The Circular economy approach is increasingly been adopted by industries to improve the sustainability by maintaining the value of resources in the economy for as long as possible. The move towards a circular economy will bring several benefits including alleviation of some of the risks related to the supply of raw materials, growth in economy, increase the competitiveness of industries and create new business opportunities (re-use sector) and bring about innovative products, technologies and services, which can create new jobs. This would also bring valuable benefits to the environment – less waste, less GHG emissions and other benefits, like better air and water and soil quality.

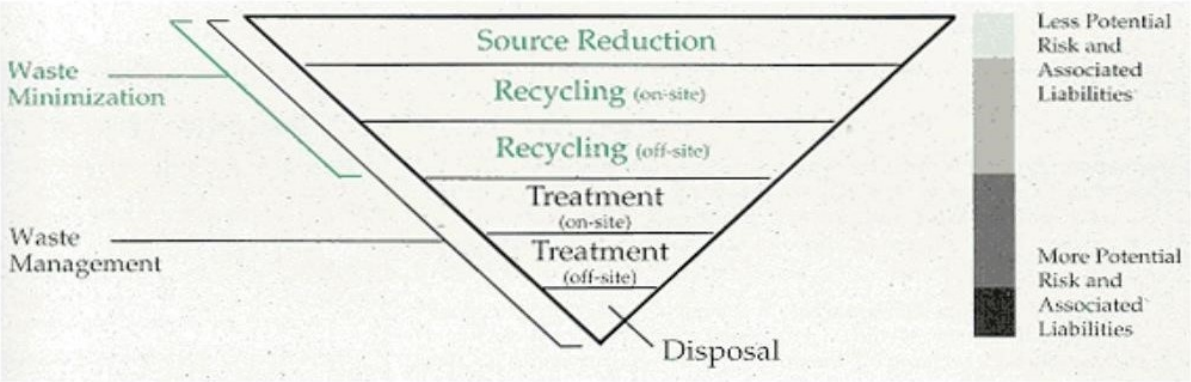
This report is outcome of the Government of India's approach to integrate circular economy in several sectoral areas to improve sustainability of industrial operations in the country also increase their competitiveness. This report deals exclusively for toxics and hazardous wastes sector. Niti Aayog has formed a committee for the purpose and the copy of the constitution of the committee is attached as Annexure-III.

2. Need and Relevance

India with large industrial base mainly of drugs and pharma, textiles, chemicals and petrochemicals, generate significant quantities of Hazardous waste. India has ratified the Basel convention of Hazardous waste and accordingly, notified HW rules, way back in 1989, which are amended from time to time, and new Hazardous substances (Handling and Management) Rules 2016 comprehensively deal with regulatory aspects of Hazardous substances management. The rules identify the hierarchy of hazardous waste management and in Rule 4 outlines the basic approach to the HW management as, ` For the management of toxic and hazardous industrial and other wastes, an occupier shall follow the following steps, namely: -

a) Prevention:
b) (Design, Manufacture with Circularity & LCA approach)
c) Minimization;
d) Reuse,
e) Recycling;
f) Recovery,
g) Safe disposal.

Hazardous Waste Management Strategy:



As it can be seen from the HW regulations, that the regulation is aimed and designed to promote new and innovative approaches for prevention and minimisation of HW besides sound reuse and recycle of the waste. The Rule 9 of HW rules 2016 is specifically designed to streamline the reuse and reutilisation of HW following due procedure and adopting necessary safeguards.

Still however, India needs to commit itself to a transition to a circular economy in hazardous waste and toxics. This would entail decrease of landfilling or incineration of hazardous waste, an increase of recycling of materials and realisation on a no-toxic environment. According to studies by CPCB and some of SPCB related to CEPI industrial areas, the concentrations of hazardous chemicals in effluent, soil and air is found to be in very high concentrations[1],[2]. These observations indicate release of such hazardous chemical through unscientific Hazardous waste management in environment, mainly through the spent solvents.

a. Generation and Disposal of Hazardous Waste (HW) in India

[1] https://cpcb.nic.in/displaypdf.php?id=Q1BBL2Vudl9jcml0aTQzXzIwMTMucGRm
[2] https://www.mpcb.gov.in/sites/default/files/focus-area-reports-documents/MPCB_VOC_Report_ver5.pdf

According to the HW inventory published by CPCB[3] (2028-19) as per the provisions of HW (Handling and Management) Rules, 2016, there are 69416 HW generating industries generating HW in the country. The inventory report gives state wise details of HW generation and its disposal. The summray of the details of the HW generation and disposal is as under;

HW Disposal method	Authorised quantity of Generation MT/annum	Actual Quantities of HW generated MT/annum
Landfillable	6,271,456	2,475,378
Incinerable	2,348,945	337,459
Recyclable	9,289,833	1,520,802
Utilisable	22,335,318	4,305,591
Total	40,43,7590	8,639,229

The table indicates that the actual generation disclosed by the industries is around 21% of the authorised quantity of HW. The inventory also shows sizable quantity around 66% of the HW is either recycled back or is utilised. The balance of about 34% is landfilled or incinerated. It is not clear how much quantity of the incinerable is incinerated at common facilities and how much is incinerated as part of co-processing. The CPCB has already highlighted the need of reliable and realistic assessment of HW generation and its impacts on environment. The report also mentions that there are 17 integrated Common hazardous waste treatment and disposal facilities (CHWTSDF) including landfill and incinerators; 12 facilities having only common incinerators and 16 facilities having only landfills. The CHWTSDF have been developed in PPP mode with capital subsidy by State and Central Governments, with 25% capital contribution coming from both State and Centre. Still however, there is need of additional

[3] https://cpcb.nic.in/uploads/hwmd/Annual_Inventory2018-19.pdf

CHWTSDF in several states considering the HW generation, distance to be travelled from HW generating industry and also, the type of HW to be treated and disposed. The matter is also sub-judice where NGT ahs already issued directions to the CPCB and States to provide atleast one CHWTSDF in each state.

b. HW Contaminated Sites:

