

**LAW AND POLICIES IN RELATION TO
HAZARDOUS WASTE MANAGEMENT IN INDIA:
A CRITICAL STUDY**

A Thesis

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for the Award of the Degree of**

**DOCTOR OF PHILOSOPHY
IN
LAW**

By

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20th, March, 2020

DECLARATION

I hereby declare that this thesis titled, “**LAW AND POLICIES IN RELATION TO HAZARDOUS WASTE MANAGEMENT IN INDIA: A CRITICAL STUDY**” submitted for the award of the Degree of Doctor of Philosophy in Law, to Goa University, Panaji, is an original research work done by me.

I also hereby declare that this thesis or any part of it has not been submitted to any other University for the award of any Degree or Diploma or Fellowship.

Place: Panaji –Goa

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Date: 20/03/2020

CERTIFICATE

This is to certify that the thesis titled, **“LAW AND POLICIES IN RELATION TO HAZARDOUS WASTE MANAGEMENT IN INDIA: A CRITICAL STUDY”** submitted for the award of the Degree of Doctor of Philosophy in Law, is a record of the research work done by Mr. Srinet Narendra Kothwale under my guidance and supervision during 2014 - 2020.

I certify that this is a bonafide work of Mr. Srinet Narendra Kothwale.

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ABSTRACT

India has become a Manufacturing Hub for various Industrial Products besides known to be the “Pharmacy of the World” and hazardous waste production due to Industrial Process is an inevitable outcome of these Industrial and developmental activities. Hazardous waste means any waste, which by reason of characteristics, such as physical, chemical, biological, reactive, toxic, flammable, explosive or corrosive, causes danger to health, or environment. It comprises the waste generated during the manufacturing processes of the commercial products such as industries involved in Chemicals, Fertilizers, Pesticides, petroleum refining, production of pharmaceuticals, petroleum, paint, aluminium, electronic products, engineering etc. These wastes may pose a potential hazard to the human health and the environment (soil, air, water) when improperly treated, stored, transported or disposed of or managed.

The total hazardous waste generation in the country is around 10 million metric tonnes per annum (0.3MMA in the State of Goa) from about 44,000 industries. The disposal rate is only 30% (40% in the State of Goa), which means around 70% of the Hazardous Waste generated in India remains to be untreated and without disposal. Therefore, scientific treatment and systematic disposal of hazardous waste generated is a necessity. This thesis which include an in-depth cross sectional study aims at overall appraisal of the Hazardous Waste Management scenario in India in respect of testing of effectiveness of implementation of the Hazardous Waste Management Rules in India with special reference to the State of Goa, namely the extent of violations of the said Rules by the Industries, the resulting impact on Environment and Ecology, non - performance or failure on part of various authorities in terms of non-implementation of the Rules and lastly analyzing the adequacy of these Rules and present Regulatory Framework in arresting the associated problems. A case Study analysis of the Cuncolim Industrial Estate, Goa which is declared as a Critically Polluted Industrial Estate has been carried out so as to examine the efficacy and adequacy of the Hazardous Waste Management Rules notified by the Ministry of Environment, Forests & Climate Change, Government of India from time and again including the effectiveness of the present Regulatory framework available.

This Study focuses on the current status, problems and challenges, policy issues, and future strategies for improvement in HW management system in India.

During the study, it was observed that due to a range of factors including limitations in governance systems, inadequate infrastructure, limitations in compliance and limited trained and skilled stakeholders, the management of hazardous waste in India is largely ineffective leading to serious threat to Life and Environment. The aim and objective set up by the Central Government regarding prevention, minimization, reuse, recycling, recovery, co-processing and ultimate safe disposal largely remains only on paper. Thus there is a requirement of an urgent attention to be given to the ever growing problem of management of Hazardous waste in India with a considered approach of whole revamp of current strategies and policies to be adopted for safer India.

Key Words: *Hazardous Waste Management, Critically Polluted, Treatment, Disposal, Regulatory Framework, Recovery, Co-processing, Recycle.*

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ABBREVIATIONS

3Rs	Reduce, Reuse, Recycle
CAG	Comptroller and Auditor General of India
AIR	All India Reporter
CETP	Central Effluent Treatment Plant
CHWTDF	Common Hazardous Waste Treatment and Disposal Facility
CIE	Cuncoim Industrial Estate
CPCB	Central Pollution Control Board
CPIE	Critically Polluted Industrial Estate
Dept.	Department
DGFT	Directorate General of Foreign Trade
EIA	Environment Impact Assessment
EPA	Environment Protection Act
Fig.	Figure
FICCI	Federation of Indian Chamber of Commerce and Industry
GIDC	Goa Industrial Development Corporation
GSPCB	Goa State Pollution Control Board
HC	High Court
HW	Hazardous Waste
HWM	Hazardous Waste Management
IPC	Indian Penal Code
MMT	Million Metric Tonnes
MMTA	Million Metric Tonnes Per Annum
MOEF	Ministry of Environment and Forest.
MOEF & CL	Ministry of Environment , Forest and Climate Change

MSME	Micro, Small and Medium Enterprises
MSW	Municipal Solid Waste
MT	Metric Tonnes
NGO	Non-Government Organization
NGT	National Green Tribunal
No.	Number
PCC	Pollution Control Committee
SOP	Standard Operating Procedure
SC	Supreme Court of India
SCC	Supreme Court Cases
SPCB	State Pollution Control Board
SEZ	Special Economic Zone
TSDf	Treatment, Storage, and Disposal Facility
UT	Union Territories
WHO	World Health Organization
WTO	World Trade Organization

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2.	Indian Council for Envirolegal Action v. Union of India, AIR 1996 SC 1446
3.	Virulent Gar v. S.O. Haryana , AIR 1995(2) SCC 577
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CHAPTER-I
Introduction

CHAPTER I

1.1 INTRODUCTION

Life, death and waste are the three facts on this earth which will remain forever on this Earth and nothing much can be done to prevent it. In fact, all these three facts are closely associated with each other. Health cannot be isolated from waste. Maintaining cleanliness and hygiene is one of the necessary measures towards achieving a Good Health, which in turn is an essential condition of living a purposeful and meaningful life. Scientific management of waste is one of the ways to maintain cleanliness, hygiene and to achieve a healthy life. Everyday a lot of waste material is generated from homes, offices, factories, hospitals, industries and in fact all the establishments. So also there is a huge waste which may be termed as “legacy waste” already generated through various sources and is lying unattended in various locations like fields, open spaces, drains, industrial estates, forests, and in fact every corner of India¹.

The continuous generation of waste material is an inevitable aspect of human action. Wastes may be defined as materials or substance or thing which no longer can be used for the purposes they were intended for originally or which has lost its effect or usefulness. Waste in a common parlance can be termed as “something which is not put into proper usage at a given time”. The original definition of waste *res derelicta* corresponds to the concept of ‘use and throw away’ culture. The word “waste” can also be referred to as useless, unused, unwanted, obsolete, scrap or discarded material or items².

Depending upon its origin, waste can be broadly categorized as domestic or household waste (solid waste), industrial waste (presently given a scientific term as “Hazardous Waste” which is a subject matter of present research), hospital waste (Bio-medical waste), construction and debris waste, plastic waste, radioactive waste, batteries waste and e-waste. Human beings are responsible for creating or generating waste materials. These waste materials are either the by-products of any of his activities, for which he could not find any further use of it or the products that have reached the optimum usage stage or end of useful

¹ Alexander Kiss, “The International Control of Transboundary Movement of Hazardous Wastes”, Texas International Law Journal Vol. 26 (1991) p. 563 .

² Bell, Stuart and Donald McGillivray, “*Environmental Law: The Law and Policy Relating to the Protection of the Environment*” (5 th edition, Oxford: Blackstone Press, 2000), p.13.

life and cannot be used anymore for any purpose³.

Although this process of generation of waste was going on throughout the centuries, it was not considered as serious problem until recent times because all this time it was taken care by nature's own waste treatment mechanism and disposal processes like dispersion, dilution, disintegrative and degradation. Wastes which were dumped into the water bodies were washed away quickly and they used to get diluted to the point and therefore no noticeable effect on overall water purity was observed. So also with the emission released in the atmosphere were getting absorbed in the atmosphere leaving no harmful impact on air quality. Waste materials disposed on the surface of earth were decayed by spontaneous chemical, biological and degradation process thereby maintaining the ecological balance in nature⁴.

This natural process has reached to its optimum or saturation point and the same is not effective in modern days. The waste problem has arisen mainly due to both quantitative and qualitative nature of the wastes which is being generated. The natural degradation processes which were going on smoothly once upon a time are now slow and below the optimum level and they can help in the degradation of limited amounts and specific kinds of wastes only. The water bodies do not possess the ability to further dilute and degrade sufficiently the vast amount of municipal and industrial effluents dumped everyday into them. And thus one has to wait for a long time perhaps millions of years for the heaps of millions tonnes of waste material dumped to blend in with the earth's crust again in the form of fossil or ores which is the case with all categories of waste except bio degradable waste. The pollutants or emission released in air are now responsible for global climate change. The concentration of ambient air quality is beyond permissible limits in many places of the world. But this will never happen, because the rate at which wastes are being generated and dumped is much faster than the nature's ability to degrade and absorb them. Further, many of the modern waste materials are non-biodegradable in nature and all these cause serious threat to the ecology, environment and overall ecosystem⁵.

³ Narayan S, Majumdar S, Bhattacharya K, "Hazardous waste management in Indian Scenario." www.Srcosmos.gr.srcosmos/showpuli.aspx?aa=13034 accessed on 23/05/2019.

⁴ *Ibid*

⁵ Akalanks, "Descriptive law on pollution and Environment", Aklank Publishing (2003), p.5.

No doubt, industrialisation and urbanisation has given rise to the production of a wide variety of industrial and consumer products, and made human life easy, improved and happier but by-products and wastes generated due to modernisation cannot be simply ignored. Effective and safe handling and disposal of all categories of wastes has become a big challenge to mankind due to growing population, space restrictions, and stress on environment, technological issues and cost. Improper and indiscriminate dumping and disposal of waste has become one of the challenging problems of overall modernisation.

Rapid and ever growing industrialisation and manufacturing sector has improved the quality of life by providing chemical products which have improved the health and life expectancy, increased the agriculture and livestock production, enhanced the economic opportunities, provided sustainable employment and improved the facilities for luxury and comfort. However, it is also true that chemical residues, which are generated unavoidably during the production of these chemicals or goods or items, have posed unprecedented risks to life and environment and also threat to mankind.

Classification and categorisation of waste is a science in itself. Generally, waste can be divided into four kinds, *viz.* solid wastes, liquid wastes, plasma waste and gaseous wastes. Based upon its origin waste can also be categorized as domestic waste, industrial waste, E-waste, biomedical waste, Batteries waste etc. Waste can be further classified by multitude of schemes: by physical state (solid, liquid, gaseous and plasma), and then within solid waste by original use (packaging waste, food waste, etc.), by material (glass, paper, etc.), by physical properties (combustible, compostable, recyclable) by origin (domestic, commercial, agricultural, industrial, etc.) or by safety level (hazardous and non-hazardous). This indicates that the concept of waste management is not so simple and needs a scientific, technical and legal approach. In India, for regulatory purposes, waste is generally classified into specific categories under the Environment Protection act, 1986 as solid waste, Bio Medical waste, Plastic Waste, Batteries Waste, E-Waste, Construction and debris waste and hazardous waste⁶.

Hazardous Waste(HW): A major fraction of the wastes generated all over the world constitute the Industrial or Hazardous wastes. Hazardous wastes are those wastes, which exhibits certain specific inherent properties with respect to their impacts on the ecology,

⁶ See Central Pollution Control Board (CPCB), "Guidelines for Hazardous Waste Treatment Facilities" (Feb 2018) available at <http://www.cpcb.nic.in> accessed on 4/5/2018.

environment and the living world on the planet. As the name suggests hazardous wastes are responsible for causing a serious threat or hazard to the environment. Till the mid-seventies hazardous waste (HW) was referred to special waste or chemical waste. The degree of hazard posed might be different categories of hazardous for different wastes, but it is not the only criteria to evaluate the impact of the hazard.

During the recent years a tremendous progress has been observed with regards to industrial sector especially the manufacturing sector in India, and this has contributed to high economic growth but at the same time it has also given rise to severe environmental pollution more particular due to ineffective handling of waste generated which is termed as Hazardous waste. There is an ancient telling which says “we have not inherited this world from our parents; we have merely borrowed it from our children.”⁷ It is a fact that the Earth is not inherited; rather it is merely to be held in trust for generations to come. There is a need to handle natural resources with a care in order to save them to fulfil the needs of the future generation. So also the environment should also be preserved and protected in the best possible way, taking all necessary precautions which are provided by science and technology. Striking a balance between the interests of the present generation with those of the future requirement is a difficult task in itself due to selfish human tendencies and needs. This is a measure reason for man-nature conflict where the human needs in the guise of sustainable development prevails over the protection of Environment⁸.

Management of Hazardous Waste: India is the second most populous country, which has about 17% of the world population and 25% of the land area. Due to rapid industrialization during last few decades there is depletion and pollution of precious natural resources in India. Industrialization also resulted in various health and hygiene problems, reduction in crop yield and fertility of soil. Besides this, growth in manufacture had also add up the growth in generation of various waste leading to severe pollution of air, water, soil etc⁹. The estimated amount of total hazardous waste generated in India due to Industrial activities is about 10 million metric tonnes per annum and only 30% of the total HW generated is treated and disposed of as per the Hazardous Waste Management Rules. This means considerable amount of HW i.e. to the extent of about 70% of annual HW remains

⁷ S.M. Shafi, “Environmental Pollution”, 262 (2005), p.12.

⁸ *Ibid*

⁹ *Supra* n5

untreated and without disposal. This violation is coupled with the serious issue of haphazard dumping of HW all over the places like open areas, low lying areas, water bodies etc.

The deadly pollutant present in this HW finds their way to the water bodies resulting in pollution of water bodies, drinking water source, retardation of growth in plants, diseases in human beings and animals, etc. Thus ultimately the issue of HW is directly link to the livelihood of all of us. Hazardous waste management is a new concept for most of the Asian countries including India. The safe and scientific management of hazardous waste is relatively a new concept involving a planned scientific approach with a legal control over every phases. This has led to the improper unscientific methods of hazardous wastes disposal in many Countries including that of developed Countries and thereby posed serious risks to human, animal and plant life. Thus there is a growing concern all over the world with regards to the safe and scientific management of HWs generated from the manufacturing Industries¹⁰.

The issue is not different in the State of Goa. During last two decades, the Industrial growth in Goa has been a major contributor to the economic growth of the state and at present there are more than 6000 Industrial Units are set up in the State as per the Economic Survey Report 2019 of the Goa State. There are twenty-two Industrial Estates set up and developed by the Government of Goa. The total quantum of the Hazardous Waste generated in the State is 45000 MT per annum. The HW comprises of heavy metals like chromium, cadmium, nickel, arsenic, lead, mercury, etc. besides other compounds which are harmful to living organisms, plants, animals and human beings¹¹.

Heavy metals exhibit toxic effects towards soil biota by affecting vital microbial processes thereby reducing the number and activity of soil microorganisms. Even low concentration of heavy metals can inhibit the physiological metabolism of plant. Heavy metal toxicity results in a major threat and several health risks. They do not have any biological role but they accumulate and remain present in the body thereby disrupt normal function in vital organs and glands such as the brain, heart, lungs, kidneys, bone, liver, etc. The adverse impacts caused due to the improper disposal of Hazardous Wastes falls under the category

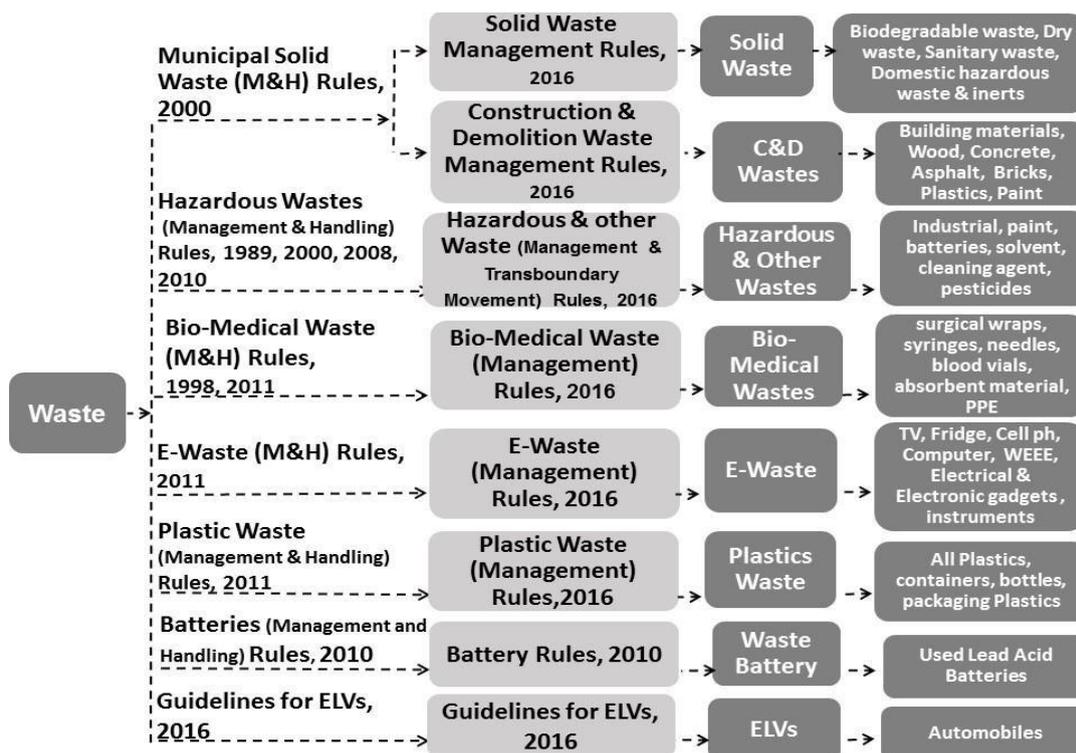
¹⁰ www.CPCB.nic.in/Dir_MSW_NGRBA.pdf. visited on 13/12/2019.

¹¹ S.M. Shafi, Environmental Pollution, 262 (2005), p.12.

of Environmental Disasters.

The following Fig 3.1 depict the major Waste Management Rules notified by MOEF & CL indicating examples of various categories of waste and examples of these wastes:

Fig. 1.1. Various Waste Management Rules Notified in India



Source: Secondary¹²

In India, the concern and a need to manage the hazardous waste in a scientific manner was realized only in the mid-eighties after the occurrence of the Bhopal gas tragedy on 2-3 December 1984. The Government's attention was then drawn towards environmental disaster and the casualties that such hazardous waste might cause. The MoEF (Ministry of Environment and Forests) enacted an umbrella act i.e., the Environment (Protection) Act in 1986 and Rules thereof. Soon the Government of India notified the Hazardous Waste (Management & Handling) Rules in 1989 through the MOEF under the aegis of Environment (Protection) Act, 1986. It was the first time in India, the waste streams are

¹² www.CPCB.nic.in/Dir_MSW_NGRBA.pdf. visited on 13/12/2017.

distinguished into eighteen variants. So also, the definite powers and functions of the enforcement authorities was specified.

These Rules were further amended in the year 1991 specifying scientific specifications and norms. Subsequent amendments were carried out by the Central Government in the year 2002 & 2003 so as to give effect to the international convention. In these amendments, the ambit of hazardous waste was also expanded.