CPCB has reported[4] that there are several contaminated dumpsites in various parts of country where hazardous and other wastes dumped historically, which resulted in contamination of soil, groundwater and surface water thereby posing health and environmental risks. Most of the contaminated sites created when industrial hazardous wastes disposed by occupiers in unscientific manner or in violation of the rules prescribed. Some of the sites were developed historically when there was no regulation on management of hazardous wastes. In some instances, polluters, responsible for contamination, have been either closed down their operations or the cost of remediation is beyond their capacity, thus the sites remain a threat to the environment. According to this report, total No. of Sites covering in 21 states, (As submitted before Hon'ble NGT) are 280 while No. of Probable contaminated sites (Assessment needed) are 168. The total number of Contaminated sites (Confirmed) is 112. These number shows the serious and long-term consequences of the unscientific disposal of Hazardous waste.

c. Innovative Approach – Circular Economy

The circular economy is comparatively a new concept in India and limited to certain industry sectors and mainly, it is deliberated at high echelons of the industry management. It is necessary that such a concept is driven through entire production cycle though there can be

[4] https://cpcb.nic.in/uploads/hwmd/Brief_Contmainated_sites_in_india.pdf

strategic and operational goals on hierarchical basis. It would be worth to note following facts which can act as driver for any innovative approach for the resource consumption efficiency.

i. The world's population is growing……. EXPONENTIALLY! Between 1900 and 2000 the increase in world population was three times greater than the entire previous history of humanity– an increase from 1.5 to 6.1 billion in just 100 years. Current estimates put our population at 7 billion in 2017.

ii. There is a finite amount of non-renewable natural resources available. This includes water, oil, natural gas, phosphorous and coal. All materials that were once plentiful and cheap are reaching the limits of known reserves and a future of costly and potentially destructive exploration to find unidentified sources.

iii. Price Volatility and Price Increases Make Commodities More Expensive. As scarcity enters the equation, there is upward pressure and volatility on commodity pricing, making "CHEAP" access to the materials non-existent.

iv. More often than not, current systems of recycling or disposing them are not able to effectively deal with their hazardous nature. Often it is extremely expensive to dispose them to the standards required. For example, the Stockholm Convention ordains that hazardous waste limits define the value at which wastes are considered to be POPs wastes and therefore must be "Disposed of in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed" (Stockholm Convention Article 6.1 d ii.). Hence, toxics and hazardous components become barriers to their being re-introduced into the material process. This fact makes it virtually impossible to grow the market for recycled materials, since it is uncertain and unknowns what the recycled products may contain. Successful recycling is further hindered by a lack of information about what the chemicals added to the materials. By eliminating hazardous content and replacing it with non-hazardous content that provides the same quantity feed from recycling the waste

material as virgin materials does, will ensure that we have robust market for recyclables in the near future decreasing the hazardous content of a product, possibilities for recycling are increased and the demand for virgin raw materials and the energy costs to produce them reduced.

d. Chemicals and Environment

Hazardous chemicals used during these processes, as well as those added to products to make them more usable, are another important aspect of this chain. These chemicals may be released directly or as by products in manufacturing processes or as as part of end-of-life waste. With over 100,000 chemicals being in use in industrial chemistry today, most of them have been untested for their impacts on human health and the environment. More recent studies on chemicals such as endocrine disruptors have shown that the impacts can be long term through chronic and low-level exposures over time and could lead to diseases like cancer, could be inter-generational, be bio accumulative and bio magnifying, and even gene altering and impact whole ecosystems. Examining such hazards from a circular and life cycle approach necessitates the need to examine them holistically through the lens of wastes, chemicals and products to be able to either eliminate or substitute them with safer alternatives entirely or minimize their impacts through dealing with them more effectively. The CPCB and SPCB report indicating the presence of significant concentration of hazardous chemicals in air, water and soil in the industrial areas referred above demonstrate the urgent need of control and abatement of Hazardous chemical entering in the environment. This can be achieved only through the innovative and techno-economic feasible approaches and the circular economy approach provides such an opportunity.

Similarly, as discussed and mentioned in the meeting, there are many hazardous materials which can be removed from the production cycle

in the design stage itself. The cosmetics and fast moving consumer goods manufacturing sector is one area where this can be implemented. Microbead and Microplastics are used both by the personal care and cosmetics industry in vast quantities and are resistant to bio-degradation and last in the environment for decades if not centuries. More than half our dental care products contain micro plastics. The plastic soup foundation has already collected data of over 17,000 products ranging from shampoos, toothpaste, creams, makeups and hand sanitisers that contain micro plastics in them.

e. Resource efficiency:

The toxic and hazardous industrial wastes may also contain useful resources such as metals and critical resource materials (CRM), which if recovered would save them from being mined afresh and replenish them in the supply chains. In fact, many such metals are in limited supply globally, or their extraction would put at risk delicate ecosystems such as forests and it is imperative that they not be wasted. Successful recycling is further hindered by a lack of information about what the chemicals added to the materials. By decreasing the hazardous content of a product, possibilities for recycling are increased and the demand for virgin raw materials and the energy costs to produce them reduced. Various sectoral industries are now investing in new industrial processes to extract and re-use some of the useful materials that are often dumped among tonnes of less useful mining waste. With platinum group metals (PGMs), base metals, and even rare minerals among these unintended constitutions of the hazardous waste. There is growing emphasis through several initiatives across the sectoral industries to improve the reclamation of resources and push the sector towards a truly circular economy.

In summary, the existing regulatory system does reasonably well when it comes to managing certain toxic wastes from industrial facilities. Through enforcement of state and central laws, hazardous waste from industrial sources is tracked, reported, and managed according to

requirements and standards that are vastly improved over the time. Still however, many toxic chemicals are released into the environment through Permitted discharges, Exclusions to regulations, Non-point source pollution, and Problems associated with hazardous waste management. Though 2016 notification incorporate the house hold generation of HW, there is a need to include other sources to estimate the reliable and realistic assessment of HW generation and its impacts on environment. The CPCB and SPCB studies showing presence of hazardous chemical in environment demonstrate the urgent need to adopt innovative approaches like Circular economy. Such an approach would also provide an opportunity to industry to look into entire lifecycle of their activities to ensure optimisation of processes and better alternatives, making the industries move towards beyond compliance, while making them more competitive. Experts in and outside the business community are making the business case for circular economy--not just in terms of doing the right thing, but in terms of the bottom line. “Waste represents inefficiency,”

3. Concept of Circularity

The key element of a circular economy is the rational management of raw materials including that of metals, energy, chemicals and industrial raw materials as well as water and biomass. The aim of the circular economy is to boost economic growth without increasing the consumption of resources. Circularity starts with designing and using the right materials for the manufacturing of products so that they may be recycled in perpetuity at their end of life using readily available conventional technologies present in the country or elsewhere. It all starts from the drawing board, selecting the most appropriate materials and chemicals even before the product ever sees the light of day. This thought process when applied with a critical mind, can simply design out the production of future toxic waste, replacing it with materials that can be utilized by others. Many environmentally progressive companies have

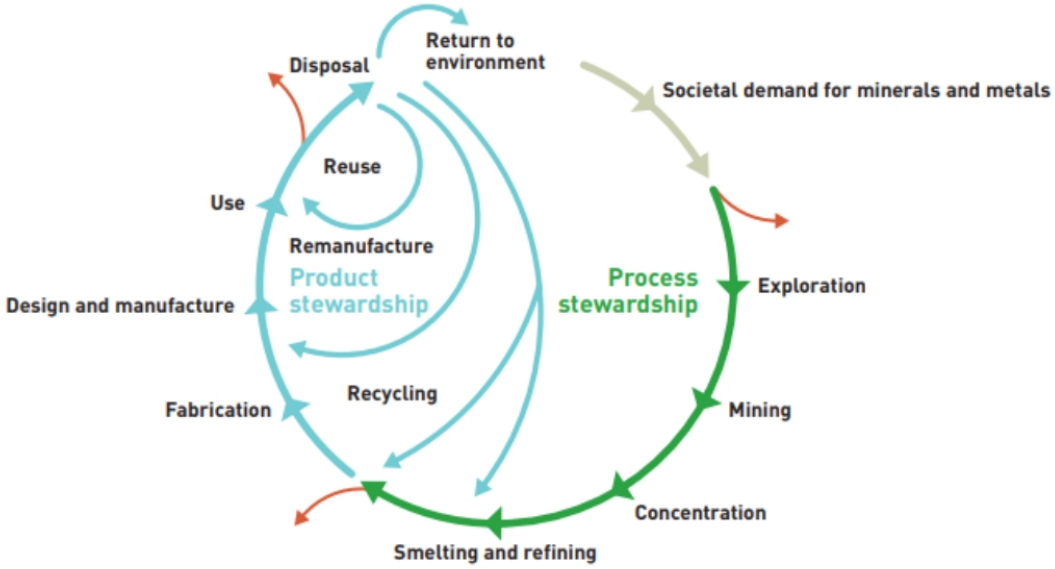
overcome this by either educating their designers or by giving them a set list of chemicals to work with. In a properly built circular economy, one should rather focus on avoiding the recycling stage at all costs. It may sound straightforward, but preventing waste from being created in the first place is the only realistic strategy. While we obviously need to continue recycling for quite some time, putting the emphasis on genuine circular innovations – that is, moving us away from a waste-based model – should be our sole objective.

A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the end-of-life concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals and aims for the elimination of waste through the superior design of materials, products, systems and business models. Nothing that is made in a circular economy becomes waste, moving away from our current linear 'take-make-dispose' economy. The circular economy's potential for innovation, job creation and economic development is huge: estimates indicate a trillion-dollar opportunity.

Hence in order for us to move towards a circular economy in toxic and hazardous waste we must start addressing the design and material aspect related to production and get on board material specialists.

Recycling is a crucial part of the circular economy, but unfortunately the term is increasingly being used to greenwash and flash flawed green actions to consumers and authorities alike. The goal of "true recycling" is that of converting the waste resource back to its original form, without sacrificing quality or integrity in the process. The recycled material should be at par with what was originally created using virgin raw material. As of now most waste material is either down cycled, incinerated or dumped. Given that there are serious limitations in practically implementing true recycling across the spectrum, we should envision implementing true recycling where possible. In fact, this is happening in many areas though not truly true recycling these waste materials and the processes of recycling them have managed to come

pretty close. Example: paper, metals and now even certain types of plastics (HDPE, PET,) and used automotive & DG set oil and cooking oil.



Source: ICMM, Maximizing Value, London, ICMM, 2007

The circular economy concept is an important contribution to countries efforts to achieve sustainable development. It has the potential to bring together many sustainability concepts and ideas in a logical model and strategy, including understandable objectives that can often reveal new positive business cases

4. Current Status of Toxic and Hazardous Industrial Waste Management

The hazardous waste management in India is regulated by Hazardous substances (Management and Handling of Waste) 2016. India is signatory to Basel convention of Hazardous waste. The HW regulations has evolved significantly since first regulation in 1989 and recent notification of 2016 has included the hierarchy of waste management in order to encourage the reuse, recycle and reutilize the wastes. The Rule 9 of HW waste 2016 specifically framed to streamline and encourage the reutilization of HW is a scientific and transparent manner. CPCB, in compliance to these Rules, have notified[5] more than 43 SoPs for sectoral reutilization of HW.

[5] https://cpcb.nic.in/sop-for-hw-specific/

CPCB has started publishing annual inventory of Hazardous waste generation and disposal in compliance with HW Rules, 2016 which has been referred earlier. Few of the important observations from the inventory are;

i. There is significant difference between authorized generation of HW and actual generation of HW.

ii. The maximum HW is either recycled or reutilized, in comparison to land filing or incineration.

iii. There is significant uncertainty in data presented in inventory as the data is coming directly from industry and there are no validation checks either through industry benchmarks or physical audits.

iv. There is an urgent need to ensure the compliance of waste disposal including the recycle and reutilization of HW.

Still however, there is a gap in capacity of registered hazardous waste management companies with the CPCB are not enough to handle all the waste that is being generated, in some parts of country. There are specific directions of NGT (OA 804 of 2017) in this regard to the state government and CPCB to ensure that each state shall have at least one such facility to cater the demands of the state. As a consequence, the majority of the capacity for authorized hazardous waste management companies is utilized by multinational

companies who have strict global mandates. Most MSME's have to resort to informal sectors for waste disposal.

Broadly, the current practice of HW handing and management can be described as under:

Secured Landfill: Secured land-fill is a process that is deployed for industrial waste management at the common facilities but is rarely defined or detailed partly because it is a general term referring to many types of waste but mainly because the inadequate enforcement there are questions regarding the stabilization and disposal practices at such landfill sites.

Solvent Recovery: Solvent recovery is a process which is the closest to a circular economy in the current industrial waste sector. The solvent recovery process allows for certain chemicals to be recovered and used for the

purpose they were originally manufactured. There are two types of solvent recovery, firstly; the generator of the spent solvent has his own solvent recovery plant, and secondly, there are common solvent recovery plants catering to several spent solvent generators on commercial basis. The spent solvent is either returned back or used for some other purposes depending on the quality requirements.