The indiscriminate dumping of HW by the Industries amounts to nuisance, annoyance, health hazard, and as such these aspects are also looked after by various authorities such as police, District Magistrate, Labour Department, Industries Department, Revenue Authorities etc. Due to vague provisions in earlier Rules, there was often a confusion as well as passing of buck when it comes to take action against violations of the Rules. Finally, the new rules are introduced by the central government “the Hazardous and Other Wastes (Management and Trans-Boundary Movement) Rules 2016” which are the expanded version of the earlier rules as well as to achieve objectives of the Ease of Governance and giving definite role and responsibilities to the various authorities¹³.

1.2 STATEMENT OF PROBLEM

As mentioned earlier with rapid industrialization the generation of hazardous waste has become an inevitable scenario and both will grow proportionally and thus the quantity of Hazardous waste generation is directly related to growth of industrialisation and so also due to expansion of production capacities of the existing industrial units. The Government of India through Ministry of Environment, Forests and Climate Change (MOEF & CL) has notified the Hazardous Waste Management Rules under the Environment Protection Act,1986 for safe and scientific management of Hazardous waste and these Rules were amended time and again until new revamped Rules were introduced in 2016 which were subsequently amended in 2017 and 2019. It is pertinent to note that this category of waste is most dangerous waste compared to any other waste generated by human beings. Moreover, with rapid generation of this category of waste it is a biggest challenge to the entire world for the safe and scientific disposal of this waste. The present study has analysed the various legal aspects of the Hazardous waste management rules in India and

¹³ See Central Pollution Control Board Annual Report: 2017–2018.,(India Offset Press:Delhi) p.24-27.

efficacy of these Rules in combating the menace of severe pollution due to it.

1.3 SIGNIFICANCE OF STUDY

Hazardous Waste Management is a burning topic at the International, National and State level because of numerous challenges, dimensions and reasons associated with its safe, efficient, scientific management. Industrialisation and its growth is meant to boost the exports, generating employment, attracting investments and help the economy to grow but it has started showing major side effects since 1980's which predominantly include issue connected with huge generation of HW and its management and resultant environmental Pollution aspect. The existing Industries have already generated huge quantum of waste out of which substantial quantum is lying unattended plus every second HW is generated and additionally new Industries which will be set in future will also contribute to growth of HW. The biggest challenge lies with the clearing of existing legacy waste besides technological, social, economic, political and legal aspects connected with safe and scientific disposal of HW. Under these circumstances an in-depth study on what constitute HW, how the legal regime in India deals with its management and how effective they are necessary to be examined.

1.4 OBJECTIVES OF THE STUDY

The researcher has analysed several aspects of hazardous waste generated in India and a special emphasis has been laid on the status of the implementation of the Hazardous Waste Management Rules by the Industries operating in the 22 Industrial Estates in the State of Goa. The research further emphasised upon the enforcement of the HWM Rules by the State Government and its various authorities and the impact of the HW on the Ecology and Environment in the vicinity of the Industrial Estates. This study has also examined the adequacy of the Regulatory framework and HWM Rules to combat the ill effects of the HW being dumped in unsafe and haphazard way. Keeping these aspects in view the following objectives were proposed:

The Major objective of the study is: -

To analyse the problem of Hazardous Waste Management in the State of Goa and to investigate the adequacy of law and efficacy of administrative agencies in effective handling and proper disposal of Hazardous Wastes.

The other objectives of the study are:

- (i) To analyse the concept of Hazardous Waste, various kinds of such waste and to have a comprehensive understanding of its nature and scope and the methods available to handle and dispose this waste.
- (ii) To trace the international efforts for the management and handling of Hazardous Waste in view of the legal systems prevalent in the United States of America, Europe, Singapore and Australia with a view to have a broad perspective about the legal control of such waste management at the international level.
- (iii) To trace the concerns of the legal system in India from ancient times in terms of waste management generally and to analyse the modern laws and rules promulgated in India relating to management and handling of Hazardous Wastes.
- (iv) To analyse the existing rules and regulations pertaining to the management and handling of Hazardous Wastes for their efficacy, especially in the context of enforcement and feasibility in India.
- (v) To examine the role of the higher judiciary in contributing to the development of environmental jurisprudence and the legal control of Hazardous Waste Management, generally as also with particular reference to the State of Goa.
- (vi) To make suggestions and recommendations for better implementation of Hazardous Waste Management Rules in the state of Goa and consequently to protect the environment and health of the public.

1.5 HYPOTHESIS POSTULATED:

The researcher proposes the following two hypotheses to be verified and tested in the present research: -

- (i) The Hazardous Waste (Management and Handling) Rules framed from 1989 onwards are being violated by the Industrial units operating in India thereby posing dangers to the Environment and the public at large.
- (ii) The Hazardous Waste (Management and Handling) Rules, 2016 suffer from certain basic shortcomings. As a result, they have become ineffective in protecting the environment generally and health of the people in particular.

1.6 RESEARCH QUESTIONS

In order to arrive at the definite and focussed conclusions, the researcher has addressed the following questions:

- (I) What is the historical background, policies, institutional framework and legal practices pertaining to the concern of Management of the Hazardous waste management both at the International Level, especially highly Industrialised countries and national level, and the effectiveness of the authorities?
- (II) To what extent these practices are incorporated in the Hazardous Waste Managing Handling rules and its efficacy?
- (III) Whether the Hazardous Waste Management Rules are sufficient enough to address the issues of Scientific Management of such waste?

1.7 METHODOLOGY ADOPTED FOR THE STUDY: -

The present study examines the effectiveness of the implementation of the Hazardous Waste Management Rules in India with a special reference to the Cuncolim Industrial Estate, Goa. To achieve this researcher has analysed the legal framework evolved and developed in respect of hazardous waste management, both the domestic and international level so that effective comparative analysis could be carried out.

Therefore, the present research employs the combination of both Doctrinal and Empirical method of legal research. The doctrinal prepositions are developed based on series of International conventions on Hazardous Waste management and various legislation, reports, case laws, data of regional, National and international level. The data for this purpose has been collected through Books, website, newspaper, research papers, conventions, journals, annual reports, articles and case laws.

The empirical data has been scientifically analysed to examine the effectiveness of the implementation of the Hazardous Waste Management Rules in India as well as the state of Goa. The researcher has used several empirical research techniques such as observation, interview, international and survey. The requisite data is also collected through structured questionnaire and structured interviews. A large group of stakeholder are selected by random sampling across India and Goa.

There are several books, Reports, and articles written on environmental protection, hazardous and solid waste management. For the purpose of the study, the authoritative primary sources of information have been collected from the Indian statutes mainly, Environment (Protection) Act 1986, Indian Penal Code 1860, Civil Procedure Code 1908, Criminal Procedure Code 1973, Constitution of India 1950, Besides this, various waste specific Rules are notified by the central Government which includes the Municipal Solid Wastes (Management and Handling) Rules 2000, the Bio-Medical Waste Rules 1998, Batteries waste Rules, Construction and Demolition Waste Management Rules , 2016 , the E-Waste (Management and Handling) Rules, 2011 , etc.

The other persuasive primary sources of information extracted for the research is from various International Conventions and declarations such as BASEL Convention 1989, Stockholm Declaration 1972, and Rio Declaration 1992. The secondary sources of information are collected from various committee reports such as Pitambar Pant Committee on Human Environment 1972, National Committee on Environmental Planning and Co-ordination which was established in the year 1972, N. D. Tiwari Committee and Mr Asim Burman Committee Report and various Annual Reports published by the Central Government as well as various State/ UT Governments, CPCB and SPCB's/PCC's.

1.8 LITERATURE REVIEW:

Several studies are available on the Topic “Hazardous Waste Management”, however most of these studies are focused on Scientific aspects of hazardous, moreover in terms of chemistry point of view. Other aspects which are analyzed by various researchers include economics, social, health, environmental and technical aspects of hazardous waste management. There is hardly any research carried out on legal aspects of Management of Hazardous Waste. In the present research, researcher has analyzed the legal control over the management of Hazardous waste and for the said purpose the researcher has surveyed and extensively examined various literature available in terms of International Treaties, Journals, International and National Legislations, research papers, statistics, books, Notifications, Office Memorandum, Circulars, affidavits filed by various stakeholders before the Supreme Court of India and National Green Tribunal etc.

To indicate few, the Researchers has extensively reviewed the specific legislations on the Hazardous waste right from the Resource Conservation and recovery Act, 1976 enacted by

the US, to the Hazardous Waste Management Rules Notified by the Government of India from 1989 (amended in 2000, 2003, 2008 and finally revamped in 2016 and further amended in 2017 and 2019). These Regulations played a key role in shaping the international regulations on the Hazardous waste. The Researcher has reviewed various reports prepared by the World Health Organization like the Report of the Commission on Health and Environment made in 1992, HW: The Beginning of the World Challenge, 2019, etc. as the WHO has played a pivotal role in studying the health impact of the HW. Indeed, considering the role played by the International agencies like United Nations Organization, Organization for Economic Cooperation & Development, European Union etc. is very crucial as far as safe and scientific disposal of HW is concerned. The various treaties and policies framed by these international organizations are analyzed by the Researcher which inter alia include the Stockholm Declaration 1972, The London Convention 1972, The Oslo Convention 1972, The Paris Convention 1974, The Basel Convention, 1999 etc. Whereas, amongst others certain important policies like the “Guidance document on the definition and classification of hazardous waste” published in 2015, “Hazardous Waste Statistics- Eurostat Statistics explained” published in 2019, “Regulations and Restrictions” published in 2019, “Health and environment in sustainable development: Five years after the Earth Summit” published in 1997 are worth mentioning here which provides the insight out of the multidimensional subject of the Hazardous waste management.

Finally, on national front, the Annual Reports Prepared by the Central Pollution Control Board and various State Pollution Control Boards and Pollution Control Committees including guidelines issued by the Central Government on the management of Hazardous waste from 1995 onwards are analyzed by the Researcher which throws light on the evolution of this modern time waste, its various facets and multidimensional aspects involved in its disposal.

1.9 IMPORTANCE OF THE STUDY:

Production or generation of HW Waste in large quantities is an inevitable side effect of modern manufacturing Process adopted in numerous industries and nothing can be done to prevent it. The reduction or minimisation, handling, treatment and disposal of this modern time waste, however, is an extremely relevant and sensitive issue, because it involves questions related to environment pollution, social and economic factors, sustainable

development angle, multidimensional aspects and public health hazards. In this context the management of hazardous waste is a pressing need of the hour.

The importance of the study on management of hazardous waste lies in the fact that it analyses the problems associated with HW and suggests remedial measures to tackle the problem of HW management in a more planned, systematic and strategic way. The research and consequent suggestions and recommendations including a proposal for a specific policy on hazardous waste management will be useful to legislators, administrators of Industrial establishments, academicians, lawyers, enforcement authorities and non-government organizations. The importance of the study lies in its purpose of making an original contribution to the discipline of law.

Environmental Pollution have multilevel impacts. Some impacts are immediate and quick like airborne diseases whereas some impacts are seen over the period of time like chronic diseases due to heavy metal traces present in soil and water leading to impact human genes and carcinogenic diseases and organ failure. Improper management of waste takes away the legitimate rights of People leaving them subjected to polluted soil, water and air. They are sometime subject to drink polluted water, breathe polluted air and effect their livelihood due to reasons of drop or retardation of plant growth, loss of crop, accidents and finally environmental disasters.

The impact is not always on life and environment but also have ramification like economic, social and legal. The improper management of hazardous waste causes physical, biological and chemical threat to life and equally create societal impact due to loss of employment and economic impact like cost to be incurred to remediate HW contaminated sites. It is a known fact that HW toxic materials tend to alters on ecological balance on which we depend for air, water and other resources. HWM is not only essential to social welfare and protection of environment but for overall economic development of any nation.

Exploitation of natural resources in an unrestricted and haphazard manner due to indiscriminate HW dumping can cause loss of biodiversity thereby endangering variety of species. The resultant impact due to HW could be fatal and irreversible compared to other categories of waste. Hence, the study is significant one in the attempt of saving mankind and the earth against environmental pollution and improper management of hazardous

wastes.

1.10 SCOPE AND LIMITATIONS OF THE STUDY:

The definition of Hazardous waste is vast and its management includes various components and fields since the area relating to HW Management is also extensive and having wide magnitude and dimension. The subject is interdisciplinary comprising of field of science, technology, sociology, economics and law. In the present study the researcher has confined to only the problems created by such wastes generated in the area of notified Industrial areas and accordingly has investigated with reference to relevant legal norms. Other forms of Hazardous waste or Hazardous substances generated through ways and means unconnected with Industrial areas and process thereof like originating from research and development activities, defence establishments, offices, household and although important in their own way, have not been dealt with in the present study, primarily since their contribution to the problem of HW Waste Management is to a miniscule extent and so also there are specific norms , guidelines and waste management Rules to that effect.

This research has analysed the efficacy and adequacy of existing laws, rules, notifications and its enforcement relating to environment protection due to HWM. The researcher has extensively explored the areas with respect to the legislations enacted during the pre-independence era and post-independence era, moreover due to industrialisation taking shape and gradually evolved in India, its implementation, enforcement and management of hazardous waste. The data for this purposes is collected and analysed for the period of last 10 years. The limitation of this research is that, the research analyses only the legal perspectives of the hazardous waste management with respect to the Indian scenario along with comparison of developed and developing nations. The present study also highlights the scenario of HW in the Cuncolim Industrial Estate, Goa with exhaustive review of Rules and role played by Enforcement authorities and loopholes thereof.

No study can be said to be without any limitations; the present study also has followings limitations: -

Updated, credible, reliable and real time information is not available with various State Government Departments and enforcement authorities in India even though it is mandatory

for them in terms of the directions of the Supreme Court of India to prepare a National Inventory on HWM. There is mismatch regarding information available with central and state government and their authorities. As per the directives of the Hon'ble Supreme Court of India, the Central Government and State Government need to prepare the National inventory of HW generated, handled, transported, treated, recycled, co-processed and disposed of, however no serious efforts are taken in this regards to prepare the inventory or update the existing database and as such no accurate and credible data is maintained by them. Additionally, the formats maintained by various State Government regarding generation, treatment and disposal of HW and annual reports are not consistent and are not in line with schedule appended to the HWM Rules.

The researcher could not visit all the States and U.T's of India and most of primary data and secondary data is collected from the Ministry of Environment, Forests and Climate Change, New Delhi being the administrative Department in the field of WM in India and its central agencies and regional offices. The researcher conducted interview and interaction with representatives of Industries, Developers, Unit holder, Industries and Trade Associations, Labour Unions and personnel of the Industrial units. One cannot enter in HW disposal site without a prior permission from the authority mainly from the Labour, Industries Department of State Governments and State Pollution Control Board due to safety and security reasons. Present research study is restricted to Law, Policies and Procedures relating to the Industrial HW which is generated in the notified Industrial areas in India which include Industrial Estates, Industrial corridors or parks and special Economic Zone. The other waste which includes HW generated in households, office, Defence establishments, etc. including hazardous substances and hazardous materials and hazardous component of Biomedical waste, Batteries Waste and E waste is not considered in the present research.

1.11 SCHEME OF THE STUDY:

The Present Study is divided into five chapters.

(I) Chapter I: Introduction

First Chapter is an introduction to the research and has underlined the meaning of waste in general and the special reference of Hazardous Wastes amongst other types of wastes. The

issues and problems associated with mismanagement of Hazardous Wastes are elaborated. This chapter further set out the objectives, need for the study of the legal control of HW Waste Management, Research questions, scope and limitations of the study. This chapter also deals with components of the environment, close relationship between man and environment, the concept of the environmental protection, the problem of wastes in the present and the past, how the accumulation of the hazardous waste causes major sanitary, hygiene and health problems to the people. It also covers the methodology adopted for this Research.

(II) Chapter II: Policies and Regulations for management of Hazardous Waste: - Evolution, Legislation, Regulatory Framework and Global Contour

The Second Chapter has examined the international legal machinery, which includes the legal systems of HW Waste Management in the United States of America, Europe, Singapore, Canada and other Countries most of which are pioneered in state of art waste management techniques. This Chapter has also focussed on the aspects of international disputes or calamities due to illegal export of HW. This Chapter also highlights the concept and evolution of HWM, its source and origin and impacts on ecology and environment. Finally, this Chapter has highlighted the scenario of import of HW which is much debated issue in the global context of illegal import and cross border transportation of HW leading to international environmental disputes.

(III) Chapter III: Policies and Regulations for Management of the Hazardous Waste in India- Legislative and Regulatory Framework

The Third Chapter has examined the journey of waste and its management in Indian context. The specific rules for management and handling of HW Waste in India right from the initial concepts including that of ancient times till the present modern time, journey of law along with the amendments including the specific judicial response in this regard is also elaborated. A detailed discussion is made to analyse the various Constitutional mandates which have aimed to conserve and safeguard the ecology and environment in India. The obligations of the State as well as the citizens towards protection of the environment, the right to life guaranteed under the constitution which includes right to know, right to clean drinking water, right to live in a healthy environment, and right to

have a pollution free environment, are discussed. The special attention provided by the Supreme Court of India for protection of environment with formulation of certain new principles and pronouncement of new doctrines in the field of Hazardous Waste Management which includes the creative interpretation of the courts and National Green Tribunal also has been analysed.

(IV) Chapter IV: Effectiveness of Implementation of Hazardous Waste Management Rules in India and a special reference to the Cuncolim Industrial Estate, Goa: A Critical Analysis

The fourth chapter deals with the implementation of the HW rules and procedures for proper handling of HW Wastes in India and Goan experience with regard to the problems of HW Waste mismanagement across a spectrum of notified industrial Zones, which involves voluminous information gathered through various means and subject to statistical techniques and scientific data analysis. A specific reference study of the Cuncolim Industrial Estate is made which is one of the polluted Industrial Estate in India having representation of most of the manufacturing sector of India.

Finally, in the fourth chapter, the importance, use and purpose of this study is discussed and an evaluation of the data and findings gathered from the different aspects of research methodology has been carried out. This has been done by taking into consideration the objectives of this research and it will involve assessment of the salient aspects of information generated through research tools in the field of management of hazardous waste.

Based on the research analysis, the hypotheses which were set out by the Researcher were duly verified, tested and conclusions were drawn regarding the efficiency and effectiveness of HWM in India.

(V) Chapter V: Conclusions and Suggestions

In the fifth chapter “Conclusion and Suggestions” the researcher has drawn inference from the detailed study and thereafter given his own concrete conclusions and pragmatic, realistic and remedial suggestion for strengthening the efficacy of the existing legal mechanism for easy, safe, effective, efficient and scientific management of hazardous

wastes in India. This study has critically analysed the infrastructure of the notified industrial areas in India which includes Industrial Estate, Industrial Corridors and SEZ. The suitability of the provision of law in the context of HWM and their implementation are being examined in this research, based on which suggestions and recommendations has been made for effective management of HW Wastes in India. After legal analysis and testing of Hypothesis postulated the researcher has made various realistic and implementable suggestions.

CHAPTER-II

Policies and Regulations for Management of Hazardous Waste: Evolution, Legislation, Regulatory Framework and Global Contour

CHAPTER II

2.1 INTRODUCTION:

Waste is produced or generated in every facet and action of human being. It starts with house to work place, from small shops to large scale industries, from animal shelter to modern dairy farms and so on. No area or sector or establishment can be excluded wherein it can be considered that it is not prone to generation of waste. When the history of waste generation is looked upon, the first kind of waste encountered is human excreta. The roman maxim cloaca to the Persian maxim motta papellardorum provides a strong proof to this fact that the concept of waste was known to ancient civilization¹⁴.

The concept of the community waste or society waste is evolved over the period of time, though the amount of waste generated was comparatively small during this era. It was only because of the tainted environment (in modern term “Polluted Environment”); the concept of neo-Hippocratic medicine concept came into practice which was necessary as an effective measure against major cause of human mortality arise out of accumulation of waste materials and epidemic. This has led to the activities towards city cleanliness started in Europe and US mostly during the period of 1750 to 1850 to prevent any possible epidemic. During the same period agriculture was the main activity being carried out throughout the word and use of certain household waste materials was used as a manure in agriculture fields¹⁵.

During 1870, when the Industrial revolution had just started at the same time fertilizer revolution also started due to which there was an increased growth in coal and petroleum sectors which was the starting point of evolution of concept of Industrial waste or chemical waste also known to be a bye-product of industrial process¹⁶.

With advancements in industrial revolution an enormous amount of industrial waste is being delivered to the environment thereby creating adverse impact on an ecosystem and life. Between the past two generations, the concern related to the harmful effects of the

¹⁴ Kolstad, Environmental Economics, Oxford University Press. New York, 2000, p131-133.

¹⁵ See "State and Territorial Environment Agencies.", U.S. Environmental Protection Agency (EPA), USA (2012).

¹⁶ Greenpeace International, “International Toxic Investigator”, 2nd Quarter (1996), p.12-16.

disposal of various industrial wastes on the public health have raised serious debate among and between many professionals from different disciplines within the public health community. From chemical engineering perspective, generation of HW in any industrial process is inevitable and toxicity or hazard associated with this category of waste is the potential for disease or death¹⁷.

During the late 19th century, a rapid urbanization and industrial revolution resulted in air and water pollution problems in the United States and Europe which were never experienced earlier anywhere in the world. The one of the predominant reason was use of coal fired combustion in most of the Industries. This drastic increase in water pollution created a serious concern to the growing public health profession and thus became the special center of sanitary engineers, bacteriologists, biologists, and chemists, as well as some physicians. During the 1880s and 1890s, due to the competing medical theories, limited understanding regarding the etiology of airborne and waterborne disease, and also due to methodological limitations to check air and water quality, no much attention was given to prevent accumulation of waste and disposal of same which were only developed gradually over the period of time. However, most of the studies carried out during the period highlights that the industrial waste is the major reason for degradation of environment and majority of Health diseases due to soil and air pollution¹⁸.

Due to low population density and lesser exploitation of resources the issue of waste generation was insignificant earlier. Common waste which were predominant earlier include mostly biodegradable waste having minimum environmental impact. Burning was the only disposal mechanism available. However, in the modern civilization with growth of Industrialization and addition of multidisciplinary aspects to waste, its management become an independent subject.

2.2 CONCEPT AND DEFINITION OF HAZARDOUS WASTE:

2.2.1. What is waste?

The facts related to the histories of waste, and of the words which have been used to define it are inseparable from one another. It is observed through a quick survey that now a day

¹⁷ "Our Planet, Our Health", Report of the World Commission on Health and Environment (1992) p.42.

¹⁸ Supra n 7 at 364.

altogether three different types of vocabulary have developed which is being used to describe the term “waste”. The first category, includes the terms which are associated with the themes of loss and uselessness: *déchet* in French from the verb *choir* (to fall), refuse, useless, condemned or scrapped and also garbage in English (which primarily refers to animal offal), *dechets* in French, *desperdicio* in Portuguese, *rifiuti* in Italian, *residuo* in Spanish, *Abfall* in German. The second category contains the terms that emphasize the dirty or repulsive characteristics or nature or even appearance of these substances: *immondice* in French, *immondizia* in Italian, from the Latin *mundus* which means clean; literally meaning horrible. The third category of waste includes those terms which describe the materials that make up the waste or composition of waste: *boues* in French, *spazzatura* in Italian, *Müll* and *Schmutz* in German, rubbish in English derived from rubble. The word waste comes under the first category. From the old French *vastum*, which simply means empty or desolate, and it was first used to depict a desolate, ruined or neglected region. Later, this term was used to describe a wasteful expenditure. In early 16th Century the current meaning to the word “Waste” attains somewhat finality¹⁹.

The fact that the original meaning of waste has a spatial dimension in that it described a place, similarly to *spazzatura* from the verb *spazzare* ie to make a space, is likely not neutral. It is also undoubtedly the case with the rich vocabulary, which has only been touched on lightly here, used to describe various wastes. Indeed, the issue of waste is closely related with (even confused with) both the issue of salubrity and sanitizing of urban space and the management of urban urine and excrement since long time²⁰.

In general, waste can be defined as something which is not useful or which is unwanted. Wastes can be regarded as those things which are no longer required by an individual, institution, society or industry. This waste can be produced from various sources including household, offices, shops, animal husbandry, hospitals and health care institutions, commercial activities, agriculture, construction, industries, mining, etc. In fact, waste is generated from almost all the sectors with difference in characteristics, amount and its nature. Thus it can be considered as by-products or end products resulting from production and consumption process respectively. According to the European Union legislation the

¹⁹ Nicholas Rousakis, 'Intergenerational Justice: A Primer', *Institutions for Future Generations*, Gosseries, A. & I. Gonzalez (eds.), Oxford University Press 2016, pp. 34-45.

²⁰ *Ibid*

term “waste” is defined as “any substance or object in the categories set out which the generator or possessor condemned, disposed or wishes to disposed”.

The flow of materials in any developed or developing society can be depicted by the following schematic diagram shown in Figure 2.1.

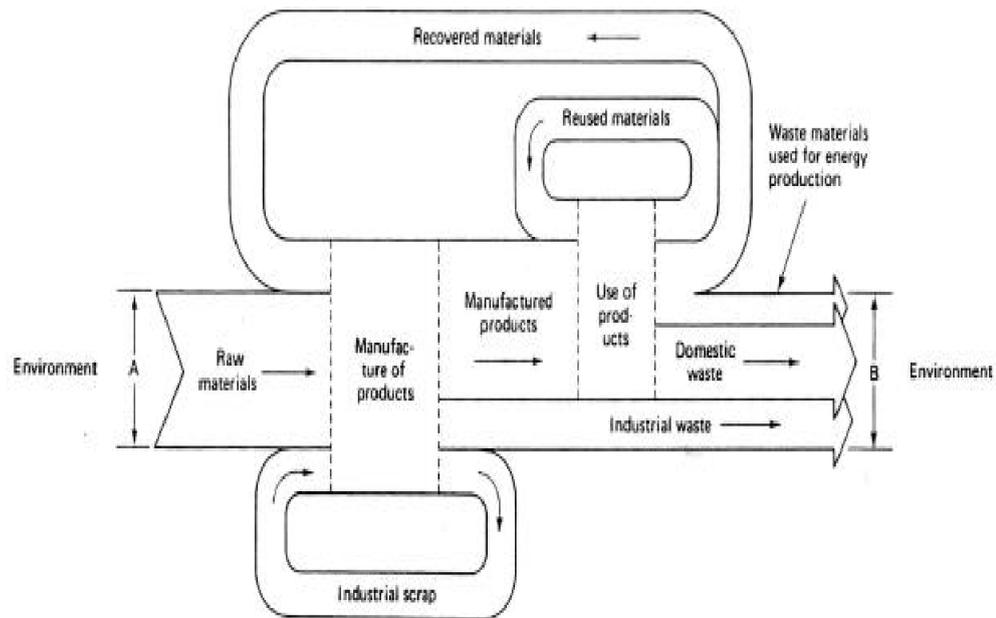


Fig 2.1. Schematic diagram indicating concept of waste generation in Industry

(Source: Secondary²¹)

Depending upon the physical nature waste can exist in four different states i.e. solid, liquid, gas and plasma²²:

- (i) **Solid State wastes:** Solid State wastes includes discarded, scrapped or abandoned material which are useless and unwanted products which exist in a solid form. Majority of waste items in this category includes waste items derived from human activities and also those items which are discarded by society. These category of waste are delivered either during the production process or produced during the disposal of objects or materials after their use from the domestic or commercial sector. It mainly includes wastes like household items

²¹ Schelling, T., “*Incentives for Environmental Protection*”. MIT Press, Cambridge, Mass.,2008, p.7.

²² Sukanta K.Nanda, “*Environmental Law*”, Central Law Publications, Third Edition, UP, 2013, p.69-74.

life food, vegetables, tubes and tyres, old furniture, fruits and meat, crop residues, cans, bottles, cored metal pieces, wrappers, ashes etc.

- (ii) Liquid State wastes: Liquid wastes include sewage from toilets of houses, sullages, sewage of kitchen and offices, restaurants, hospitals and industrial effluents.
- (iii) Gaseous wastes: Gaseous wastes include effluents released from Industrial process like Steel, Fertilizers, Pharma, Power, Chemical Industries exhausts which contain gases such as Sulphur dioxide, carbon dioxide, nitrogen oxide and carbon monoxide including particulate matters.
- (iv) Plasma State Waste: It's a molten state of waste and such waste materials are bye products of several chemical Industries which include molten slurry, used oil, etc. This state of waste is a minimal in nature and found in very specific category of process like radio activity, etc.

2.2.2. Sources of waste generation

Waste can be any substance which is discarded after primary use, or it is worthless, defective, scrap, condemned and of no use. The term is often subjective (because what is considered as waste by an individual may not necessarily be waste to another and sometimes it is a raw material to another industry (For example, using scrap metals to a landfill cannot be considered as waste, since they are recyclable).²³ Examples of waste which can be considered here include municipal solid waste (household trash/refuse), hazardous waste (Industrial or chemical waste), wastewater (such as sewage and sullage, which contains bodily wastes (faeces and urine) and surface runoff), radioactive waste, Bio-Medical waste (Hospital, Pathology laboratories etc), Plastic waste, Electronic waste, Batteries waste, constructions and debris waste and Radioactive waste²⁴.

Households, markets, institutions, streets, public areas, commercial areas and manufacturing industries are the main sources of wastes and it is same for any country throughout the world. Industrial waste is the waste generated by industrial activity and it includes any of those materials that are rendered useless during a manufacturing process in factories, industries, mills and mining operations. It came into existence since the

²³ World Commission on Environment and Development, *Our Common Future* (Oxford University Press, 1987), p. 13.

²⁴Radioactivity means "property exhibited by unstable isotopes of elements which decay, emitting radiation, principally alpha, beta, and gamma particles".

beginning of the Industrial Revolution. A few common examples of industrial wastes include chemical solvents, paints, sandpaper, paper products, industrial by-products, metals, packaging, chemical slurry, effluents and emissions²⁵.

2.2.3. What is Hazardous Waste?

From ancient times till the beginning of industrial revolution, streets and more precisely the open areas in cities were used as receiving sites for urban waste i.e. human and animal urine and excrement, other organic materials from domestic or artisan activities, rubble from demolitions, various mineral debris, etc. And it is only due to this reason the composition of these soils gives us an overall idea about the history of a particular city. The release of waste directly into the soil was important because streets and squares were not always cemented and thus they could absorb more rainwater or also urbanized areas were built on low, sometimes even on marshy ground²⁶.

The need for cleaning up of polluted urban space was realized during the construction of the famous Roman cloaca maxima, which was built under Tarquin the Proud (7th- 6th century BC) to drain the Velabrum and the lowlands located between the Capitoline Hill and Palatine Hill. Initially it was through an uncovered canal network, and later with a subsurface sewage system, urban refuse and materials from latrines was collected and then drained into the Tiber. Subsidiary lines, such as ditches originating from houses, led to the cloaca maxima and helped in cleaning up of Rome. Therefore, Rome was called as a “hanging city” (urbspensilis) by Pliny the Elder due to its location just above the underground passages. The task of maintenance and cleaning up of sewers, was given to convicted criminals, formed the basis for the cloacarium tax²⁷.

Many of the cities during that time were equipped with such types of community facilities. Draining and cleaning up of urban areas using the underground pipes reduced to considerable extent during the Middle-Ages in Europe and it was then replaced by surface runoff for rainwater and drainage waters. Urban brooks (still identifiable today in France as Merdereau or Merderet) and moats behaved as sewers. Many of the cities were diverted, canalized and constructed networks of drainage systems to allow the proper development

²⁵ K.L. Bhatia, “*Human Rights and Human Environment-A Study in the Policy Perspectives*”, ALJ, Vol.10,1990 at p. 57.

²⁶ Encyclopedia Britannica (1964), vol.27(2018), p. 180 .

²⁷ Extracts from “Connect”, a UNESCO Publication.

of their artisan activities.

Since these canals were useful in the drainage, thus they were considered as sewers. Apart from this they also played a significant role in finding urban prosperity. Soon, the status of human excremental materials changed with time and space. Some cities retained a combined sewerage system used since Roman time; many cities adopted, during the Middle Ages or the Renaissance, pit privies, which in the beginning were just simple holes and later underground reservoirs placed under dry latrines. The growing use of these cesspools gave rise to a new profession known as the cesspool emptier (but in some cities local growers did this job).

Moreover, the necessity for salubrity led many cities to prohibit the disposal of human waste into sewers and rivers - this was the case in Paris where, since the 13th century, the Great Sewer (“Grand Égout”), a former backwater of the Seine River, drained the Right Bank. However, these bans, as well as possible sweeping and cleaning obligations, were often ignored by urbanites²⁸.

Industrial Revolution encouraged the growth of industries all over the world. Though, rapid industrialization plays an important role in economic growth. One of the drawbacks of industrialization is generation of enormous amount of byproducts and resulting waste generated due to the process, which is termed as Hazardous Waste²⁹. Such wastes can be generated during the manufacturing processes as a by-product or can be generated due to the use of various catalysts, which need to be disposed of soon after its application. Thus rapid industrialization has resulted in the generation of huge quantity of wastes, both solid and liquid, in industrial sectors such as sugar, pulp and paper, fruit and food processing, sago / starch, distilleries, dairies, tanneries, slaughterhouses, poultries, etc³⁰.

²⁸ Jenny H. 1941, Factors of soil formation. New York: McGraw Hill

²⁹ The term "hazardous waste" lacks a single globally accepted definition. This Comment adopts the definition of hazardous waste used by the United States Environmental Protection Agency (EPA). Prior to classifying waste as "hazardous," the EPA first determines if the substance at issue is a "solid waste." "Solid waste" is defined in the Resource Conservation and Recovery Act (RCRA), (1988), as: any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges or source, special nuclear, or byproduct material .

³⁰ Susan G Hadden, “Statutes and Standards of Pollution Control in India” (1987) Economic and Political Weekly XII, No 16, p145-160.

Industrial process wastes include a wide range of materials and its composition in any Industry depends upon nature of the industrial base. Wastes can be present in the form of relatively pure substances or as a complex mixture of varying composition and physicochemical states. Examples include general factory rubbish, organic wastes from food processing, acids, alkalis, metallic sludge and tarry residues. The peculiar feature of industrial wastes is that a significant proportion is regarded as hazardous or potentially toxic and thus special handling, treatment and disposal is needed³¹.

2.3 SOURCE, CHARACTERISTICS AND IMPACT OF HAZARDOUS WASTE ON PUBLIC HEALTH AND ENVIRONMENT.

2.3.1. Major Sources of generation of HW: -

Four types of industry account for about 70% of total industrial hazardous wastes generated in the World which include Metal Units, Chemical, Petro-chemical, and oil refineries. However, MSME industries also generate HW. It is not the size of the Industry but category of Industries or industrial process which contribute to generation of HW. Nevertheless, other category of Industries account for about 30% of the HW generated in the world³².

Certain pesticides like Glyphosate, trifluralin, DDT, monocrotophos and mancozeb are hazardous chemicals which are banned in most of the countries are still manufactured and used in the Europe, Australia, Canada and US. Fungicides, Weedicides, Pesticides, mosquito repellents etc are designed to kill weed, fungus, insects, germs, etc and protect agricultural crops, horticulture plants etc. But research found that most of these pesticides are toxic chemicals themselves and their production involved more HW generation. The HW division regulates generation, transportation, disposal, and treatment during their manufacturing stages, but environmental pollution and ill effects caused due to applications of these items after application are not specified in HW regulations. (“The EPA's Office of Pesticide Programs oversees pesticide use and handles cases where pesticides in agricultural or landscaping runoff pollute air and water or compromise human health”)³³

³¹ *Ibid at p.168-169.*

³² *Ibid*

³³ Stephen Johnson, “The Basel Convention: The Shape of Things to Come for United States Waste Exports”, 21 ENVTL., 312 (1991), p.35-38.

2.3.2. Other sources of HW

Other sources of generation of are associated with military bases, mines and mineral extraction, Oil refineries, and discarded household and consumer items³⁴. The small scale Units are also posing certain enforcement challenges which includes: (1) The chemicals used by service centers of automobiles and machineries, laundries, building sites, laboratories, photo developers, printing units, large are often hazardous (2) HW generated by SHWGs are sometime having variant characteristics and larger degree of toxicity than the HW generated through large scale industrial process which also requires a dedicated treatment and disposal facilities (3) SHWGs, which do not have the requisite legal and administrative support at large companies, often find its difficult in complying with HWM Regulations. Noncompliance can lead to serious violations on part of such small generators and due to many such generators the coupling effect is alarming³⁵.

2.3.3. Specific Sources of Generation of HW: -

- a) Most of the Military installation in the world have some of the most serious hazardous waste disposal problems. About 23,000 sites at 8000 military installations show some degree of contamination of soil and ground water table. More than 100 military bases in USA are also identified as major generator of HW. Moreover, these military bases enjoy a sovereignty and protection from inspection the enforcement agencies who finds it's difficult in enforcement of HWM Regulations. However, with rapid growth in violations, these military establishments are also not subject to state or federal environmental laws which has led to massive remediation and clean up drive across the World³⁶.

- b) Mining and mineral extraction waste: During extraction on minerals and washing of ore certain toxic waste are released in the Environment. These toxic having hazardous characteristics. Also during some processes involving mineral processing, screening, at site, certain toxic waste as well as byproducts are generated.

³⁴ "Hazardous waste generation" is defined as "the act or process of producing hazardous waste." 42 U.S.C.

³⁵ Phillip Sands, "Principles of International Environmental Law", (Cambridge University Press, 2009), p.25.

³⁶ Kuokkanen," International Law and Environment: Variations on the theme (Martinus Nijoff Publishers, 2002) p.46.

c) Household hazardous wastes: This category comprises of various discarded and old items, domestic goods, electro mechanical products, scrap items, etc. also constitutes hazardous materials.

2.3.4 Some of the other chief sources of HW are:

Agricultural land and agro-industry: Hazardous wastes produced from agriculture land and agro-industry exposes people to pesticides, fertilizers and hazardous veterinary product wastes. Farms are a major source of these wastes where agrochemicals can leach into the environment during their storage or cause damage after their application in field.

Domestic: Households contains various hazardous substances like batteries and dry cells, furniture polishes, wood preservatives, stain removers, paint thinners, rat poisons, herbicides and pesticides, mosquito repellents, paints, disinfectants, fuels (i.e. Kerosene) and other automotive products. All these represents a variety of dangers during storage, use and disposal.

Mines and mineral processing sites: Mines and mineral processing sites harbors hazardous products which are contained in the additives, the products and the wastes.

Health care facilities: Are sources of various laboratory equipment's, chemicals, etc. which can be categorized as the HW.

Institutional hazardous waste sources: Are mostly research laboratories, research centers and military installations where many hardware are categorized as the HW.

Industrial hazardous waste sources: Hazardous wastes are generated by several industrial activities. Almost all of the manufacturing activities results in the generation of HW.

The most important source of the HW production is the Industrial activity. Industrial operations result in considerable generation of hazardous waste and in a rapidly industrializing country like India, industrial contribution to hazardous waste is largest. However, the significant amount of the HW is generated from five manufacturing areas:

- i.** Chemical, Fertilizer, Pesticides and pharmaceutical manufacture
- ii.** Metals refining

- iii. Petroleum and coal products
- iv. Metal working and fabrication
- v. Rubber and plastics manufacture.