Oil recycling: Oil recycling in the form of pyrolysis, bio-diesel etc have debated efficiency. These processes however rarely repurpose the recovered material to be used for what it was originally manufacture.

Plastic waste: Plastic waste has seen significant success in industrial and post-consumer collections. Most industrial plastic waste is collected by private recyclers who process it of further sell it. However, rarely is it used in a circular methodology. This is in part due to the quality of plastic waste collected at industrial and post-consumer level. However, the pricing of recycled material and policy can also play a negative role. In the case of PET for example, policies by FSSAI don't allow for recycled plastic to be used in primary packaging even though it is possible to recover food grade industrial plastic waste and post-consumer waste through Deposit Return Schemes. Regardless, even if it is Introduce legislation for bottle to bottle recycling (Food Grade) to reduce dependence on virgin material & secure the demand & pricing for R-PET

recovered, the pricing of the virgin material is still cheaper which leaves no incentives for industry to buy cheaper material.

Incineration: As consequence of most waste not having been adequately collected, not having enough resources and correct technologies deployed, is incinerated. Industrial effluent, industrial chemical waste, fertilizers and the packaging that all of the above waste is collected in is often incinerated. Incineration happens as a consequence of dated norms, vague policies and most importantly because of volumes which cannot be catered to.

5. Main Pillars:

A. Policies Initiatives:

Internationally there are several policy initiatives on circular economy in waste management. The OCED[6] has identified some policy and regulatory instruments including, specific evidence-based regulations, Extended producers' responsibility, green public purchase, awareness, research initiative etc. In order to promote the circular economy in toxic and hazardous waste, it would be necessary to examine all such aspects of policies in a very focussed manner.

I. India has specific environmental regulations related to toxic and hazardous waste which have been notified under the provisions of Environment (Protection) Act, 1986, like:

- Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 as amended in 2019
- The Batteries (Management and Handling) Rules, 2001 as amended in 2010
- Bio-Medical Waste (Management and Handling) Rules, 2016 as amended in 2018
- E-Waste Management Rules, 2016 as amended in 2018

The country also has a National Hazardous Waste Management Strategy adopted in 2017. However, these regulations are essentially residue based and oriented regulations and through, directly or indirectly, promote recycle, reuse and reutilisation of waste, the core ingredients of circular economy are not imbibed in these regulations.

II. The Department of Chemicals & Petrochemicals, GOI, circulated the 5th version of the draft Chemical Management and Safety Rules (CMS) to a handful of stakeholders, in August 2020. These draft rules are based on the EU REACH legislation and the existing Manufacture, Storage and Import of Hazardous Chemical Rules 1989 (focusing mostly on prevention and

[6] https://www.oecd-ilibrary.org/sites/9789264309395-en/1/2/4/index.html?itemId=/content/publication/9789264309395-en&_csp_=eb1a6df214d830e8947687c08b10a07b&itemIGO=oecd&itemContentType=book

management of accidents). This new daft is progressively forward looking and lays optimum emphasis on data. “No Data, No Market”. India is also one of the major countries not to follow the UN’s GHS (Global Harmonized System of Classification and Labelling of Chemicals) and these draft rules envision to that change that by incorporating GHS in the final draft due later this year (2021). In view of the above information, specifically in regards to India and the new CMS rules, it becomes imperative that it is necessary to define what circularity & recycling means in order to recommend appropriate action plan for implementing a circular economy in toxic and hazardous industrial waste. In India also, there are some examples like NGT order on lead and bromide contents in PVC pipes, ODS program, HCFC program etc.

III. Globally, many countries are in the process of or have already drafted policies and implemented legislation pertaining to toxic and hazardous chemicals. The EU has enforced REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) a comprehensive set of legal frame work addressing chemicals in use and requiring companies marketing chemicals to present a set of test data. The EU also has RoHS that restricts the use of certain hazardous chemicals in the manufacturing process of electronics and electrical equipment. The US has TSCA (Toxic Substance Control ACT) and like always California has its own legal frame work called Prop 69 which includes a list of 800 chemicals and requires companies to publish a list of chemicals that are known to cause cancer, birth defects and other reproductive problems. China also has specific Circular Economy promotion law[7] which is of its own kind.

[7] https://www.greengrowthknowledge.org/sites/default/files/downloads/policy-database/CHINA%29%20Circular%20Economy%20Promotion%20Law%20%282008%29.pdf

B. Amendments in Existing Regulations:

The Priority should be to provide the waste management sector as a whole Industry status. Keeping the above-mentioned policy, legislation and definitions of circular economy and recycling in mind, mentioned below are regulatory recommendations:

It's imperative that the policy and subsequent legislation encourage entrepreneurship, innovation and best practices when it comes to achieving circular management of toxic, hazardous waste and chemicals. To achieve this the following is proposed:

i. Ensure efficient regulation and enforcement to ensure that the use of concerned hazardous chemicals is minimized in the manufacturing process, both virgin and recycled
ii. Define the term essential use pertaining to the use of hazardous chemicals in production of materials. Essential use should mean "necessary for health safety or functioning of society" as stated in the Montreal Protocol and not essential for the profit of a specific company or continued use in any type of product in our society.
iii. Remove red tape, speed up the regulatory process as there are many highly toxic chemicals that are used in a variety of production processes.

    With no real compulsion of companies to disclose data, hazardous chemicals and toxins are kept in circulation through continued production, use and re-use. The Precautionary principal is one major pillar on which the EU's chemical legislation is shouldered and can be used to take decisions even when all possible data is not in hand.
iv. Use REACH to identify substances of very high concern and ensure their effective substitution
v. Focus on regulating groups of substances instead of regulating specific substances on substance to substance basis
vi. Enforce the "No data, No Market" principal and incentivize companies to disclose a comprehensive list of chemicals that

they manufacture and or use in the process of manufacturing various materials

vii. Time bound commitments must be mandated from companies to be fully transparent in the use of hazardous chemicals in the upstream and downstream supply chains.

viii. Consumers should be made aware of the hazardous chemicals and toxins present in their products and packaging through proper labeling and detailed information on the said company's website.

ix. Apply equivalent chemical requirements for recycled and virgin products to ensure that we move towards a toxic free circular resource economy.

x. Apply same regulations to imported materials and products

xi. Use the REACH document to identify, regulate and minimize the use of EDC and PFAS in pesticides, cosmetics, food contact materials and more.

xii. One country one singular legislation and regulations because our environment is shared and the health and wellbeing of our citizens should be a national priority.

xiii. Strengthen the hands of states and union territories to ensure that regulations are enforced nationally.