2.3.5. Characteristics of HW: -

Hazardous waste is a special category waste which possess an inherent property which is detrimental or toxic to life and environment. Hazardous waste can be generated by various manufacturing process such as Industrial, servicing of vehicle's, health care institutions, petro-chemical refineries, pesticides units, etc. The physical and chemical properties of hazardous waste may differ from process to process so also quantum of waste³⁷.

Characteristics of Hazardous Waste: According to EPA, hazardous waste can be categorized based upon its following seven characteristics³⁸:

- (a) ignitability or something flammable,
- (b) corrosively or something that can rust or decompose,
- (c) reactivity or something explosive,
- (d) toxicity or something poisonous,
- (e) Infectivity,
- (f) Radioactivity, and
- (g) Bioaccumulation

These six inherent physical – chemical characteristic of HW are summarized below³⁹: -

1. Ignitability: There are three types of ignitable forms of HW: -

- (a) Liquid HW—the lowest temperature at which fumes above waste ignite—of 60 degrees Celsius or 140 degrees Fahrenheit. Examples include alcohol, gasoline, and acetone.
- (b) Solids HW where combustion take place immediately.
- (c) Oxidizers and compressed gasses: -

In this category of HW, when it is subjected to oxygen get combusted.

Ignitability exhibits a flash point of less than or equal to 140°F (60°C) determined by using a standard test method in the laboratory. A non-liquid waste under given

³⁷ Sara Tompson, "Hazardous Waste Reference Resources, Science & Technology" (2017), p.78-81.

³⁸ *Ibid*

³⁹ *Ibid*

standard conditions, can cause fire due to friction, absorption of moisture or a spontaneous chemical change and when it is ignited, it burns so vigorously and persistently causing a hazard. The resultant impacts are immediate⁴⁰.

2. **Corrosively:** Corrosive substances like hydrochloric acid, nitric acid and sulphuric acid, have the ability to cause corrosion of metal/material in which it is stored due to this harmful property. Common examples of corrosives are battery acid examples of corrosive HW are rust removers etc.

3. **Reactivity:** The HW under this category are normally unstable but reacts violently with water or produces toxic gases when comes in contact water or other materials. Due to their instability, reactive wastes are very harmful. They appear to be inert in normal circumstances. According to EPA there exists several conditions and situations which helps to identify all kinds of reactive materials and they have laid certain guidelines to help generators⁴¹:
 - (i) unstable, and routinely experiences violent change without detonating
 - (ii) potential for explosive mixture or violent reaction when combined with water
 - (iii) toxic gasses are released when mixed with water.

4. **Toxicity:** Certain HW pose a threat to groundwater, and can have long term effects on human health and the environment. It is different from the first three groups, which are recognized as containing immediate and first hand dangers by EPA. There are a total of 60 contaminants on the toxicity characteristics list. They are identified based on a test method referred as “Toxicity Characteristic Leaching Procedure” or TCLP. Contains certain substances considered as harmful in excess, or at maximum concentration. Example: Lead, arsenic, mercury, etc⁴².

5. **Infectivity:** A waste which can cause an infectious disease like hepatitis. Example: Medical wastes containing microbial cultures, pathological wastes, contaminated

⁴⁰ Freeman, M. H. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill Book Company, New York(1998).

⁴¹ Vandecasteele, C. Management of Wastes, UNESCO, Paris. Unit 9: Hazardous Waste: Management and Treatment (1995) p.423.

⁴² Wentz Charles A. Hazardous waste management, McGraw Hill International editions, Chemical Engineering series, McGraw Hill Inc., 2nd edition, Singapore (1995), pp. 80-86, 296-351.

human blood and its products, sharps, skin-piercing objects, contaminated animal wastes, contaminated exudates and secretions, etc⁴³.

6. **Radioactivity:** Wastes containing radioactive elements and mainly comes from biomedical training and research institutes. Example: radioactive elements of uranium, molybdenum, cobalt, iodine⁴⁴.
7. **Bioaccumulation effect:** Wastes that cannot be degraded easily when exposed to the environment. Examples: polychlorinated biphenyls (PCB), dioxin⁴⁵.

The impact of hazardous waste is immediate and high. Also this category of waste cannot be disposed of using a standard treatment and disposal methods available for other category of waste like solid waste, plastic waste, batteries etc. Hazardous waste mostly consists of by-products of industrial, commercial, domestic and health care activities. Further development and improvement in industrial technologies, products and practices are expected to cause tremendous increase generation of HW. HW is mostly generated during the manufacturing of products for the purpose of consumption or industrial applications. Sources of HW include industries, institutional establishments, research laboratories, mining sites, defense establishments, mineral processing sites, agricultural processes and the natural environment. All those sources which are responsible for the discharge liquid, gaseous or solid wastes which fit under the definition of the HW are considered HW sources⁴⁶.

2.4. EVOLUTION OF DEFINITION OF HAZARDOUS WASTE

There does not exist accepted definition of the term "hazardous waste" till today. Some countries have defined "hazardous wastes" with regards to the danger caused to human health, and others relate it with the damage caused to the environment. However, both the concept i.e. Hazardous waste and general waste being hazardous waste are different

⁴³ *Ibid*

⁴⁴ N. Schrijver, *Permanent Sovereignty over Natural Resources: Balancing Rights and Duties* (Cambridge: Cambridge Univ. Press 1997), p.390-392 .

⁴⁵ *Ibid*

⁴⁶ Blackman, W. Basic. *"Hazardous Waste Management"*. Boca Roca: Lewis Publishers, 3rd Edition. 2001.

concept. So also there is specific stream of waste “Hazardous Substance”. Hazardous characteristics of wastes are corrosivity, infectiousness, flammability, reactivity, explosivity and Eco toxicity. Some countries refer to similar hazardous characteristics in their respective environmental legislation, but there may be considerable differences in the testing procedures which are used to determine whether a waste exhibits actually one or more of the characteristics⁴⁷.

Even the specific Basel Convention has not defined the term Hazardous waste. While most countries have defined what they consider to be ‘hazardous waste’, those definitions differ in their detail, and while there are similarities, there are also many inconsistencies. Even the terminology differs: some countries use the term ‘hazardous waste’ while in others the terms ‘chemical’, ‘special’, ‘poisonous’, toxic’, ‘difficult’ or “Industrial” are used to describe such wastes. The importance attached to a legal definition of hazardous waste depends both on its purpose and the use that will be made of it. Therefore, a range of definitions is possible. The need for a clear-cut definition is greatest if national policy requires that hazardous waste be treated and disposed of separately from non-hazardous waste⁴⁸.

Criteria for defining hazardous Wastes:

Most countries use a definition for hazardous wastes based on the following three criteria⁴⁹:

- (a) lists of particular types of wastes which are defined as hazardous; (Inclusive list of various wastes defined as HW)
- (b) lists of industrial processes from which the waste is defined as hazardous; and (Inclusive list of various processes which leads or creates HW as by products)
- (c) In addition, often countries use lists of substances, the presence of which is indicative of potential hazard and which require testing (Inclusive list of active ingredients which constitutes HW)

In general, any wastes or materials which cause a threat to human health and/or the

⁴⁷ European Union (EU)., Guidance document on the definition and classification of hazardous waste, 2015, Available at https://ec.europa.eu/environment/waste/pdf/consult/Draft%20guidance%20document_09062015.pdf (accessed on 23/4/2017).

⁴⁸ *Ibid*

⁴⁹ World Health Organization (WHO), “Report of the Scientific Group on the Treatment and Disposal of Wastes. Geneva”, 1997.

environment are considered as hazardous. This include chemical and oil by- products which does not serve useful purpose and are capable to pose a threat when it is disposed of improperly.

2.4.1. Hazardous Waste Definition in the United States:

The USA has introduced the regulations by passing the Resource Conservation and Recovery Act (R.C.R.A.) in the year 1976. The main objective of the R.C.R.A. was to create a "cradle to grave" system with emphasis on tracking of every step from the source to disposal. Under this Act, HW are categorized into two main categories⁵⁰: -

Listed Hazardous Wastes: Following are the four HW lists set out by Environment Protection Agency(EPA) regulations:

- (i) Category F (general HW) This category of HW distinguishes waste from the various manufacturing processes identifies wastes from common manufacturing and industrial processes, domestic and commercial establishments. Examples of this category waste are spent solvent, electroplating, preservatives, leachates, etc. solvents which are used for the purpose of cleaning or degreasing operations. These category waste are also called as general hazardous waste because the processes involved in the production of these wastes may take place in different sectors of industry.
- (ii) Category K (process specific HW). This category of HW includes a particular process like fertilizers, chemicals, explosives, pharma, etc. Project or product specific HW like organic and inorganic chemicals, sludge's etc. are examples under this category of HW.
- (iii) Category P (Acute Toxic HW): This list constitutes acute HW which releases its toxicity with exposure to even small quantity in a short span of time. E.g. Designated chemical wastes, arsenic, Cyanide, etc.
- (iv) Category U (Toxic HW): This category of HW include list of certain designated chemical waste which are toxic in nature. E.g. Formulations, compounds, antifungal chemicals, etc.

⁵⁰ <https://en.wikipedia.org/wiki/Heterotroph>(accessed on 17/12/2017).

In the US, the hazardous wastes are classified as per the Federal Register of May 19, 1980. The following are the guiding principles on which EPA classifies the HW⁵¹:

- (i) “Whether the Waste falls under the category of solid wastes as defined by the Resource Conservation and Recovery Act of 1976? The term solid waste includes semi-liquids, liquids and contained gaseous materials as well.
- (ii) Whether the waste has been legally discarded? This stipulation is applicable to the wastes that are stored or treated prior to disposal but not to those to be recycled.
- (iii) Whether the waste is specifically excluded by the regulations? For instance, municipal solid wastes, agricultural wastes and animal manures are excluded.
- (iv) Whether the waste has toxic or hazardous characteristics. That is, whether it has the potential to increase the mortality or illness or whether it poses a substantial threat to human health or environment on the basis of hazardous characteristics such as corrosivity, inflammability, toxicity or explosiveness.”

2.4.2. Hazardous waste Definition in European Union:

One of the oldest EU legislative acts on the hazardous waste is The Hazardous Waste Directive. Its provisions are essential for ensuring a high level of environmental protection; and the differentiation introduced between hazardous and non-hazardous waste is along with the differentiation between recovery and disposal laid down in the Waste Framework Directive which is regarded as a key element of waste management policy. The European Waste Catalogue provides for a core list of 850 types of waste for which around 420 are classified as hazardous wastes and are divided into 19 categories⁵².

2.4.3. Hazardous waste Definition in Canada:

Hazardous wastes are generally defined depending upon their physical and chemical characteristics. They are broadly described using these criteria and thus include those wastes which exhibit either toxic, reactive, explosive, ignitable, corrosive, infectious, mutagenic, carcinogenic or teratogenic, bio accumulative or radioactive nature. Initial

⁵¹ <http://www.preservearticles.com/2012030625250/food-chains-food-web-and-ecologicalpyramids.html>(accessed on 9/12/2017).

⁵² Rosenberg, J. “Toxic Memo, Harvard Magazine. Available at World Health Organization. Waste and human health: evidence and needs”. WHO Meeting Report: 5–6 November 2015. Bonn, Germany. Copenhagen: WHO Regional Office for Europe; 2016. <https://www.harvardmagazine.com/2001/05/toxic-memo.html> (accessed on 11/12/2019).

attempts at legislative definitions in Canada followed the European model giving broad categories of materials, such as "hauled liquid industrial waste" and demands special handling and disposal practices⁵³.

Recently Canadian governments made an attempt to follow the American model of developing schedules of specific substances to be treated as hazardous waste under their environmental protection legislation. The federal and Ontario government's current efforts to define hazardous waste include combinations of both the "listing" and "criteria/hazard" models⁵⁴.

2.4.4 Standard List of hazardous waste generating Industrial processes

The following table indicate the Standard List of hazardous waste generating Industrial processes in the World:

Table No. 2.1 Standard List of hazardous waste generating Industrial processes

Industrial Process	Resulting Hazardous Waste
Petrochemical	Solid and liquid residue from furnace and reactor, debris, residue oil sludge, liquid emulsion, wastewater, etc.
Oil and natural gas Production	Sludge, drilling oil residue, mud
Oil tankers cleaning	Chemical residue, sludge, waste water
Metal Production	Flue gas, sludge, heavy metals, process residue, tar,
Chemical , Fertilizers, Pesticides	Residues, spent carbon , spent oil, sludge's,
Pharma	Waste water with high COD and BOD values, sludge's, discarded products,etc
Tanneries	Chromium sludge and residue
Cement Manufacture	metal compound, fly ash, used fuel, sludge's, emissions from kilns, etc

⁵³ *Ibid*

⁵⁴ P.S.Jaswal, Environmental Law, Pioneer Publications, Delhi ,Second Edition,2003, p.37.

Industrial Process	Resulting Hazardous Waste
Thermal Power Plants	Fly ash, sludge's
Sugar	Waste water contain
Electronics	Heavy metal residues, spent acid, discarded parts, etc.

Source: Primary

2.5: PUBLIC HEALTH AND ENVIRONMENTAL IMPACT OF HAZARDOUS WASTES

Chemicals affect us every day. They are used for the production of almost everything, from paper and plastics to medicines and food to gasoline, steel, and electronic equipment. Approximately 70,000 chemicals are being used regularly all over the world. Some of which occur naturally in the earth or atmosphere; while the rest are synthetic or manmade. Their application and proper disposal they enhance our quality of life. But their improper disposal may lead to harmful effects on humans, plants and animals. Also inadequate or improper management of solid waste produced through human activities can cause serious public health problems and adverse effects on the environment⁵⁵.

2.5.1. Why HW is a matter of Concern?

Many commercial products use materials which are not available in nature and they have to be manufactured artificially and same is possible only through Industrial process. In the manufacturing set up necessary precautions should be taken during their manufacture, transport, storage, use and disposal in order to prevent them from causing harm to people, other organisms and the environment. Many of these chemicals are not biodegradable i.e. they can be broken down into their components by microorganisms. These chemicals have high potential to cause serious health effects that can last for decades⁵⁶.

Following are the major concern about Hazardous Waste⁵⁷: -

1. Can cause damage to non-living material and living organisms causing disability,

⁵⁵ World Health Organization. "Population health and waste management: scientific data and policy options", Report of a WHO workshop. Rome, Italy, 29–30 March 2007. Copenhagen: WHO Regional Office for Europe; 2007.

⁵⁶ Barrett JR. The Navigation Guide. Systematic review for the environmental health sciences. Environ Health Persp. 2014.

⁵⁷ World Health Organization. WHO Handbook for Guideline Development. In: World Health Organization; 2014 .

death, etc.

2. Can cause environmental damages such as water, soil and air pollution.
3. Can cause potential increase in bioaccumulation of chemicals especially chlorine containing chemicals, which cannot be biodegraded or remediated easily.
4. Can cause long term irreversible health problems (mutagenicity and carcinogenicity)
5. Can cause trans-boundary movement of toxic wastes with impact at distant places away from the source of HW;
6. Can cause of massive toxic health damages.

2.5.2. Health Impact Analysis.

Efforts are on throughout the world including the Government Organizations in India to study the health impacts of hazardous pollutants. Along with research on health impacts, there are other impact-related guidelines are being developed for carrying out a full-fledged Health Impact Assessment (HIA)⁵⁸.

When hazardous wastes are released in the air, water or soil they can spread, resulting in contamination of more area of the environment and creating more threats to human health. For example, when rainfall occurs on soil at waste disposal site, the rain water can carry hazardous waste along with it deeper into the ground and thus the waste reaches the water table. Very small amount of a hazardous substance released may get diluted and it will not cause injury. A hazardous substance may lead to injury or death of a person, plant, or animal only if⁵⁹:

- a. A large amount is released at a time,
- b. A small amount is released many times at the same site,
- c. The substance does not get diluted,
- d. The substance is very toxic (E.g. Arsenic).

2.5.3. Exposure to Hazardous Waste:

The Figure 2.2 indicates the different ways by which the HW can be transmitted to human

⁵⁸ *Ibid*

⁵⁹ Marsili , Fazzo and Comba , “P. Health risks from hazardous waste disposal: the need for international scientific cooperation”, FaZo., 2009, p.178-190 .

bodies. These ways are:

Inhalation - By breathing, vapors from hazardous liquids or from contaminated water during bath.

Ingestion - Consumption of fish, fruits and vegetables, or meat which is already contaminated by exposure to hazardous substances.

Dermal exposure - Hazardous substance can come into direct contact with skin and it is then absorbed in”.

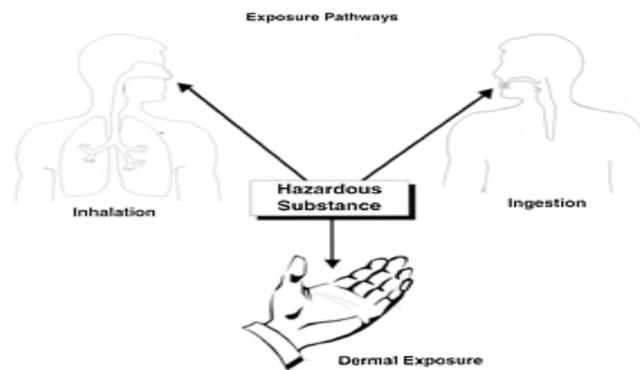


Fig. 2.2: Exposure Pathway of Hazardous Waste in Human Body

Source: Secondary⁶⁰

Exposures can be lethal or long term. The lethal or acute exposure could be a onetime contact to a hazardous substance for a short period of time and health symptoms may appear soon after the exposure; for example, the death of a fly when it gets covered with bug spray. Long term or Chronic exposure is the one in which contact occurs over the period or for longer duration like those which include people staying in stockpiles or working in hazardous sites, etc. Chronic health effects are usually illnesses or injuries which are developed over a long period of time. E.g. Cancer, liver failure or slowed growth and development⁶¹.

Residing in a vicinity of poorly maintained landfill or hazardous waste site can induce serious health effects such as Cancer, Birth defects and Genetic mutations, especially in

⁶⁰ *Ibid*

⁶¹ Perkins DN, "E-Waste: a global hazard. *Ann Glob Health*", 2014.

children⁶².

Exposure to Hazardous Waste can result from⁶³:

Air - Toxic chemicals from the soil can be vaporized in areas such as basements, leading to high concentrations of hazardous chemical gases in the house.

Groundwater - When harmful chemicals are present in the soil surrounding a water supply, they percolate into the water supply and cause harmful effects if present even in minute quantities.

Soil - When a landfill or waste site is developed as commercial or residential area without taking the proper abatement/remediation measures, the soil from such sites remain contaminated even after waste dumping has stopped. And harmful chemicals are absorbed through the skin after exposure with contaminated soil and vegetables and other edible plants grown in such soil.

Researchers have proved that the overall risk of birth defects may be increased by residing close to a hazardous waste site, but if the site is well maintained and proper habitation distances is maintained, the risk can be reduced.

2.5.4. Toxic Effects of Hazardous waste:

Exposure to a toxic substance result into immediate or long-term effects. Such effects could be irreversible and long term. An immediate reaction to a HW can occur during the time of exposure, and include vomiting, eye irritation, or other symptoms which can be linked to a chemical exposure and are refereed as immediate effects. Long-term effects are observed years after a single serious exposure, or as the result of chronic exposure due to which it becomes difficult to trace their cause and can include organ damage, respiratory diseases, and other illnesses. Certain toxic substances cause long-term effects by altering the genetic code or DNA, which directs the body's cells to perform certain activities. Such effects can be categorized into three effect⁶⁴:

⁶² *Ibid*

⁶³ *Ibid*

⁶⁴ Pruss, A., and P. Rushbrook, Safe management of wastes from health-care activities: World Health Organization, 1999 .