C. Technology

i. Circularity starts with designing and using the right materials for the manufacturing of products so that they may be recycled in perpetuity at their end of life using readily available conventional technologies present in the country or else ware. It all starts from the drawing board, selecting the most appropriate materials and chemicals even before the product ever sees the light of day. This thought process when applied with a critical mind, can simply design out the production of future toxic waste, replacing it with materials that can be utilized by others. Many environmentally progressive companies have overcome this by

either educating their designers or by giving them a set list of chemicals to work with. Hence in order for us to move towards a circular economy in toxic and hazardous waste we must start addressing the design and material aspect related to production. However, this aspect needs a continuous and close collaboration between industry and academia, and the industry needs to support the long-term research in this direction.

ii. Product Planning and Design:

The circular economy has recognised the importance of a smart design as the most critical stage in a product's life cycle. The most cost-effective approach is to select the appropriate materials and chemicals right at the drawing board, before the product even exists. By doing this, toxic waste can simply be "designed out" and instead replaced by resources and products that can be utilized by somebody else. However, such a good practice requires support of the necessary research and development to the industries. This necessary require significant industry-academia interaction in a sustained manner which itself is a big challenge in the country like India.

The greatest obstacles to successful recycling of the product or its components, are actually the original design and lack of information about what chemicals were added to the materials from the very beginning. This essentially require demonstrated knowledge and transparency in production disclosures which will add value to the product. Products and materials that are designed to be recoverable, reconditioned and upgraded have around twice the value of products and materials that are not, as they maintain their chemical and physical integrity and can be recycled in perpetuity, hence establishing a firm ground on which to build a circular economy. Re-using several times is against the ethos of a circular economy, and is already happening across the country (downcycling) sold several times.

The main purpose of decreasing the hazardous content of a product is to increase the possibilities for recycling and success in the aftermarket. This will also have a co-benefit of reduction in the requirement for virgin raw materials and the energy costs to produce them, reducing product's overall carbon and environmental footprint.

The central idea that the circular economy presents is that good design is not only environmentally good; it's also more profitable. As a consequence, chemicals management need to be a higher priority on the corporate agenda and deliberations. The individual industry can set up its own targets and goals and accordingly, the chemical issues can be prioritized at different levels. At the lowest, for the so-called reactive level, the regulations can simply be followed. Per contra, the industry can actively seek out green chemistry and sustainable materials that position the organization for the circular economy at the highest and most ambitious level. It is well documented that the industries who adopt the circular economy principle at product design stage, not only comply the regulations on sustained basis, but also are significantly competitive in the market, with micro management of the production management.

iii. Supply Chain Management, Transparency and Traceability

In modern manufacturing process, the product generally consists of components that are produced and assembled by many different suppliers in the supply chain. This makes it challenging to communicate the chemical content down the supply chain without appropriate communication and information from the previous suppliers. Many companies, who finally bring the product in market, have set the priority for establishing the systematic chemical control up and down the supply chain. The need of supply chain management and chemical quality control

will only grow in the future as recycled materials are being circulated back into the production loop.

There are mainly three broad activities that are needed in order to approach the circular economy from a hazardous waste and toxic point of view:

- increase knowledge of the composition of products, and
- phase out chemicals that do not fit within a circular economy.
- Review the processes that generate HW and use toxics

There are some established practices, mainly in automobile sector, that have already created effective systems for transferring information between suppliers and users in the supply chain. The IMDS and BOM-check databases are already used in the automotive industry and the electronic industry respectively, and relevant parts may be accessed by everyone in the entire supply chain. With better communication tools like bar code etc it is easy to communicate the entire information very effectively. This change is happening already, as many brands with big purchasing power are pushing for more and more chemical transparency in the supply chain. Further, new international standards are being set for product quality and manufacturing processes based on principle of environmental benchmarking which also is proving catalyst in this process. There are some court cases even in India (NGT: lead content in PVC pipes) which mandate the disclosure and control of the hazardous chemicals in product manufacturing. Finally, the consumer awareness is one of the major triggers for such practicing such disclosures as one of their marketing strengths and therefore, put pressure on suppliers to increase chemical transparency and use safer alternatives so that these companies can serve as role models and pave the way for other, smaller companies to follow suit.

D. Economic Instruments and Incentives

Moving to a circular economy requires reorienting market forces towards resource conservation. To do this, government and regulators can incentivise practices that encourage less waste and penalise those which generate more waste. Different economic instruments, such as taxes or financial incentives can fulfil this role based on the impact that producing and consuming a certain good has on human health and the environment. By sending clear price signals to both producer and consumer, circular economy-friendly business models are more likely to emerge and become mainstream faster. Some of the incentives that can be explored are as under;

i. Zero GST exemption on waste recycling technology and related equipment.
ii. Exemption of Import Duty on waste recycling technology and related equipment.
iii. Tax Holiday for Establishing facilities for waste recycling technology and related equipment.
iv. Extending tax incentives for achieving hazardous waste reduction by industries through internal process improvement/adoption of new technology.
v. Market based instrument formulation for Green chemistry certified units for Industries with demonstrated waste reduction.
vi. Mandating preferred disposal of incineration waste at Cement Kilns, instead of Stand-alone incineration facilities.
vii. Incentivise voluntary eco-labelling of industrial products with minimum environmental impacts as per ISO 14021 standard.
viii. Designing the EPR scheme for the toxics and HW management.
ix. Extending Central and State Subsidy for setting up of Common Hazardous waste Mgt. and Recycling facilities to developers with minimum land requirements and maximum recycling targets. This may be fixed for availing financial grants.
x. Extending incentives for industries to shift from Red to Orange and Gradually green category as per CPCB categorization.

It is not very appropriate to estimate the financial requirement for this activity at this stage where the data is not sufficient and also, there are many other factors like industry acceptance which can not be estimated at present. It is therefore proposed that in first two year 100 industries can be supported with such fiscal incentives. In case of additional demand, the ministry may consider revision of targets. In any case, this is independent of the pollution control and abatement related schemes of MoEFCC and SPCBs which can be the primary schemes and the present scheme can be of complementary nature.

E. Awareness and Advocacy

The awareness and advocacy are critical strategies for advancing the circular economy approach. Such efforts need to be initiated with all the stakeholders including; waste generators, sectoral industries, government regulators, financial institutions and most importantly the people. The awareness and sensitisation of relevant stakeholders will ensure that the circular economy approach is in `demand' and hence the waste generator would need to `supply' this demand as part of the sustainability of the industry operations.

The chemical industry sector contributes significantly to the toxic and hazardous waste generation and covers large number of small, medium and large-scale industries manufacturing wide spectrum of chemicals. Most of the small scale and medium size industries are located within designated industrial estates. The chemical industries use variety of hazardous and toxic chemicals as raw materials. The most significant is the different types of Solvents and catalyst. There are several new methods and techniques of solvent recovery and catalyst reactivation, however, it is necessary that these technologies reach to the small entrepreneurs in affordable manner. The awareness and advocacy by the sectoral industry associations can play an important role in such circular economy approaches.

"Circular Economy" concept is new to chemical industry. Many industries have implemented Environment Management System Standards ISO 14000 and

adopted Pollution prevention and Cleaner production practices. The workforce in chemical industries is handling Hazardous Chemicals /Wastes.

There is need to create awareness among all the stakeholders within an industry (Management, workforce, Customers, transporters, Community) on the basics of circular economy. As the hazardous chemicals and wastes are handled and managed by workforce, they need practical training on all aspects of Circular economy and their role. The focus areas are Resource conservation, Pollution prevention, Recover/Reuse/ Utilisation, etc.

Such awareness can be a multi-dimensional activity comprising seminar, training programs, consumer awareness, school education etc, which needs to be evolved through a detailed study. The concerned government departments and industry associations need to provide necessary resources for this activity.

US EPA had initiated a program called as 33/50 which focuses on the industrial sector and identified 17 toxic chemicals as a target for reduction. This programme was voluntary industrial production program for 17 toxic chemicals to achieve an overall targeted national reduction of 33% and 50% in a particular timeframe. Similar programs have been designed in EU also. Considering the CPCB reports referred above, it is therefore necessary to have India Specific something like REACH, Classification, Labelling and Packaging Regulation (CLP Regulation), POPs regulations to have streamlined initiative.

Another important approach is information dissemination to all the stakeholders. This can be done through ensuring information on hazardous substances is passed along the entire material life cycle. (RoHS, Toys directive • Eco-design directive • Food packaging reg)

Another important aspect is the advocacy where the technical institutions can play an important role. It would be necessary to showcase the success stories in sectoral circular economy initiatives, to bring environmental benchmarking even in product specifications (something like eco-labelling) and gradually bring them under certification program. This will require sustained advocacy

and communication efforts. Institutes like Gujarat clean production centre (GCPC) and/or academic institutes like IITs can be repository of knowledge in the sector.

Another important aspect is involvement of informal sector in the entire toxic and HW management. IT has already been noticed that there are several activities like e-waste processing, battery reprocessing, oil reprocessing etc which re carried out in informal sector. These unauthorised operations are not carried out sufficient safeguards to protect the informal labour involved in operations, and pose a serious risk to their health, beside depriving them of necessary safeguards and facilities. The HW rules 2016 provides necessary provisions for the labour safety. IT is necessary that the state governments through labour departments should be more proactive to ensure compliance of Rule 4 of HW rules, 2016. Suitable advocacy and awareness program needs to be carried out on large scale in sustained manner.

Educating ourselves & others: There is a dire need to educate not only the industry but also the authorities about proper management & processes involved in managing hazardous waste.

Labelling is a big part of this and must be prominent, in your face and in easily understandable. The challenge with labelling is that most individuals handling waste at industries may not be educated enough to read them or understand them. In a country like India with regional languages given prominence, could we decide on a singular national label that clearly depicts the information to the waste handler.

F. Research and Development

Many different environmental initiatives for design exist, from eco-design, eco-efficiency to design for the circular economy, though some of the concepts overlap. They are not completely interchangeable causing misunderstanding and confusion, especially for stakeholders less involved with the new concepts. As a major problem it was recognised, that the business sector, especially small and medium sized enterprises, do not actively seek

collaborative ties with R&D institutions in general. However, it is proposed that the proposed action plan would encourage the sectoral industry association to interact with academia and government to prepare a road map of research areas considering the opportunities offered by adopting circular economy approach.

Increased knowledge and common understanding of CE principles could support better collaboration between stakeholders and provide a level playing field to initiate more R&D and innovation activities supporting CE transition within the region. Exchange of good practice should not be limited to the private and academic spheres but should also include exchange of information on successful strategies and policies. It is necessary to create a communication platform between companies and academic sphere, where the small and medium-sized enterprises can apply for solutions connected with innovation problems.

- Some of the broader areas of research are listed below as an indicative list.
    i. There is an urgent need to conduct evidence base and scientific studies to understand the complexities of HW and toxics related circular economy approach.

    ii. Collecting information on the presence of `identified' substances in all phases of the product life cycle, including the post-recycling phase.

    iii. Formulating insights regarding the fate, emissions and resulting exposure of substances of concern in product cycles

    iv. Providing stakeholders with general lessons for the development of an evidence-based assessment framework.

    v. Developed approach for setting limit values within the assessment framework

    Such research initiative would will provide the regulatory authorities deciding on the regulatory fate of a recycled material containing a substance of concern with an evidence-based, structured and transparent framework. With this, the regulators can assess how to

manage the presence of substances of concern in waste and recycled materials, and their potential adverse effects on human health and the environment.

- There is an urgent need to coordinated action research in sectoral areas of research. Adoption of circular economy need to be priotorised and taken up in a mission mode at the government level by infusing significant resources and also, promoting coordinated research through several departments like DST, DBT, and other ministries. There is need of National knowledge network on Circular economy something on the lines of Knowledge network for National Clan Air program formulated by MoEFCC, to coordinate, collaborate and synergise the efforts of all concerned.
- It is necessary that the subject of circular economy is included in all relevant academic courses to promote the wide based research activities in various sectors of manufacturing with focus on reducing HW and toxics. There are few courses in engineering and design streams, however, it is necessary to expand the coverage of the academic understanding and action research. Initially, ministry can also propose few fellowships and research programs which can promote the wider deliberations on circular economy.