- (a) A carcinogenic effect is an increase in an individual's risk of insulation of cell leading to cancer. Exposures to barium, beryllium and other heavy metals can cause cancer of skin, bones, muscle, blood etc.
- (b) A mutagenic effect is a permanent change in the genetic material (DNA), of an individual and it is then passed on to the future generations. Metals like lead, nickel, and chromium can cause damage to the central and peripheral nervous systems, blood systems, kidney and reproductive system in humans. It can also affect the endocrine system and hampers the brain development in children. Lead accumulates in the environment and result in acute and chronic effects on plants, animals and microorganisms as well.
- (c) A teratogenic effect is an increased risk of physical defects in a developing embryo. Heavy metals such as cadmium, arsenic, chromium, mercury can cause damage brain, kidneys and the foetus. The developing foetus is highly vulnerable to mercury exposure. Inorganic mercury after reaching the water gets transformed to methylated mercury which bio-accumulates in living organisms and further concentrates through the food chain mainly through fish.

The toxic effect of the HW on living organisms is also referred to as physiological effect and they are classified into following groups⁶⁵:

- (a) Irritants are chemicals which inflames living tissue at the site of contact, leading to pain and swelling.
- (b) Asphyxiants are chemicals which prevent the cells of organisms from receiving oxygen. Example is Carbon monoxide which chemically binds with haemoglobin in the blood resulting in slowing down body metabolism and finally stops.
- (c) Central Nervous System (CNS) depressants affect the nervous system and include vapours from most anaesthetic gases, depressants, and organic solvents such as paints, glues, adhesives and alcohol. Some CNS depressants can cause dizziness or giddiness or even death in extreme cases.
- (d) Systemic Toxins adversely affect specific organ systems. For example, mercury

⁶⁵ Nemerow, N.L. and F.J. Agardy, Strategies of industrial and hazardous waste management, (Oxford University Press,2009) ,p.16-19.

vapour can cause a serious nervous system disorder which could lead to mental disorder.

Many chemicals present in the HW possess severe multiple toxic effects. For example, xylene is an irritant and CNS depressant as well and upon its toxic exposure cause chronic coughs, difficulty in breathing, skin ulcers, diarrhea, irregular heartbeat, headaches, dizziness, chest pain, sore eye and skin, insomnia, lack of appetite, weight loss, nausea, tremors, etc. But such symptoms can also result from other sources and therefore finding the source of a particular reaction is a challenge to the environmental toxicologists, allergists, and industrial hygiene specialists. And their work becomes more difficult since effects of the reaction are delayed and appear very late⁶⁶.

When the body is exposed to toxins, the internal defenses try to remove the contaminant. The primary internal defense is excretion of the contaminant with other wastes in the faeces or urine. Initially, before excretion wastes are filtered by the liver and kidneys. Thus, these two organs are prone to damage by toxic substances, since they store the substances which cannot be broken down in their tissues. Parts of the lungs contain cilia, which helps in expelling out the particles by cough. Particles large enough for removal may remain as deposits in the lower part of the lungs, and they may cause toxic effects like fibrosis or cancer. Other body defenses include breathing and sweating. Tears remove contaminants entering into the eyes. But, these defenses help in the removal of just a small amount of body's detoxification and this ability of body to defend differs among individuals. Children are more prone to get affected by the same amount of a substance compared to adults. Gender can also play a role in toxic responses; for example, some cancers are sex-linked (prostate and ovarian cancers). Hygiene and the overall health of an individual can also ability of body to catabolize certain toxic substances⁶⁷.

Some individuals show allergies to certain substances and can cause them to react violently, even fatally, while other individuals are not affected by the same substance. Chemicals which causes allergic reactions are referred as sensitizers. For example, epoxy resins and polyester resins cause sensitivity reaction in many individuals and also cause

⁶⁶ Danny Worrell, "Issues and Policy Considerations Regarding Hazardous Waste Exports", 11 Hous. J. INT'L L. (1989) , p.46-39.

⁶⁷ *Ibid*

illness. Exposure to a toxic substance is of serious concern when the inner defenses are not capable of breaking down and remove the substance, or when the substance is more than the body can tolerate. Under such circumstances, antidotes are available but for a limited substance⁶⁸.

Currently about 20 antidotes are used for the thousands of poisons in the world. and therefore the safest barrier to toxic exposure is to prevent the exposure. Thus it is essential to make oneself aware about the dangers caused by hazardous materials, and also to learn to minimize or prevent unnecessary exposure to such materials.

Determination of minimum levels of exposure to produce noticeable symptoms is carried out by scientists using various types of studies. Epidemiological studies make use of data on the mode in which the toxic substances affect human beings. It makes a comparison between the numbers of individuals developing lung cancer after exposure to a certain substance with those individuals who develop the same without exposure in the rest of the population. Clinical studies determine the effects of concentration of doses of substances on animals or animal tissue.

A basis of research on toxic substances is that the severity of the effect increases with an increase in the amount of dose. Theoretically, there is a threshold value for exposure to each substance. Below this threshold, the dose is so less that it will not cause harmful effect. As the dose increases, there is a point at which there is an effect, but the organism can compensate for it by internal healing, and it will not cause permanent injury. Beyond that, there is a dose at which the organism cannot repair itself from the damage and disease results. And at the upper limit of the curve, death of an organism occurs⁶⁹.

Due to these uncertainties, there is a considerable debate on what makes a "safe" level of exposure. The Occupational Safety and Health Administration (OSHA) uses "Permissible Exposure Limits," or PELs, while the American Conference of Government Industrial Hygienists (ACGIH) uses "Threshold Limit Values," or TLVs, to define the workroom air concentration that is considered a safe upper limit of exposure. In case of carcinogens and

⁶⁸ *Ibid*

⁶⁹ A. Pruss, E. Giroult, and P. Rushbrook, *Safe Management of Wastes from Healthcare Activities, Handbook*, World Health Organization, Geneva, Switzerland, 1999.

mutagens, there is no such "safe" exposure limit for regulatory purposes since every exposure cause some risk⁷⁰.

In view of the possible effect of the Hazardous waste on the health of human being residing in the vicinity of the Waste, The Central Pollution prepared The Health Impact Assessment (HIA) Report which clearly states that the adverse health effects are predominant and these are summarized below table no.2.2

Table No. 2.2: Health Effect on Human Body due to Hazardous Waste

Hazard Classification	Sources of HW	Characteristics of HW	Impact on Environment & Human Health
Flammable/ Explosive	Biomedical research facilities, colleges and university laboratories, offices, hospitals, nuclear power plants.	Due to its properties of combustion, this category of waste is prone to fire , combustion and like hazards.	Air Pollution, Fire, Explosion.
Oxidizing	Chemical Units, laboratories, Pesticides, Power Plants.	In presence of oxygen it can contribute to combustion	Severe Water Pollution, loss of crop, severe effects on aquatic life.
Poisonous (Acute)	Chemical Industries, Radioactive and Nuclear Units.	Immediate death, organ failure, skin burn , serious illness due to immediate impact	Loss of productivity of land, Behavior abnormalities, Cancer, Physiological malfunctions
Infectious Substances	Research and Development Organizations, Health care Units, Bio Tech Laboratories, Drugs manufacturing units, etc.	This category of waste could be career to various gems which could transmit diseases.	Loss of fertility of land, water contamination, Contagious diseases,

⁷⁰ *Ibid*

Hazard Classification	Sources of HW	Characteristics of HW	Impact on Environment & Human Health
Corrosives	General Manufacturing Units	Reactive nature of waste leading to further chemical reaction	Loss of productivity of materials, Water contamination, etc.
Eco-toxic	Bio Technology Industries, R & D Units, etc	Storage of waste for long term and have toxic impact over long period of time	Genetic mutations, Physical deformations, Birth defects, etc
Toxic (Delayed or Chronic)	Chemical and Pharma Units, Pharma Units, Fertilizers Units, Tanneries, etc	Impact of human tissue seen over the period of time leading to diseases like cancer due to cell mutation.	Soil contamination, loss of production, etc
Organic Peroxides	Plastic and Rubber Industries, etc	Heat formation capacity and reaction in tissues.	Water Pollution,

(Source: Secondary⁷¹)

2.5.5. Environment Impact Analysis:

Industry and agriculture continuously generate huge amount of hazardous waste, and most of it finds its way in the environment. It can cause immediate and destructive impact on ecosystems, causing deaths of plants and animals, making fish unfit for human consumption, and changing fertile cultivable and into barren zone. Hazardous wastes cause pollution of soil, air, surface water or underground water. Soil pollution may affect people living on it, plants that grow on it and animals that move over it. Sludge from municipal sewage disposal contains toxic elements when it is mixed with industrial waste. When the sludge is used as a fertilizer, these elements possibly cause contamination of the fields. Toxic substances which are not degradable, get tightly bound to the soil and are then absorbed by the crop plants; these same substances enter in the bodies of animals feeding on those plants and also in the bodies of people through food chain⁷².

⁷¹ H. Duan, Q. Huang, Q. Wang, B. Zhou, and J. Li, "Hazardous waste generation and management in China: a review," *Journal of Hazardous Materials*, 2008, vol. 158, no. 2-3, pp. 224-229.

⁷² *Ibid*

Air contamination can take place due to direct emission of hazardous wastes. Evaporation of toxic solvents from paints and cleaning agents is a common source of air pollution. The air just above hazardous waste gets contaminated by escaping gas, as in houses built on mine tailings or old dump sites. When rivers and lakes get polluted and turn enough toxic, it can cause death of animal and plant life instantly, or it may cause slow injury. For example, fluoride concentrates in teeth and bone, and too much fluoride in water may cause dental and bone problems. Compounds such as dichlorodiphenyltrichloroethane (DDT), printed circuit boards (PCBs) and dioxins are more soluble in fats than in water and thus accumulate in the fats in plants and animal bodies. These substances may be present in very low concentrations in water but accumulate in higher concentrations within algae and insects, and build up to even higher levels in fish. Birds or humans consuming these fish are therefore exposed to very high levels of hazardous substances. In birds, they can interfere with egg production and bone formation⁷³.

Phosphates and nitrates, acts as fertilizers to the algae that grow in lakes or rivers. Algae in the presence of sunlight perform photosynthesis and release oxygen. But if algae grow too much or too fast they cover the water surface, they consume great amounts of oxygen, and when the algae die and they begin to decay. Due to lack of oxygen other organisms in the water die, some living organisms may get poisoned by toxins contained in the algae. This is called eutrophication and can severely kill life in lakes and rivers.

2.5.6. Impact of Hazardous waste on the Environment:

Improper disposal of hazardous waste causes harmful effects on human health and the environment due to the toxic material presents in such waste. The impact is immediate, long lasting, serious and irreversible. The principle hazard of improper HWM is contamination of soil, air and groundwater which is mainly due to waste containing hazardous substances deposited in landfills or on the ground and its characteristics to react

A worldwide awareness is being created against the improper and uncontrolled disposal of hazardous wastes. Such practices have even caused the death of livestock and serious health problems in humans. Some of the examples of effects of improper disposal of hazardous wastes are given below:

⁷³ USEPA, (2007) "Hazardous Waste", available at <http://www.epa.gov/osw/hazwaste.htm> last viewed on 13.12.2019.

During the mid-70's more than 250 houses were constructed in Netherlands in the municipality named Lekkerkerk on a belt where hazardous and toxic waste was dumped earlier. About ten years later, the harmful effects of dumped hazardous waste were observed by the residents and about 150,000 tonnes of the polluted soil had to be dug out and disposed of. In Japan, zinc mining industry at Kamioka discharged effluents containing toxic material without treatment into the Zintsu River. Water from the river was used for drinking and irrigation purpose. In 1919, a thirty-five-year-old patient showed symptoms similar to those of Itai-Itai disease, which is caused due to cadmium poisoning. In 1955, Itai-Itai disease was reported to the Society of Medicine, yet only in 1963 did the Ministry of Public Health and Welfare organise a survey committee on this pollution associated disease. And after another ten years before the Japanese Government announced official findings on Itai-Itai disease, linking it to health damage caused by cadmium⁷⁴.

In yet another incidence in West Germany's Hamburg city during 1935 to 1971, about 150,000 m³ of waste oil as liquid chemical waste and 50,000 drums of solid chemical waste were dumped along with the city refuse in Georgswerder landfill site. The total area of the site is about 42 hectares and it is 40 m high. In 1983, dioxin was identified in the oily leachate from the landfill site. One of the most serious cases was seen in India in 1988. Bichhri village of Udaipur district suffered heavy water pollution due to the pollutants released from Silver Chemicals Factory. The water turned fully red with the dye stuff waste released by the factory. This water was unfit for drinking worthless as well as for irrigation purposes. Till 1990, the water remained contaminated, the amount of pollutants was virtually 1.5 lakh times the standards of safety prescribed by an Aligarh Muslim University study. The authorities sued the culprits but procedures of court are too long to provide instant relief to residents of Bichhri village⁷⁵.

One of the raw materials used in electroplating and heat treatment operations of metals is Cyanide and HW generated as sludge from these operations therefore contains high concentration of cyanide.

⁷⁴ U.S. Environmental Protection Agency, "Household hazardous waste—common wastes and materials", 2014.

⁷⁵ Satish Shastri, Pollution and The Environmental Law, Printwell Publisher, Jaipur, 1990, p.41.

A number of large and small scale units using cyanide as raw material were located near Madras. Since there was no control over the disposal of hazardous wastes, it disposed of indiscriminately. In August 1989, an incident of cyanide dumping came to light in Madras due to the death of buffaloes. The Tamil Nadu Pollution Control Board served a show cause notice to M/s. T. I. Cycles in Madras. After investigations, it was found that the unit had dumped their cyanide containing waste near Ezhilnagar canal resulting in the pollution of canal water causing the death of buffaloes due to cyanide contamination. The unit also admitted that they had handed over vast quantities of cyanide waste to the contractor for dumping into the sea at a distance of 7 kilometre from the sea shore. The contractor dumped the waste on Ezhilnagar canal bank. Analysis of canal water showed that the cyanide content was as high as 210 milligrams per litre. Since the canal passed through a low income group colony, the pollution of canal water could have resulted in loss of human life if it was not detected⁷⁶.

2.5.7. Effect of Hazardous waste on Animals and Aquatic Life:

The HW is known to move across its source to even areas like perennial water source, in polar ice caps, groundwater sources and cases such as those in Minamata Bay, Japan and Love Canal, USA have invited the attention of the public worldwide on the threats caused by the improper disposal of hazardous waste and accidental release of toxic chemicals into the environment. Inappropriate storage, handling, transportation, treatment and disposal of hazardous waste creates adverse impact on ground water and water bodies such as springs, lakes, rivers, sea and ocean as well as on marine plants and organisms. When disposed on land, heavy metals and certain organic compounds which are phototoxic even at very low concentration affect soil productivity for quite a long period. For example, uncontrolled release of chromium contaminated wastewater and sludge resulted in contamination of aquifers in the North Arcot area of Tamil Nadu and these aquifers cannot be used as sources of freshwater anymore. Discharge of acidic and alkaline waste affects the natural buffering capacity of surface waters and soils resulting in the reduction of species number⁷⁷.

⁷⁶ *Ibid.*

⁷⁷ Environmental Health Criteria 241, DDT in Indoor Residual Spraying: Human Health Aspects, World Health Organization, 2011, p.26.

About 60 % of the marine pollution is due to the discharge or dumping hazardous waste into the water. Nearly all forms of water bodies from small lake to ocean are polluted due to the HW which in turn affects the water quality, aquatic life, etc⁷⁸.

2.5.8. Environmental Impact of Hazardous Waste Disposal on Land:

Disposal of hazardous waste on land in open dumps or in improperly designed landfills (e.g. in low lying areas or fields), it may result the following effects on the environment⁷⁹:

- (a) Contamination of ground water aquafer due to the seepage of leachate generated by HW dump
- (b) Surface water and perennial water source contamination by the run-off from the HW dump
- (c) Odour and air pollution
- (d) Production of inflammable gas (e.g. methane) within the waste dump leading to fire incidence
- (e) Bird menace affecting aircraft
- (f) Fires within the HW dump area
- (g) Erosion and stability problems relating to slopes of the HW dump
- (h) Epidemics through stray cattle's
- (i) Acidity to surrounding soil and
- (j) Release of greenhouse gas

2.5.9. Impact of Hazardous Waste on Agriculture and Crop Production:

Agriculture is one of the most important sectors of any national economy and the necessity of livelihood of rural communities throughout the world. The continuous accumulation various pollutants including heavy metals on account of open dumping of HW in soils results into contamination of entire soil and subsequently results in causing toxicity to the crop plants growing on these contaminated soil leading to accumulation of high metals levels in plant tissues⁸⁰.

⁷⁸ United States Environmental Protection Agency, US-Mexico Environmental Program, Border 2020: US-Mexico Environmental Program, available at www.epa.gov/border2020) last viewed on 15/12/2019

⁷⁹ Mary Critharis, "Third World Nations are Down in the Dumps: The Export of Hazardous Waste", 16 BROOK. J. INT'L L. (1990), p.34-45.

⁸⁰ Ray M. Harrison, "Pollution: Causes, Effects and Control", Royal Society of Chemistry, Cambridge, 4th Edition, 2001, p.59.

The settlement of pollutants in soil and roots and contamination of grown water seriously affects the growth of plants, agriculture production, horticulture, herbal plants due to retarded growth and plant death and thus leading to reduction in agricultural productivity. This issue is more serious during the rainy season because surface runoff water from the Hazardous waste dumping site enters into the fields directly⁸¹.

2.6. POLICIES FOR HAZARDOUS WASTE MANAGEMENT: AN INTERNATIONAL ENVIRONMENTAL AGENDA & GLOBAL DIASPORA.

The main objective of hazardous waste management plan is to eliminate or reduce the hazardous waste through process changes or resource recovery followed by elimination of the hazardous or toxic characteristics or properties associated with it thereby making the HW an inert substance or permanently inactive. The waste must be accounted for from its origin to ultimate disposal. This cradle to grave concept is followed by most of the developed countries and developing countries are trying to adopt it⁸².

2.6.1. BASEL CONVENTION:

In early 80's there was a hue and cry across Asia and Africa on illegal dumping of HW by the developed nations in the guise of trade. Since early 80's, the safe and scientific management of HW is on the international environmental agenda. During, UNO's Environmental Plans in 1981 it was included as one of three priority areas which is adopted on 22 March 1989 in Basel, Switzerland.

The primary aim of this Convention is to protect human life and ecology against deadly effects of HW and also to prevent illegal cross border movement of HW. Its application includes a wide range of wastes defined as "hazardous wastes" based on their sources, composition and their characteristics (Article 1 and annexes I, III, VIII and IX), and in addition two more types of wastes defined as "other wastes" (household waste and

⁸¹ Philippe Sands & Jacqueline Peel, Principles of International Environmental Law, 3rd edition (2012), p.125.

⁸² Donald, R. D. (2004). International Organization of Supreme Audit Institution. International Journal of Government Auditing, 32(2), p.2-39.

incinerator ash; article 1 and annex (II). The provisions of the Convention consist of the following objectives⁸³:

“(i) the reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes (ii) the restriction of trans boundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management; and (iii) a regulatory system applying in cases where trans boundary movements are permissible. Since its adoption, the Convention has seen a number of significant developments. The Ban Amendment was adopted in 1995 looks after prohibition of exports of all hazardous wastes covered by the Convention that are intended for final disposal, reuse, recycling and recovery from countries listed in annex VII to the Convention (Parties and other States which are members of the OECD, EC, Liechtenstein) to all other countries. Informal discussions were initiated at COP 9 in 2008 to identify a way to enable the entry into force of the Ban Amendment while addressing the concerns and needs of all countries in this context. The BASEL protocol which was adopted in 1999 regulates civil liability for damage due to the illegal import-export of HW and other wastes, including incidents resulting from illegal traffic.”⁸⁴

To the World, most important contribution of the BASEL Convention is the framework of policy instruments on HWM with non-binding nature with technical guidelines to the parties to the convention which has led to framing of HWM specific regulations my many countries including that of India in 1989⁸⁵.

2.6.2. BAMAKO CONVENTION:

The Bamako Convention is a treaty executed in 1991 by African countries to protect their territories from illegal dumping of HW in the guise of raw materials and processing. The parties to this Conventions are most of the African nations raising voice over not to allow the import of HW. The reason cited for conducting the Bamako Convention is due to non-binding nature and failure of the Basel Convention to stop trade of HW and other toxic materials to African Countries. This was supported by several instances. In 1987, Nigeria

⁸³ Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, (1989) (Basel Convention); Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, 2244 UNTS 337 (1999).

⁸⁴ Couto, N., Silva, V., Monteiro, E., Rouboa, A., “*Hazardous waste management in Portugal: An overview*”, TerraGreen 13 International Conference. Energy Procedia 36, p. 340-390.

⁸⁵ *Ibid*

received thousands of barrels of HW from Industries operating in Italy. Due to trade dispute these Barrels were abandoned by both nations leading to issues of environmental dispute leading to closure of ports etc. and subsequently it is noted that these barrels were dumped in deep sea.

The Articles in Bamako Convention are of binding in nature towards ban on all imports of hazardous waste to African Nations. Also it does not make any exceptions in any categories of HW unlike that of the Basel Convention.

2.6.3. ROTTERDAM CONVENTION:

The objective of this convention is “to protect human health and the environment by prohibiting international trade in certain hazardous chemicals. Unless the importing state first gives its informed consent, and by facilitating information exchange to promote the safe handling and use of such chemicals”. This convention was adopted in 1998 in respect of chemical pesticides⁸⁶.

2.6.4 STOCKHOLM CONVENTION:

The Stockholm Convention on Persistent Organic Pollutants (POPs) is adopted in 2001. This convention bans or severely restricts production, trade, and use of twelve POPs known as the “dirty dozen.” Which are constituents of the HW. It was in response to a public outcry following the discovery, in the 1980s, in Africa and other parts of the developing world of deposits of toxic wastes imported from abroad.

Most of these chemicals are no longer manufactured or used in industrialized countries; however, the nature of POPs means that people can be seriously impacted by releases of POPs that occur hundreds or even thousands of miles away. The Stockholm Convention contains provisions for the disposal and treatment of POPs wastes and stockpiles. It also establishes procedures for listing additional POPs that may be banned or severely restricted⁸⁷.

⁸⁶ Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, (2004).

⁸⁷ *Ibid*

2.7 THE INTERNATIONAL EXPERIENCE:

Dependence on the consumer and industrial products is multifold and no country can escape from it. May it be for household purpose or Industrial needs; every human being is dependent on the manufacturing set up. Nonetheless, the manufacturing sector is the biggest generator of the HW. This stream or category of waste is largest growing in terms of the quantity and risk. In terms of world scenario, HW constitutes 30% of the total waste generated in the world as per the reports of EPA, USA prepared in 2019. Most of the developing countries including some of the developed countries are struggling to manage huge HW generated by them. To add to this cross border illegal import- export of HW leading to international. As such, sound and effective HWM has become a priority worldwide⁸⁸.

2.7.1. Global Initiatives:

USA introduced the Emergency Planning and Community Right to Know Act, in 1986. This was the breakthrough incidence across the globe on 'Community Right to Know'. Need was felt that all Industries must prepare disaster management and accident plans in consultation of local government and community. The UNO Conference on Environment and Development (UNCED) held in the year 1992 stresses upon preparation of inventory on HW generation. This has led to preparation of National inventory on HW by most of the countries. Further this has also prompted the Industries to put a display board in their premises on which HW they are handling. Subsequently, most of the countries made it mandatory to Industries which handles HW to prepare their accident preparedness plan and disaster management plan⁸⁹.

2.7.2. HWM in Europe:

In the year 2007, European legislation has introduced directives on Waste Electrical and Electronic Equipment (WEEE). These directives governed the disposal of HW. The British Environmental Agency (BEA) which governs the environmental regulation in UK found that the some of the countries which are not parties to BASEL are engaged illegal export

⁸⁸ Samanlioglu, F., "A multi-objective mathematical model for the industrial hazardous waste location-routing problem. *European Journal of Operational Research* (2013), p.340-349

⁸⁹ Surjit Mansingh, *Historical Dictionary of India*, Scarecrow Press, Inc, United States of America, Second Edition, 2006, p.44.

and import of HW as a scrap materials or as a raw material.

2.7.3. Comparative analysis of HW Management in Switzerland and India.

Switzerland is one of the technologically advance country in the World. As per 2019 estimates, Switzerland has 4.5 million computers, with 100 % houses having Televisions and refrigerators. In spite of 100 % dependent on consumers Goods, Switzerland ranks fourth on the 2019 Environmental Sustainability Index with a successful environmental management plan. It is the first country in the world which has set up 100% compliant HWMS⁹⁰.

India is one of the fastest growing developing country, with strong consumerism. However, it ranks 104 on Environmental Sustainability Index 2019. The environmental compliance is also comparatively at lower side⁹¹.

In Switzerland, there is strong enforcement control both scientific and legal across every step of the HWM. Whereas, in India, control is virtually non-existent. Switzerland treats the individual steps of HWM as a crucial and as distinct entity. Whereas, India treats HWM as a holistic entity. This difference leads to non-compliance at every stages of HWM further leading to overall failure. It also leads to ineffective HWM leading to severe environmental degradations in India besides other incidental health issues and socio- eco impact⁹².

2.7.4. Legislation in USA.

The Environment Protection Agency of USA has introduced a green National Electronics Action Plan in 2005 in order to effectively consider the issues concerning HW. The main focused of US is on minimization of waste concept and accordingly has introduced various steps towards achieving the reduction of HW at source itself. For this matter a state of art manufacturing set are introduced. US, Canada and Mexico are the members of the North American Pollution Prevention Partnership(NAPPP) which is working towards setting up of clean and clean enterprises in this belt. California State has introduced the Hazardous

⁹⁰ Available at <http://www.elaw.in/issues/htm> last viewed on 23/11/2018 on 25 July, 2012

⁹¹ Kummer, K., 1999. International Management of Hazardous Wastes: The Basel Convention and Related Legal Rules. Oxford University Press, UK.

⁹² Retrieved from <http://www.tkf.org.in/blog/ngo-for-environment-in-india-striving-for-a-greenerand-better-tomorrow/> visited on 3/12/2016.

Waste Recycling Act in 2003 which is treated as one of the best regulations for effective HWM in the World⁹³.

2.7.5 Legislation in China:

China is a growing economy having a thrust on manufacturing set up in almost all categories of Industries. China is generating around 12 % of the total worlds HW. The Government of China has introduced a regulation to control environmental pollution due to HW called as Restriction on Hazardous Substances (RoHS) in China. The same is called as “Administrative Measure on the Control of Pollution Caused by Electronic Information Products”, which was jointly formed under the administrative control of 8 wings of the Administrative Departments in 2006. According to Article 1 of the Administrative Measure, “it was formulated on the basis of the legal and administrative laws of the ‘Law of the People’s Republic of China on Promotion of Clean Protection’, the ‘Law of the People’s Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste’, etc., in order to control and reduce environmental pollution caused by the Hazardous waste, discarded electronic information products, promote manufacture and sale of low pollution electronic information products, and protect environment and human health”. All the shipments entering China need to signed a dedicated checklist as to certify the items entering China are environmental complaint or not⁹⁴.

The Electronic Information Products hologram and logo which are introduced by China are used to distinguish between main parts, assembly parts which are essentially complying with or not to the regulations. Thus environment safe items are distinguished separately with certain logos. Under the Article 3, the Regulations of China has identified 6 items as hazardous lead, mercury, cadmium, hexavalent chromium, biphenyls, diphenyl ethers. Chinese territory Hong Kong has banned the import of batteries, old medical equipment’s and old consumer items⁹⁵.

⁹³ Li, L., Wang, S., Lin, Y., Liu, W., Chi, T., “A covering model application on Chinese industrial hazardous waste management based on integer program method. *Ecological Indicators*”, 2014, p.268-287.

⁹⁴ *World Affairs: The Journal of International Issues* Vol. 19, No. 2 (SUMMER (APRIL-JUNE) 2015), p. 87-97.

⁹⁵ *Ibid*

2.8. SAFE AND SCIENTIFIC MANAGEMENT OF HAZARDOUS WASTE: A SUSTAINABLE DEVELOPMENT GLOBAL APPROACH

Management of hazardous waste is a matter of concern throughout the world. The term waste management refers to the material produced due to human activity and the systematic and planned measures undertaken to minimize or reduce their effect on life, environment or aesthetics. These measures should be scientifically, technically and legally accepted. HWM includes a comprehensive process right from the generation, collection, transportation, treatment and finally disposal to ensure minimal environmental effects or to make the HW permanently inert and inactive.

It is a well-defined mechanism which treats all the material such as solid, liquid, gaseous, plasma or even radioactive substances under a material which belongs to single class or characteristics having reduced or minimal further impact. The disposal method of HWM may vary depending on the physical and chemical characteristics like nature, characteristics, and quantum of hazardous waste⁹⁶.

The hazardous waste contains around 1800 variants of toxic substances, chemicals, compounds and heavy metals which can create serious threats to the environment and human health if not treated and disposed of scientifically. Due to indiscriminate dumping or simply storage or unscientific disposal methods, the HW unattended at the disposal sites and thus attracts animals, birds, rodents, fleas etc., creating unhygienic conditions like unpleasant odour, release of airborne pathogens and flow of leachates in soil and ground water. The improper storage, handling, transportation, treatment and disposal of hazardous waste result in adverse impact on ecosystems including environment and human beings. It is therefore clear from the above facts that it is essential to handle the hazardous waste using a safe and proper scientific methods⁹⁷.

Under the universally accepted practice, Hazardous wastes can be effectively disposed of through Treatment, Storage and Disposal Facility (TSDF) or Common Hazardous Waste

⁹⁶ UNEP (United Nations Environment Programme). 1992. "Hazardous Waste Policies and Strategies: A Training Manual." UNEP Industry and Environment Programme, Technical Report 10. Paris.

⁹⁷ Vaccari M., Vinti G., Tudor T. An Analysis of the Risk Posed by Leachate from Dumpsites in Developing Countries. *Environments*. 2018;5:99. doi: 10.3390/environments.

Treatment and Disposal Facility which consists of a centralized located facility catering to the hazardous waste generated in the area with a cluster approach. Thus, the hazardous waste generated from all category of Industries like heavy and large scale and MSME and also all variant of HW can be disposed of effectively and efficiently. The sitting of facility or selection of site depend on variety of factors like zoning of land, nearby habitation, ecological sensitivity, distance from the HW generator, perennial water sources in area, waste characteristics, etc. HWM planning comprises of several aspects ranging from the identification of source, quantification of hazardous waste to the development and monitoring of CHWTDF and remediation of existing HW.

The basic steps involved in safe and scientific hazardous waste management are⁹⁸:

(i) Identification of Hazardous Waste Generation (Assessment of source):

The primary step is identifying the industries which generate hazardous waste. Not all Industries or its processes generates HW and this is an attributes to only certain category of Industries. For this purpose, the data available with the Department of Industries, SPCB's, PCC's, Factories and Boilers Department, etc. are used and compiled into usable form.

(ii) Preparation of inventory of HW:

Once the hazardous waste generating sources are identified, the real time inventory of the data related to HW need to be prepared using analysis of data. It is necessary to confirm the data obtained from the above options by using the secondary data which aids in identifying inappropriate data and correcting the database. A real time inventory of HW using IT tools could be of added advantage for effective planning.

(iii) Assessment of HW Characteristics:

The hazardous waste generated from the sources should be characterized in the laboratory with a detailed analysis and environmental parameters. The samples of HW collected from the source is then subjected to detailed analysis in laboratory. The characteristics of waste enables the policy makers to define what its dealing with so

⁹⁸ Basel Convention. 1994. "Framework Document on the Preparation of Technical Guidelines for the Environmentally Sound Management of Wastes Subject to the Basel Convention." Document 94/005. Secretariat of the Basel Convention, Geneva.

it can devise a suitable scientific mechanism to handle, transport, treat and disposed of the same.

(iv) Quantification of Hazardous Wastes:

This step includes to assess the HW in terms of its weight, volume, density and mass balance. The various options available in respect of compatibility and reactivity of wastes with different characteristics is analyzed and bifurcated. The quantity of hazardous wastes is assessed so as to distinguish the HW recyclable, incinerable, disposable, etc.

(v) Identification of Sites for Storage, treatment and Disposal:

The secured sites for final disposal ie. TSDF or CHWTDF are to be identified after assessment of quantifying of HW. One crucial element in identification of site involved the testing of site suitability in terms of the land profile, social and economic factor, distance from the generators, terrain, and environmental conditions. The GPS based system and satellite images can be used for effective identification of site. The sites so identified is also inspected to verify the environmental attributes and feasibility of the project.

(vi) Social Impact Assessment (SIA) and Environmental Impact Assessment (EIA):

The Social Impact Assessment (SIA) and Environmental Impact Assessment (EIA) is required to be conducted before setting of TSDF or CHWTDF at the identified site so as to assess that possible environmental impact and social acceptance. Amongst all, impact prediction, Matrix method assist for better decision. Awareness amongst the public living in the area is most important steps towards the setting of disposal units so as to make aware the public possible benefits and disadvantages of the plants.

(vii) Waste to energy Concept: Usage of HW as an Alternate Fuel.

The certain category of waste which are having calorific value can be used as fuel in the manufacturing process of cement, power plant, rolling mills, etc. In European Union, HW to the tune of 2 MMT is used as an alternate fuel for running turbines and mills.

(viii) Incineration:

Incineration process involved heating at higher temperature which leads to reduction in density of the waste and also minimizes the characteristics of inflammability and toxicity. This will aid in reducing the hazardous characteristics of HW before it is stored in a secure landfill. The waste generated from the petro chemical, fertilizers. Pesticides. Tanneries, textiles etc. subjected to incineration process. In most of the heavy and large scale industrial units, a captive incinerator is installed.

(ix) Secure landfill Site:

A secured landfill site comprises of the site which is scientifically designed using certain membrane material around it which act as a buffer to prevent any flow of leachate or material across the site so as to prevent any sort of pollution. A special membrane material is used comprising of impermissible lining across the landfills site is to prevent any percolation. The secured land fill site is used to store the treated HW.

(x) Implementation of CHWTDF Program:

The CHWTDF is the common facility for disposal of HW by cluster of Industries operating in the region. It's a final site where the HW is disposed and put to rest so the waste become permanently inactive and inert or loses its reactive characteristics with no further impact on the Environment. The selected site should be away from the habitation and ecologically sensitive areas having proper provisions for secured storage, treatment (stabilization, incineration etc.) and final disposal. There shall be a defined and well mapped layouts and transportation plan. The entire steps from collection till disposal of HW needs to well monitored. There has to be a facility of dedicated Effluent Treatment Plant for treatment of leachates and waste water generated from the disposal process. A well-equipped Laboratory facility should be made available at CHWTDF site to analyses the environmental parameters and efficiency of CHWTDF on continuous basis. The last disposal step involved in HWM is secured landfill for storage of the sludge material. The monitoring of air parameters in the area also need to be monitored using Ambient air quality monitoring stations. The closure plan also need to be effectively prepared

considering the capacity of the site⁹⁹.

2.9. CROSS BORDER TRADE AND ILLEGAL TRANSPORTATION OF HW

There is no universally accepted definition of the term "hazardous waste" and issues due to illegal transportation of HW crossing international borders is a great challenge for the international regulators and custom departments. One such glaring instance is of illegal shipments carrying HW from the Industrialized country into other countries for co-processing, recycling, as raw material or simply for disposal. The risk associated with such transportation via ship involved serious incidence of spillage in international water which resulted into accidents as well as severe threat to marine life. There are numerous instances wherein due to illegal trade reported the Custom Department of destination country may not accept this HW and under such circumstances the Ship operators let this waste dump in deep sea¹⁰⁰.

What is more worrying being that the quantum of HM being transported across borders is mostly not known which is predominantly due to illegal trade and no standard definition of HW across the world. The definition of HW varies country by country which is mainly because of difference in nature of chemical composition, properties, appearance and also usage. Some HW is treated as raw materials in some countries whereas same is treated as waste in another country. This seems to be a major reason for lack of cooperation amongst the various countries and their regulators¹⁰¹.

No doubt the HW generations is directly proportional to the number of Industries operating in that country. Annually the number of Industries are increasing and so also are expanding thus the developed or highly Industrialized countries like United states, Russia, Singapore, Canada and Western Europe are major generator of hazardous waste. In early eighties majority of waste never crossed the international border but with ever growing quantum of

⁹⁹ Batstone, Roger, James E. Smith, and David Wilson, "The Safe Disposal of Hazardous Wastes: The Special Needs and Problems of Developing Countries". World Bank Technical Paper ,1998, USA.

¹⁰⁰ WHO (World Health Organization). "Management of Hazardous Waste: Policy Guidelines and Code of Practice." Regional Publications, European Series 14. WHO Regional Office for Europe, Copenhagen .

¹⁰¹ *Ibid*

waste the situation post mid eighties is different. Numerous factors are contributing the import and export of HW which includes adequate disposal sites, high cost of disposal, legal and social issues, environmental conditions, etc. Custom tariff codes are different from BASEL Convention waste lists and codes which also make it difficult for effective control by Custom Department. These are the main reasons for flourishing business of illegal import of HW¹⁰².

The scenario of Industries choosing to export HW via shipment over disposal in source country indicates that international cooperation is very much required to curb this issue. If the environmental regulations in the source country are stringent, the exporter will have less opportunity for export. An issue pertaining to sovereign power is the main hurdle in effective and stringent control over cross border illegal transportation of HW. What is observed that developing countries and environmentalists tend to support an outright ban on Trans boundary movement of hazardous wastes, whereas developed countries and industries prefer to restrict hazardous waste exports and imports only to the extent necessary. Illegal Trans boundary movement of hazardous wastes is one of the global issue inviting attention leading to international trade disputes¹⁰³.

2.10 CONCLUSIONS

Hazardous waste Management is a Global issue and no country in this world can escape from it. As Industrial development and manufacturing sector will grow in future, the issues concerning safe and scientific HWM will be critical in days to come. The role played by policy makers, legislation, Industries, Regulators and Society shall be organized and systematic in order to ensure the objectives of minimization of waste, prevention of generation of waste and then systematic collection, handling, transportation, treatment and disposal of HW with a techno-legal control over every phase or cycle of HWM. The negative impact on ecology, environment and public health due to indiscriminate dumping of HW is haunting the entire world which is further coupled with complexities of

¹⁰² Susan Wolf, Anna White and Neil Stanley, Principles of Environmental Law, Cavendish Publishing Limited, London, Third Edition ,2002, p.59.

¹⁰³ Report of the United Nations Conference on the Human Environment Stockholm, 5-16 June 1972 (United Nations Publication, Sales No E 73, 11A 14 and Compendium, Chapter-1).

dangerous process, infrastructure required and sophisticated equipment's manpower and cost required for safe and scientific management of HW.