6. Recommendations:

i. **Institutional Requirements**: The report has presented various approaches for promotion and adoption of circular economy principles in hazardous and toxic waste management. The report also identifies a time bound action plan with the required granularity so that the concepts of circular economy are widely advocated and will get necessary traction for its effective implementation. It is recognised that such a time bound action plan that covers five pillars of the implementation and also multi sectoral industrial setting would require a dedicated institutional framework for effective coordination and delivery of the action plan. The effective environmental governance system, the research and development, pilot studies, public disclosure,

public awareness and enforcement are the backbone of the governance that requires a stable, consistent and resource based institutional mechanism with the trained manpower.

This needs both overarching policy and legislative support, but also detailed problem solving and enabling, both technically as well as financially along with the industry and civil society. Also, as these bits become operational in different time frames, they need protection till they are ready to be exposed to market forces with a level playing field. Currently in our legislative framework, of the components which enable circular economies, extended producer responsibility has been incorporated in some of the laws dealing with plastic, lead acid batteries and electronics and electrical waste. These however have not been fully implemented yet, and infact has several kinds of operational barriers including unregulated material flows between the formal and informal sectors, as well as collection hurdles and poor regulatory oversight. Other initiatives such as eco-labelling have not been so successful and cleaner production only partially so.

The current institutional dispensations in the Ministries are more geared for policy and legislation development rather than on implementation which requires in-process changes, deep sectoral knowledge, awareness amongst stakeholders and market acceptance. In fact, they do not have the focus or manpower to do so and are already stretched to capacity. Subsidiary bodies like the CPCB and SPCBs are by design focused on compliance of regulatory standards mostly and are again not geared for transitions of products and processes but on emissions of various types. Major transitions such as involving circular economy is a complex multi-pronged and multi-faceted progressive task which will need close cooperation with industry as well as civil society. It will need new and special institutions or dedicated arrangements which are solely engaged in this transition, to help and aid industry to solve problems, encourage innovation, help

in developing national and international partnerships, aid in information flows, create awareness, suggest legislation to the Govt, etc. if needed.

Presently, the Circular Economy subject is mainly administered through Ministry of environment and forest. However, if the proposed action plan along with other sectoral action plans being prepared by Niti Aayog are to be implemented in a time bound manner, it is necessary to have a dedicated administrative institutional framework. Such a framework would also require pooling of trained manpower and skilled expertise together and also developing a network of academic and research institutes along with industry associations and professional bodies with necessary resources. Ministry of environment and forest has already notified draft policy on Resource Efficiency. The policy has proposed a detailed framework of institutional arrangements for effective implementation of the same.

The proposed action plan on circular economy would also require a similar institutional mechanism. In fact, the overarching goals of Circular Economy as well as a resource efficiency are complimentary and synergistic, and to that extent the proposed institutional framework can be similar to what has been proposed under the draft resource efficiency policy. Till such time, it is proposed that the action plan is implemented through MOEFCC. Necessary technical support can be provided by formation of National Knowledge network comprising of experts and professionals in the field of circular economy. Similar knowledge group is formed for National Clean Air Action plan (NCAP) that is implemented through MoEFCC. At the same time, it is recognised that the efforts and initiatives in circular economy needs to be initially on voluntary basis and therefore the sectoral ministries also need to play a proactive role in promotion of circular economy in their sectoral industries and operations. It is recognised that the sectoral ministries need to steer the promotion and coordination efforts. These miniseries can also have sectoral expert committees and also tie up

with research and academic institutions to promote research-based initiatives and success stories.

ii. **Informal Sector**: Social protection in the waste value chain can be achieved to leave no one behind in the informal sector of waste handlers/pickers in the Hazardous Waste value chain. It is envisaged that all engaged in the segregation, collection, extraction and mining of raw material to production and manufacturing of products, from end-of-life disposal and recycling of products, the informal waste handlers are exposed to greater emissions, effluents, high energy consumption, release of toxic and hazardous discharges during disposal or recycling of waste. Hence, they cover the gamut of industrial processes as well as waste disposal practices. To ensure their safety and protection need is to be creating a framework on ways to strengthen social protection for informal sector workers. To address the systemic and interlinked objectives of the United Nations (UN) Sustainable Development Goals (SDGs), the guiding principles which need to be addressed for social protection are:

a. Protect and promote human rights.

b. Ensure non-discrimination.

c. Foster gender equality and women are equally paid.

d. Remain risk-informed and sensitive to environmental concerns.

e. Provide a continuum of protection measures as being one of the most marginalized, unstructured, informal section of the society, the Safai Sathis (waste pickers) constitute the informal sector and are often deprived of fundamental rights. In the Waste Value Chain, the approach for social inclusion for the waste pickers' (Safai Sathis) community needs to focus on the following.

- Organising them through self-help groups (SHGs), getting them ULB identity cards, transport cards and later linking them to several government schemes so that they have an organized economic and social set up. Also, aligning with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 as amended in 2019.

- Financial security – Opening of bank accounts for Safai Sathis and using Direct Bank Transfer (DBT) for receiving their salaries, linking them to self-help groups (SHGs) for an alternate source of income.
- Food Security – Access to ration cards and allied benefits for Safai Sathis
- Health Security – Getting Safai Sathis enrolled for health and life, medical, general, pension insurance schemes.
- Education – Supporting their children to get access to education through various government schemes of scholar ships etc.
- Others as per the laws and the evolving schemes

iii. Based on above deliberations, an **Action Plan** has been prepared to bring the circular economy in toxic and hazardous waste management, which will go a long way in not only making our industries more compliant and competitive but also will result in improved environment quality due to lesser ingress of toxics and hazardous waste in environment. The actions proposed are multi-disciplinary and will require active support and participation of all stake holders mainly, the regulators and industry associations. This would also require close industry-academia interaction on a sustained basis. Many of circular economy interventions would require substantial data and research with significant resources. The action plan is further grouped in short term and long term action plan. It is necessary that the action plan is adopted in mission mode and executed in close consultation and coordination with all stakeholders.

iv. Considering the multi-faceted actions proposed in the field of circular economy, and also the need to take suitable follow up on the concept notes, appraisal of technical documents received from industry and also assess the progress in implementation of action plan for achieving desired progress in circular economy, it is proposed that a **task force** may be formed at ministry which can take regular review of

the progress and also. Provide necessary guidance to all the stakeholders for moving towards circular economy.