The systematic approach comprises of Minimization of HW at the priority level is gaining importance across all nations. It is estimated that developing countries will generate around 5 billion MT of HW by 2030. Most of the HW is sent by developed countries to Asia and Africa under the guise of raw materials to certain industries and for metal recoveries. Amongst the developing countries very few countries have formed the local regulations or specific regulations for HHW management. However, till today there is no standard or globally accepted definition of the term "Hazardous Waste"¹⁰⁴.

The approach to safe, sound and scientific hazardous waste management has improved with the implementation of various tight management plans across the developed countries. Existing and new regulations in each region help industries shift their focus towards recycling and resource recovery as well as offer incentives to industries using sustainable manufacturing technologies. Thus in certain developed Countries there is a shift towards safe, scientific and efficient HWM which is a Silver lining and ray of hope and it is expected that the developed countries will adopt this Principal under the technology transfer.

The developing countries are struggling to manage this modern time waste due to variety of reason like not having an accurate national inventory on HW, lack of infrastructure, technical knowledge and expertise, high cost, improper enforcement mechanism, loopholes in legal control are the variety of reasons for ineffective and inefficient management of HW.

The BASEL Convention created a new hope towards international waste management cooperation in the field of HWM. As the production of hazardous waste increases, landfills reach the optimum capacity across the globe, and developing countries struggle to build disposal facilities and acquire the necessary technology to dispose of hazardous waste in an environmentally sound manner. Members of the international community must unite their efforts and assist one another to discover new practical solutions. Although not the

¹⁰⁴ Rozelia S. Park, Note, An Examination of International Environmental Racism Through the Lens of Transboundary Movement of Hazardous Wastes, 1998 .

ultimate solution to the waste management crisis, an international waste trade is a realistic and feasible option for the current state of affairs. The BASEL Convention sets forth a plan that will encourage developed and developing nations to cooperate with one another with respect to the trans frontier movements of hazardous waste. While respecting a country's sovereign right to refuse participation in the hazardous waste trade, the Convention encourages Parties to share with one another advances in waste management technology. The Basel Convention will help make the international shipment of hazardous waste as environmentally safe as possible.

CHAPTER-III

Policies and Regulations for Management of the Hazardous Waste in India- Legislative and Regulatory Framework

CHAPTER III

3.1 INTRODUCTION:

In our day to day life numerous items are discarded as waste due to reduction in their effectiveness or value or due to some toxic properties associated with it or simply because we don't need them anymore. This includes daily household waste, sewage from kitchen, waste water from bathroom and toilets, waste from industrial process, hospital waste, packaging, old cars, tyres and tubes, etc. In the Indian context "waste" are moreover substances or objects or materials which are no longer useful to human beings. Alternatively, waste refers to those materials which are not needed by anyone. In business perspective waste is defined as "anything that does not create value". In a common man's point of view waste is anything that is not required by him anymore or not useful or lost its effectiveness or just left out as garbage or as useless item¹⁰⁵.

All categories of Waste have adverse impacts on the ecology, environment and public health. In some cases, impact may be minor to large and in some cases impact may be slow or quick or immediate. Open dumps of MSW release methane gas in atmosphere generated due to degradation or decomposition of biodegradable waste leading to air pollution as well as fire hazard. Waste dumps also causes odour pollution and seepage of liquid effluents called as leachates which percolates into the soil and ground water table thereby pollutes soil and water. Biomedical waste may cause contagious diseases. Discarded tyres and plastic items at dumps yard are common mosquito breeding sites leading to of diseases like malaria and dengue. Construction debris causes blockage of water flow and chocking of public drains. Air pollutants consist of fine particulate matters and gases like Sulphur dioxide, Nitrogen Dioxide, Carbon Monoxide etc. which are a major cause of pulmonary and respiratory related disease. The impacts of poor waste management on public health are well documented, with increased incidences of nose and throat infections, breathing difficulties, inflammation, bacterial infections, anaemia, reduced immunity, allergies, asthma and other various diseases¹⁰⁶.

¹⁰⁵ Bhoyar R.V., Titus S.K., Bhide A.D. and Khanna P. "Municipal and industrial solid waste management in India". Journal of IAEM, 23, p.43-56.

¹⁰⁶ C.R.R. Environmental Education Centre, New Delhi. Environmental laws of India. Accessed on 13/5/2019 from <http://www.environmentallawsofindia.com/theconstitution-of-india.html>.

Environment Protection has always been a concern from ancient civilization, however specific legal control for environmental protection is a recent phenomenon. So also the relation between man and the environment has varied over the period of time. The concept of environmental jurisprudence is not new and the old Indian civilization embodied responsibility on man to live in harmony with nature. Our country adopted a philosophy where nature is treated as deity and Earth as Mother itself shows a culture of conservation ethics followed in India.

3.1.1 Protection of Environment in Ancient Era:

The Vedas, Puranas, Upanishads and other Hindu scriptures elaborated the importance of trees, forest, water bodies, wildlife etc. in Human life. The Rig Veda elaborates the importance of nature in climate control, fertility of land and overall health of human beings. The Atharva Veda equates trees to various gods. The Yajur Veda emphasized taking care of nature and all its creations. So there was a great amount of check on the protection of the environment from destruction by man. All religions preach the significance of nature to mankind. The Holy Quran emphasized that Nature is created by Allah. Christians are baptized in water which signifies water as the purest form of nature. Sikh religion declares that every creature in this world is the incarnation of God. In fact, all religions in the World give the principle of conservation, preservation and protection of Nature¹⁰⁷.

3.1.2 Protection of Environment in Historic Era:

During the Maurya Dynasty the concern for protection of nature was foremost and well enforced. This concern was even predominant during medieval time. The Rules pronounced by various Kings during this period directed on city cleanliness and maintenance of hygiene, protection of forests and animals. The civic sense was also embodied amongst the subject during this era. Notable features which are worth mentioning here was the concept of penalty evolved during this period for an act like throwing of dirt on roads or water bodies, open defecation in holy places, throwing of dead animals in open areas, etc¹⁰⁸.

¹⁰⁷ HS Sandhu, Environment Protection-Constitutional Framework, Law Journal, Guru Nanak Dev University, Punjab, Vol.XI,2006, p.78-82.

¹⁰⁸ Dayal, G. (1994), Solid wastes: sources, implications and management. Indian Journal of Environmental Protection, 14(9), p.672-683.

3.1.3. Protection of Environment in Medieval Era:

The trend of environment protection also continued during Moghul Rule in India where aesthetics component of nature was priority which leads to significant contribution in development of gardens, parks, fruit orchards etc. Moghul Emperor emphasized upon protection of Birds and beasts and contributed a lot towards the enrichment of nature. However, it is during the fag end of this era has shown major drift of loss of command towards care for nature¹⁰⁹.

3.1.4. Protection of Environment in British Rule:

Concept of Civic cleanliness is a major contribution during this period. However, this is also the period when British have exploited the natural resources in India to a large extent. Cutting of forests was rampant during this era for trading purposes¹¹⁰.

Although the first provisions for protection of the environment in India finds its place in Indian Penal Code, 1860 which includes both prohibitive as well as punitive provisions. Section 268 of the IPC defined “public nuisance” and Section 133 to 144 of IPC. has provisions towards “Abatement of public nuisance”. Further, Sections 269 to 278 of the IPC provides that “a person who is guilty of violating these provisions is liable to prosecution as well as punishment”.

3.1.5. Protection of Environment Post-Independence:

An endeavour towards protection of environment continued with a pace in independent India with a host of Acts, Rules and Regulations in India aimed at protecting the environment from various categories of pollution and hazards. The Environment (Protection) Act, 1986 is an umbrella Act for environment protection and to maintain the ecological balance. Various Governments at Central and state level have launched various plans, programmes, schemes to sensitize the people and arouse their consciousness towards nature and protection and improvement of Environment¹¹¹.

In India major revision in waste management Rules was carried out in the year 2016 by the Ministry of Environment, Forests and Climate Change (MoEF&CC). The waste specific Rules

¹⁰⁹ Shantha kumar, Introduction to Environmental Law, Wadhwa , Nagpur, First Edition, 2004, p.434.

¹¹⁰ *Ibid*

¹¹¹ Anand, K. Khan and Bhatt, Law, Science and Environment, Lancers: New Delhi, 1987, p.134-145.

are revamped and notified under the Environmental Protection Act, 1986. The management of radioactive waste are notified under the Atomic Energy (Safe Disposal of Radioactive Waste) Rules, 1987 by the Central government.

The Supreme Court of India in the WP (Civil) No. 860 of 1991 in the matter of M.C. Mehta v. Union of India (Environment Education Case) has directed the University Grants Commission to prescribe a course on ‘Man and Environment’¹¹². Accordingly, the UGC issued a circular to all India Universities to introduce a study course on ‘Environmental Education’. Similar instructions were issued to various Educational Authorities and institutions and at present “Environmental Protection” is a curriculum in Indian Educational Sector¹¹³.

The crucial development in the field of protection of Environment took place after the UNO Stockholm Conference on the Human Environment held in 1972. In the year 1973, the Government of India has set up the National Council for Environmental Policy and Planning with the objective to look after the environment related issues in India which was subsequently converted into the full-fledged Ministry of Environment and Forests (MoEF) in 1985. Presently the same is renamed as Ministry of Environment, Forests and Climate Change (MoEF & CL) having the administrative control of prevention and control of Pollution, regulating and ensuring environmental protection and formulate requisite legal framework in India. MOEF & CL later constituted CPCB, SPCB’s and PCC’s under the Air Act and Water Act which together constitute as core setup for environment protection in India¹¹⁴.

The different waste categories, their corresponding definitions and relevant Rules are summarized in Table. No. 3.1 below:

¹¹² *Ibid*

¹¹³ *Ibid*

¹¹⁴ Bhatia , “Human Rights and Human Environment – A Study in the Policy Perspectives”, ALJ, Vol. 10 (1990) p.39.

Table No. 3.1 Categories of Waste and its Definition in India

Particular of waste	Definition Clause	Notified Rules
Waste	“Materials that are not products or by-products, for which the generator has no further use for the purposes of production, transformation or consumption. It also comprises of those materials which are produced during various processes, the consumption of final products, and through other human activities and excludes residuals recycled or reused at the place of generation; and (ii) by-product means a material that is not intended to be produced but gets produced in the production process of intended product and is used as such”.	Solid Waste Management Rules, 2016
Solid Wastes	“Solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste and other non-residential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, agriculture and dairy waste, treated bio-medical waste excluding industrial waste, bio-medical waste and e-waste, battery waste, radio-active waste generated in the area under the local authorities.”	Do-
Hazardous Wastes	“Any waste which due to the physical and chemical properties, health problems, or even death. The danger is not restricted to human health but to plants, animals and overall ecology. Such dangers are not restricted only due to such waste alone but also due to contact with another material which is reactive nature of such waste. Also this category of waste includes those which are inserted in Schedule I,II and III of the ”	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

Particular of Waste	Definition Clause	Notified Rules
Biomedical Wastes	“Any waste generated during the process of diagnosis of diseases or process like treatment or immunization of human beings. Also includes such process or procedure on animals or research activities involving such activities “	Bio-Medical Waste Management Rules, 2016
Electronic Wastes	“Electrical and electronic equipment, whole or in part discarded as waste by the consumer or bulk consumer as well as rejects from manufacturing, refurbishment and repair processes.”	E-Waste(Management) Rules, 2016
Construction and Demolition Wastes	“Waste comprising of building materials, debris and rubble resulting from construction, re-modelling, repair and demolition of any civil structure”	Construction and Demolition Waste Management Rules, 2016
Plastic Wastes	“Any plastic discarded after use or after their intended use is over”	Plastic Waste Management Rules, 2016
Battery Wastes	“Used Lead Acid batteries after their intended use is over”	Batteries (Management and Handling) Rules, 2010
Radioactive wastes	“Any waste containing nuclides in quantities or concentrations as prescribed by the competent authority by notification in the official gazette”	Atomic Energy(Safe Disposal of Radioactive Waste) Rules, 1987

Source: Primary

3.2 ENVIRONMENT PROTECTION UNDER CONSTITUTIONAL FRAMEWORK OF INDIA

To live in an environment which is pollution free is not only a basic human right but a prerequisite towards living with dignity and Meaning full life. The word “Environment” or “Ecology” was not found initially in the Constitution of India in 1950. Although, some items in the legislative lists which enable the Centre Government and the State Government to make laws in the various connected fields like health, welfare, hygiene, agriculture, sanitation, etc. were enumerated. However, subsequent to the amendment to the Constituency of India, now to protect and improve the environment is a constitutional

obligation and commitment. The Constitution of India contains specific provisions for protection of environment under the part IV - Directive Principles of State Policy and part IVA-Fundamental Duties under the Constitution vide 42nd Amendment Act, 1976. A specific provision imposed a responsibility on every citizen in the form of Fundamental Duty. Hence, protection and improvement of environment is the duty of every State under Article 48-A and duty of every citizen under Article 51- A (g)¹¹⁵.

The Constitution of India cannot be said to be an inert document. In fact, it is a living document which evolves as well as develops and matures over the period of time. The specific provisions on protection of environment in the Constitution of India by way of subsequent amendments after 1950 are also the result of this developing or evolving nature and growth potential of the fundamental rights in India. The preamble to the Constitution of India set out the aims and objectives it wants to achieve and according it is an ultimate aim of the Constitution of India to provide a decent life and accordingly pollution free environment to its citizens. The Environment (Protection) Act, 1986 defines environment as environment which includes water, air and land and the inter relation amongst them.

The Directive principles under the Indian constitution directed towards building of welfare state. Pollution free environment is also one of the facets of any healthy society and in turns of any welfare state. Article 47 of the constitution of India provides that “the State shall regard the raising of the level of nutrition and the standard of living of its people and the improvement of public health as among its primary duties”. The improvement of the Ecology and public health cannot be achieved without the wholesomeness of the environment. Further, Article 48 of the constitution of India deals with protection of agriculture and animal husbandry thereby further provides that the State shall take effective steps to organize agriculture and animal husbandry on modern scientific lines¹¹⁶.

The Constitution of India under part III guarantees fundamental rights to the citizens of India which are essential component for the development of every individual and to which a person is inherently entitled as a human being. Right to Ecology and environment or right

¹¹⁵ Sham Divan, Environmental Law & Policy in India, Oxford University Press, New Delhi, Second Edition, 2001, p.579.

¹¹⁶ HS Sandhu, Environment Protection-Constitutional Framework, Law Journal, Guru Nanak Dev University, Amritsar, Vol.XII, 2008, p.97.

to pollution free environment also effectively embodied in Part III of the Constitution of India (Fundamental Rights) under article 14(Right to Equality), and 21(Right to Life and Liberty) without which development of individual as a human being and realisation of his or her full potential or as a human being is not possible¹¹⁷.

The Article 21 (Right to Life and Liberty) of the constitution of India ensures Life and Liberty to its citizen and also to foreigners who are in India. This is the most organic and progressive provision and as such called as the heart of the constitution. Article 21 has received judicial creativity from time to time after the decision of the landmark case by the Supreme Court in *Maneka Gandhi vs. Union of India*¹¹⁸. Article 21 guarantees fundamental right to life and this called as most fundamental right conferred by the Constitution of India. Right to health, environment, free of danger of disease and infection, right to pollution free air and water, all such rights exists in core of this right which is most essential and unavoidable. Right to healthy and clean environment is important attribute of right to live with human dignity¹¹⁹.

The right to live in a clean, pollution free and healthy environment as a component of Article 21 of the Constitution of India was first established in the landmark case called “Dehradun Quarrying Case” or “Dehradun Valley Litigation” in the matter of *Rural Litigation and Entitlement Kendra and Ors vs. State of Uttar Pradesh*¹²⁰. This is the first case in modern India decided by the SC, involving issues relating to protection of environment and ecological balance against industrial demand on natural resources in which the Court directed to stop the illegal mining activities forthwith under the Environment (Protection) Act, 1986. Also the SC directed to provide funds and administrative oversight for conservation and mitigation measures due to massive deforestation carried out in the region. In *M.C. Mehta vs. Union of India*, the SC stated that “the right to live in pollution free environment as a part of fundamental right to life”

Article 19 (1) (g) of the Constitution of India confers fundamental right on every citizen of India to practice any profession or to carry on any occupation, trade or business. This is

¹¹⁷ Shantha kumar, Introduction to Environmental Law, Wadhwa & Company, Nagpur, Second Edition, 2005, p.86-90.

¹¹⁸ *Maneka Gandhi v. Union of India*, 1978 AIR 597, 1978 SCR (2) 621.

¹¹⁹ Sukanta K.Nanda, Environmental Law, Central Law Publications, Allahabad, Third Edition, 2013, p.88.

¹²⁰ *Rural Litigation and Entitlement ... v. State of U.P. & Ors* 1985 AIR 652, 1985 SCR (3) 169.

not the absolute right and subject to certain reasonable restrictions. Right to carry out any business or trade or occupation or say operating any Industrial activities does not include absolute right to carry out activity which are detrimental to the ecology and Environment¹²¹. A citizen cannot carry on any operation of factory or industrial activity, if it is causing pollution and health hazards to the society or detrimental to the ecology and environment. Thus safeguards for improvement and taking of environment protection measures in carrying out any Industrial activities are duly recognised in the Constitution of India. The SC, while deciding the matter relating to carrying on trade of liquor in the matter of *Cooverjee B. Bharucha Vs Excise commissioner, Ajmer* pointed out that, “if there is a clash between environmental protection and right to freedom of trade and occupation, the courts have to balance environmental interests with the fundamental rights to carry on any occupations”.¹²²

Several Public Interest Litigation Writ Petition were preferred under Article 32 and 226 before the Supreme Court of India and various High Courts resulted in a new approach and new dimension to Environmental Jurisprudence in India. The landmark cases decided by the Supreme Court includes case of closure of limestone quarries in the Dehradun quarrying case, declaration of area as ‘Reserved forests’ in Delhi Ridge Case, protection against hazardous radiations in the Gamma Chamber Case, suspension of polluting Industries in Ganges Pollution Case, removal of encroachment and handing over of land back to the Government in Kamal Nath’s Case¹²³ are noteworthy cases to be mentioned. In *Vellore Citizens Welfare Forum vs. Union of India*, the Supreme Court of India observed that “the Precautionary Principle” and “the Polluter Pays Principle” are essential features and having priority over the principle of “Sustainable Development.” And further directed that “the onus of proof is on the Industry to show that his action is environmentally benign “. Class actions has been initiated by the SC under Article 32 and High Courts under article 226 by passing various landmark judgements and orders, thereby creating a practical and implementable Environmental Jurisprudence in India in the form of constitutional right to pollution free environment¹²⁴.

¹²¹ M.C. Mehta v. Union of India, AIR 1987 SC 1086.

¹²² *Vellore Citizens Welfare Forum v. Union of India* (1996) 5 SCC 647 at 659-660.

¹²³ M.C. Mehta v. Kamal Nath , AIR 1997 SCC 388.

¹²⁴ Environmental Health Criteria, DDT In Indoor Residual Spraying: Human Health Aspects, World Health Organization,2011,p.25-29.

Protection of Ecology and Environment is part of our social, economic and cultural values embodied in human beings from time immemorial and traditions. The Right to environment is also a component of human right. In Atharvaveda, it has been pointed out that “Man’s paradise is on earth; this living world is the beloved place of all; It has the blessings of nature’s bounties; live in a lovely spirit”. Our paradise comprises of Earth and atmosphere where we live and we are duty bound to protect our Earth. The constitution of India embodies the principle of protection, improvement and preservation of the ecosystem and environment as a whole without which life cannot be survived¹²⁵.

The protection and preservation of the environment is now one of the objective of the constitution of India and is also an underlying principle in the environment cases decided by the Supreme Court of India. The right to life is merely not just a right to live but to live without diseases. Waste is one of the reason against which protection and preservation of the Environment emphasised upon.