Annexure - I

The most common toxic chemical groups are:

1. Plastic: Some of the most commonly used polymers are PP, PVC, PS, PE and PU. Besides this, mixing two or more polymers to create a multi layered solution is a very common practise. What is important to understand here is that most plastic materials contain numerous additives to increase their usability/performance and the amount of addictive applies vary on a product to product basis. Many of the negative properties of plastic come from the addition of these additives and hence it becomes imperative that we ensure that these are removed in the design process itself.

2. Plasticisers: These are used to soften plastic and predominantly used in PVC. Phthalates are a common group of plasticisers and make up 30-60% of plastic composition. They are toxic and hazardous to human health including but not limited to the human reproduction system. Phthalates are also known to leach out as they are not bound chemically to the material, greatly increasing the risk to our environment and health.

3. Biocides & Pesticides: Inherently designed to kill, hence lethal for human health.

4. Flame Retardants: Used to make products less flammable (Used in clothing, curtains, fabrics etc). Known to be toxic and bioaccumulate in the environment.

5. POP's: Persistence Organic Pollutants, are known to cause cancer, reproductive disorders, disruption of the immune system and damage to the nervous system. The Stockholm convention a global treaty has been created to reduce and eliminate their use. The convention covers 24 substances/groups including the notorious "Dirty Dozen"

6. Heavy Metals: Have toxic properties that cause mental and physical disorders in Humans. Chromium, lead, arsenic, mercury are some examples. Despite knowing how toxic heavy metals are, they continue to be used increasingly in products from electronics to medical devices.

7. EDC: Hormone Disruptive Chemicals: They have shown to be a part of many public health issues from, autism, obesity and other development disorders. Dangerous stuff this is.

8. CMR: They are called CMR because they are known to cause Cancer, Mutation and Reproductive system disorders.

Annexure - II

We recommend the use of a step-wise approach, based on a number of questions. The purpose of these questions is create a gateway, allowing only the cases that may actually qualify as essential use to pass through.

We propose that the Commission apply this approach and make lists of products or uses regarded and disregarded as essential throughout the step-wise approach, to facilitate for both companies and policymakers.

1. **Is the product or process in question used for…?**

- Luxury
- Convenience
- Decoration or purely aesthetic purposes
- Leisure
- Play/toys
- Cosmetics
- Home gardening

If the answer is ***yes***, the use is regarded as non-essential. The product or use does no fulfill any basic human need, nor is it essential for the functioning of our society.

If the answer is ***no***, continue to question 2:

2. **Is the product or process in question used for…?**

- Hygiene
- Cleaning
- Personal care
- Childcare
- Textiles (excluding personal protective equipment)
- Clothes, apparel and shoes
- Furniture
- Food contact material
- Sport products
- Etc.

If the answer is ***yes***, it's regarded as non-essential use. The function these products fulfills – for example hygiene – might be essential. However, these categories represent products that are ubiquitous in our everyday life, and where the presence of high concern chemicals is unwanted.

One of the aims with the essential use concept is to ensure that consumer products don't contain harmful chemicals. Moreover, there are products without substances of concern within all these categories on the market. Therefore, there is no need to allow the use of substances of concern in these products.

If the answer is ***no***, continue to question 3:

3. **Does the product or process belong to any of the categories listed below, or a very similar category?**

- Medical devices
- Medicinal products
- Products for military operations
- Energy production and storage
- Transportation
- Communication
- Etc.

If the answer is ***yes***, the product or process might be regarded as essential. Move on to question 4.

If the answer is ***no***, it's regarded as non-essential use.

4. **Is the product or process itself essential for the *overall functioning of society?***
   Note that not all products within essential use categories (see question 3) are essential. For example, not all products within the medical device category are essential to fulfill the core service of this category. These uses are not regarded as essential.

If the answer is ***yes***, move on to question 5.

If the answer is ***no***, it's regarded as non-essential use.

5. **Are there alternative chemicals or other ways to achieve a similar end function at product level?** Note that the alternative does not need to be equally performing, nor does the cost for the applicant have to be equal, as long as the end function on product level fulfills the essential function.

If the answer is ***yes***, it's regarded as non-essential use.

If the answer is ***no***, the case moves to an expert committee.

An expert committee is now to look at the case, evaluate it, and conclude if the product is essential to society or not. If the use is regarded as essential and the substance falls under REACH, companies producing or importing an essential product with an SVHC (Substance of Very High Concern) should send in an application for authorization and the "normal" authorization process should follow.

All expert committees need to ensure that the continued use is as limited as possible in terms of applications, volumes, and time applied for by the applicant.

Annexure - III

Constitution of Committee for Circular Economy in Toxic and Hazardous Industrial Waste

Sl.No.	Name
1	Shri Samir Kumar Biswas, Additional Secretary, Department of Chemicals and Petrochemicals – Chairman
2.	Dr. Yogesh Suri, Sr. Adviser, NITI Aayog Sh. Sudhir Kumar, Adviser, NITI Aayog
3	Sh. Naresh Pal Gangwar, Joint Secretary (HSM), MoEFCC Sh. Satyendra Kumar, Director, HSM, MoEFCC N.Subrahmanyam, Scientist D, MoEF&CC
4	Sh. Prabhjot Sodhi, Head, Circular Economy, UNDP India
5	Dr. Ajay Deshpande, Adjunct Professor, Center for Policy Studies, IIT Bombay.
6	Sh. Manik Thapar, Founder and CEO, Eco Wise
7	Dr P N Parameswaran, Crop Care Federation of India
8	Sh. Asitava Sen, CEO, Crop Life India
9	Mr. D.V.S. Narayanaraju, Pesticides Manufacturers & Formulators Association of India
10	Dr. Rajesh Roshan Dash, Associate Professor, School of Infrastructure, IIT Bhubaneswar

11	Ms Bharati Chaturvedi, Founder-Director, Chintan Environmental Research and Action Group
12	Rishabh Bhasin, MD, RVM Systems India
13	Sh. Ravi Agrawal, Founder Director, Toxics link
14	Dr. Debraj Bhattacharyya, Associate Professor, Civil Engineering, IIT-Hyderabad
15	Ms. Wilma Rodrigues, Founding Member CEO, Sashas Zero Waste
16	Sh. Sachin Sharma. Founder Director, GEM Enviro Management
17	Prof. Bhate, Dyestuff Manufacturers' Association of India
18	Ms Pronita Saxena, Founder and CEO, Citizengage
19	CEO, Green ChemisTree Foundation
20	Dr. Sanjay Kr. Chattopadhyay, Convener Advisory Forum, Dept. of Chemicals & Petrochemicals – Co-ordinator