3.3 MANAGEMENT OF HAZARDOUS WASTE AND ENVIRONMENT PROTECTION IN INDIA

Manufacturing sector played key role in overall economic Growth in India. This growth also carries with it HW which is generated in every Industrial process in one form or another. A substance or material becomes waste when it has lost its value or discarded or simply kept aside without expecting to give any benefits. The leakage of poisonous gas from the Industrial Unit “Union Carbide” which was the most fatal environmental disaster in the city of Bhopal in 1981 led to massive loss of lives and adverse health impact which even continues today. Industrial pollution due to HW will continue to be a matter of concern in future with announcement of the mission mode initiatives of central Government like ‘Make in India’ and “Digital India” program which aims to restructure and transform India into a tag like ‘global manufacturing destination’ and ‘Pharmacy of the World’, etc¹²⁶.

As part of these programmes, relatively less stringent labour and environmental restrictions

¹²⁵ V.N. Paranjape, Environmental Law, Central Law Agency, Allahabad, First Edition, 2013, p.109-123.

¹²⁶ See Environmental crisis: A challenge ahead by Singh and Aggarwal, Employment news. Vol. XII No.9, 30/5/2019.

have been devised coupled with 'Ease of Doing Business initiatives 'have been designed to attract foreign direct investment into India. These initiatives will further erode environmental restrictions and regulations for setting up of manufacturing Industries in India. Thus it is now very important to know how industrial development will affect the environmental protection initiatives in India¹²⁷.

Considering the aspects of sustainability wherein the concern for prevention and control of pollution is shifted to adjudication of losses and compensation to victims. Currently in India even though certain regulations are in force for management of hazardous wastes, in terms of the HWM Rules the open dumping of HW has not been stopped thereby compromising the life and ecology. Under such circumstances, safe and scientific management of hazardous wastes including their effective disposal is a paramount important so as to protect life and overall ecology.

A safe and scientific Management of hazardous waste refers to a well-planned framework for minimisation of HW at the source till final disposal of HW in a sound, effective and efficient manner. It involves various series of steps like generation, treatment, transportation, storage and disposal of hazardous wastes. The management of HW involved a combination of Scientific, technical and legal control at every pathway. The standard pathway is indicated in Fig No. 3.2.

¹²⁷ Gupta Manisha, "India and Climate change Some Policy Issues", Encyclopedia of Environment and Development, p. 853-854.

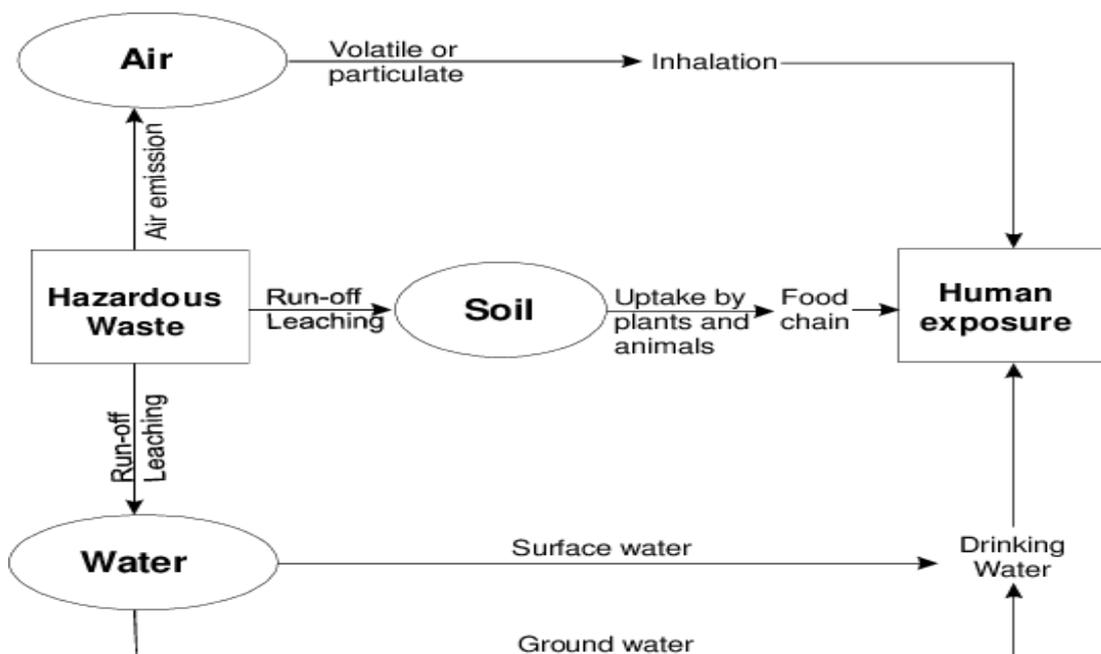


Fig. No. 3.1: Standard Hazardous Waste Pathway
(Source: Secondary¹²⁸)

The entire framework of HWM is carefully planned and executed in a systematic manner. Deficiency of any kind and nature at any of the phase will lead not only accident but could be life threatening and also ecological hazard. The sound management of HW comprises of scientific, technological and legal approach because of the complex nature of the HW and final disposal to convert HW into inert material.

The management pathway of HW is carefully devised taking into account the various aspects like quantum of waste, nature of waste, distance from the source to destination considering the principle of risk assessment and mitigation measures with a techno-legal approach of safe handling, scientific, storage, transportation, treatment, and finally disposal of hazardous wastes. The main objective of HWM is to further prevent the HW causing any impact on the environment i.e. to take HW permanently deactivate or inert.

Due to the rapid growth in generation of HW, ineffective HWM is a significant problem in India, especially in the highly industrialised states. As industrial production increases, the problems of HWM in India are also rising.

¹²⁸ P A Malaviya, "International Regulation of Global Warming Problems and Prospects" Banaras Law Journal, Volume 31. 2002, p.45-52.

3.4. SPECIFIC LEGISLATION FOR MANAGEMENT OF HAZARDOUS WASTE IN INDIA.

3.4.1: - HWM Rules notified from 1989 onwards.

With rapid growth of Industrial sector since early 1980's the new addition of HW to the stream of waste was instrumental. This new category of waste as its own distinct characteristics features and having a higher volume compared to other category of waste. However, during this period there were no method of disposal and the only method which was known was secure captive storage by the individual industrial unit generating HW.

Due to space constraint faced by the individual industrial unit in its own premises the units started dumping HW in open areas. In India, regulations to control and manage air and water related pollution were in place as early as 1974 and 1981 when the Water Act and Air Acts, were notified. The Government's attention was frequently drawn towards environmental damage and the casualties that hazardous chemical substances and toxic wastes can cause due to rapid generation of HW by Industries¹²⁹.

In India the concern and need to manage the hazardous waste generated in the country in a scientific manner was felt only in the mid-eighties after the occurrence of the Bhopal gas tragedy on 2/3 December 1984. The Government's attention was then forced to recognise this new stream of waste and its ill effects. The MoEF (Ministry of Environment and Forests) enacted an umbrella Act i.e., the Environment (Protection) Act in 1986 as a commitment under the Stockholm Conference held in 1972.

There is an inherent difference between the Hazardous waste and any waste being hazardous. For instance, E waste and Biomedical Waste also has a hazardous component. Further there is a specific category of hazardous substances which are defined based upon the physical and chemical characteristics, ingredients-compound of waste etc. Whereas, there are other categories of waste which are not defined as HW but pose significant hazard to human life and environment such as radioactive waste. Latest addition to the stream of

¹²⁹ Gupta Manisha, "India and Climate change: Policy Issues", Encyclopedia of Environment and Development, New Delhi, p.865-880.

waste is “Fashion waste”¹³⁰.

To give effect to the aim and objective set out in the EPA and as well as BASEL Convention, the MOEF has notified, the Hazardous Waste (Management and Handling) Rules in 1989. For the first time the concepts of ‘waste’ and its classification was spell out. These Rules classified hazardous waste into 18 different categories considering the constituents present in it and quantification of the name. These Rules were amended in the year 2000 primarily to bring them in line with the BASEL Convention. The amendment made in the Rules in the year 2000 classified the waste by process of waste generation and listed out these processes in Schedule-I appended. The waste classification in terms of their characteristics were listed in appended Schedule-II¹³¹.

Classification of waste by ‘process of waste generation’ covers the hazardous wastes generated in the different industrial processes and process variants. It is pertinent to note that 44 categories of HW were identified comprising 148 waste streams in Schedule-I and 79 types of wastes in Schedule-II. The amendment made in the Rules in the year 2003 streamlined the list of processes/waste streams in Schedule-I, whereby the number of industrial processes generating hazardous waste was reduced from 44 to 36 and the number of waste streams from 148 to 123. Thereafter, the MoEF & CL in the year 2003 further amended the Hazardous Wastes (Management and Handling) Rules, 1989 and notified “The Hazardous Wastes (Management and Handling) Rules, 2003”. As certain components of Bio Medical waste and electronic waste or its variants have the characteristics of ‘hazardous’ and “non-hazardous waste,” the same are covered in the purview of these amended Rules. As per the amended Rules of 2003, “hazardous waste” is defined as “ any waste which by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment, whether alone or when in contact with other wastes or substances”¹³².

These rules were further amended in the year 2008, however definition remains unaltered. and includes wastes generated from various Industrial processes which are indicated in the

¹³⁰ *Ibid*

¹³¹ *Ibid*

¹³² Mahesh Maathur, “Legal Control of Environmental Pollution”, Deep and Deep Publication (1996), Delhi, p.34-35.

appended Schedule - 1 of the said Rules. Over and above the schedule 2 is appended to these Rules wherein certain waste on account of concentration limits of certain compound is listed.

It is pertinent to note here that in the amended Rules of 2008, certain specific wastes are excluded as the same are covered under the specific waste management Rules notified by the GOI. The waste covered under the Merchant Shipping Act, Radioactive Waste Rules, Air Act, Water Act, MSW Rules, BMW Rules, and Batteries Rules are specifically delisted from the HWM Rules. The Hazardous Wastes Rules of 2008 spell out the role, duties, and functions of various stakeholders and enforcement authorities at every steps of framework of HWM in India. These steps in HWM are broadly classified as below¹³³:

- (i) Establishment of facility for transportation, treatment and disposal of HW;
- (ii) Operation and function of such mechanism;
- (iii) safe and sound disposal of hazardous waste in such mechanism.

The role, duties, and functions of the various stakeholders and enforcement agencies at every step is spelled out here below.

(i) Establishment or setting up of a Facility:

The HWM Rules of 2008 spell out various prerequisites which must be in place or to be complied with before establishment of the facilities. The generator or operator who wishes to set up the facility should obtain registration i.e. Authorization from the concerned State Pollution Control Board (SPCB) or in case of Union Territory by the concerned Pollution Control Committee (PCC). The applicant in such case will include various persons who are involved fully or partly in any one or more of processes. These includes one who generate HW, processes these wastes, carrying out treatment on it, engaged in packing-storage of HW, disposal of HW, etc. After detailed evaluation and examination of the application, SPCB/PCC may grant or reject the same within 120 days of receipt of an application¹³⁴.

The criteria laid down for eligibility of the applicant are (i) Possession of equipped

¹³³ Guha Shantanu, "Junkyard Scrapped", The Outlook (2003).

¹³⁴ Kailash Thakur, Environmental Protection Law and Policy in India, Deep Publishers, New Delhi, 1997, p.19-23.

facilities; (ii) Qualified manpower & (iii) Scientific and Technical machineries to handle HW. The SPCB/PCC grants an authorisation on such terms and conditions those are required to be followed by the applicant. The prescribed validity of the Authorisation is 5 years. Before rejection of an application the concerned SPCB/PCC shall afford a hearing to the applicant.

Furthermore, there is a provision for registration of recyclers or re-processors. The criteria laid down for the applicant to qualify for the registration is (1) Availability of approved technology & (2) possesses (a) Possession of equipped facilities (b) Qualified manpower & (c). Scientific and Technical machineries to handle HW & (3) Plant and Machineries to recycle HW, process or co-process HW or captive usage of hazardous wastes. The SPCB/PCC grants a registration on such terms and conditions those are required to be followed by the applicant. The prescribed validity of the Registration is 5 years. Before rejection of an application the concerned SPCB/PCC shall afford a hearing to the applicant. The application shall be disposed by the SPCB/PCC within 120 days of receipt of the application¹³⁵.

The HW facilities shall meet various criteria and it shall be the responsibility of the state Government, occupier operator or association for identifying such to Facilities for handling, transportation, treatment, storage, and disposal of hazardous waste. Such facilities shall be approved by the concerned SPCB/PCC and it should also regularly monitor the same. The facility shall be augmented with HW to Energy concept with the approval of CPCB.

(ii) Utilization or Operation of the Facility:

The Hazardous Wastes Rules 2008 spell out the role, functions and duties of the operator, processor or occupier who were granted the authorisation or registration by the SPCB/PCC which includes safe handle of HW which is generated in an effective and efficient way. Also it further provides to take all appropriate precautionary measures to avoid spillage of HW and to award any kind of accidents. Also emphasis is on to provide employees associated with HWM with appropriate training, machineries and measures for their safety. Besides this, the applicant is required to comply with the terms and conditions laid down

¹³⁵ *Ibid*

by the SPCB/PCC. Apart from these, the Rules of 2008 also laid down specific duties upon the HW handlers which includes safe and specific packaging and labelling of HW. The rules made the provisions for accident reporting, maintenance of inventory and records of HW, filing of annual returns, renewal of authorisation and registration after the expiry of 5-year validity period¹³⁶.

(iii) Safe and Sound Disposal of HW in the facility:

The last process of safe and sound disposal of HW depends upon the variety of factors including the norms and standards laid down for the HW by the MoEF & CL, technology available, and financial implications. The HW is stored temporarily in a secured environment to prevent and accident and discharge. Finally the HW is disposed of in terms of the approved process which includes secured storage(landfill), incineration, underground storage, deep well injection, etc¹³⁷

3.4.2. Revamped HWM Rules notified in 2016 in India

Due to the liberalised policy adopted by the GOI since 1991, the pace of manufacturing sector in India has been accelerated, which has resulted in increasing amounts of hazardous wastes every year coupled with legacy dumps of HW. The HW along with rapidly growing MSW, BMW and E-waste due to population growth, urbanisation continues to remain a daunting issue for every Governments.

The HWM Rules framed in the year 1989 and amended in 2000 failed to give any results towards waste reduction or minimisation, reprocessing and recycling. In the era of maximisation of profit, reduction of waste was appeared to be an absurd concept. Industries were not keen in adopting such 3 R measures. There were no guidelines for clean-up of contaminated and critically polluted Industrial area. No incentives were provided by these Rules to remediate the existing sites. No action was possible against the erring units on account of vague provisions in these Rules¹³⁸.

The amendment made in the Rules in the year 2003 slightly streamlined the list of

¹³⁶ Chetan Singh Mehta, Environmental Protection and the Law, Aashish Publishing House, New Delhi, 1991, p.9-12.

¹³⁷ *Ibid*

¹³⁸ *Ibid*

processes/ waste streams in Schedule-1, whereby the number of industrial processes generating hazardous waste was reduced from 44 to 36 and the number of waste streams from 148 to 123. The Schedule-2 was essentially left unaltered.

These rules were amended in 2008 to bring greater clarity to classification of hazardous wastes by linking generation of waste streams to specific industrial processes. Simultaneously, threshold levels for concentration of specified hazardous constituents in wastes were laid down to distinguish between hazardous and other wastes. For regulating imports and exports, wastes had been classified as either 'banned' or 'restricted'. The procedure for registration of recyclers/reprocessors with environmentally sound management facilities for processing waste categories, such as used lead acid batteries, non-ferrous metals waste and used/waste oil, has also been laid down¹³⁹.

These Rules were subsequently superseded and revamped and notified as the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016. The distinguishing feature of the rules is that the Rules categorically and specifically differentiate between Hazardous Waste and other wastes. The category of other waste includes left out metals, papers, Waste tubes and tyre, scraps, used electronics materials and devices etc. which can be reused and recycled. These items are treated as resources in numerous industrial processes¹⁴⁰.

The salient features of the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016 are indicated below: -

1. The Rules distinguishes between 'HW' and 'Other Waste'.
2. HWM sequence has top down approach comprising of the order of phases of priority of prevention, reduction, minimization, reuse, recycling, recovery, co-processing, re-processing, Energy and safe and sound disposal has been laid down.
3. The schedules appended to these Rules provides the various forms for seeking various approvals, filing of annual returns by operator- occupier-generator, transportation, import and export of HW etc. thereby making the procure much standardised, simplified and easy.

¹³⁹ <http://envfor.nic.in/legis/hsm.htm>, Retrieved on 12/1/2019.

¹⁴⁰ *Ibid*

4. Reduction, Re-processing, Recycling and co-processing of HW is given a priority status over all other stages of HWM
5. Concept of Waste to Energy was identified for the first time
6. Permissible norms for the reprocessing, re-processing and co-processing of hazardous waste to generate power are set out which are revolutionary steps of the GOI.
7. Set out the process of import and export of HW and streams of HW which can be imported, exported or banned are listed for the first time.
8. Ease of Doing Business concept is integrated in various imports and exports of HW. The import of certain category of waste material are exempted from the purview of MOEF& CL
9. The basic necessity of infrastructure to safeguard the health and environment from the waste processing industry has been prescribed as Standard Operating Procedure (SOPs) specific to waste type.
10. Responsibilities of State Government for environmentally sound management of hazardous and other wastes have been introduced as follows:
 - i. To set up/ allot industrial space or sheds for recycling, pre-processing and other utilization of hazardous or other waste.
 - ii. To register the workers involved in recycling, pre-processing and other utilization activities.
 - iii. To form groups of workers to facilitate setting up such facilities.
 - iv. To undertake industrial skill development activities and ensure safety and health of workers.
11. List of processes generating hazardous wastes has been reviewed taking into account technological evolution in the industries.
12. Revision in the threshold limits of Waste Constituents with Concentration Limits as per the worldwide Industry standard including irrigation and drinking water standard.
13. The State/UT Government is authorized to prepare an integrated plan for effective, efficient and sound HWM in the respective States/UT's and prepare the annual report accordingly and submit the same to the MoEF and CL.
14. SPCB/PCC is authorised to prepare the state inventory of HW indicating the details of HW generated, transported, treated, recycled, reprocessed, co-processed, exported, disposed of, etc and submit the same to the CPCB by the end of month

of September of the next year so as to enable the CPCB to prepare the National Inventory of HW.

15. The following items are specifically banned for import:
 - i. “Household waste,
 - ii. Waste edible fats and oil of animals, or vegetable origin,
 - iii. Used Medical equipment,
 - iv. Used tyres and tubes,
 - v. SW like Plastic wastes and Pet bottles,
 - vi. Electronic and Electrical assemblies scrap,
 - vii. Chemical waste in solvent form “

3.5. INSTITUTIONAL FRAMEWORK FOR ENFORCEMENT AND MANAGEMENT OF HAZARDOUS WASTE IN INDIA.

3.5.1. The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 and rules notified thereafter.

Under the “Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008”, the MoEF & CL is the nodal Ministry to deal with the subject matter of the HWM in India. The role also includes the control of transboundary movement of the HW in India. To achieve this MoEF & CL is entrusted with the responsibility of grant of NOC for export of HW from any part of country.

The substances which can be imported to India is divided into 3 components viz. “i. substances that can be imported with prior permission of MoEF & CL which includes metal and metal-bearing wastes of antimony, lead, galvanic sludge and waste lead acid batteries, whole or crushed. ii. free imports under Open General Licence with the consent of DGFT and the list of materials under this category are iron, steel and zinc scrap; lead scrap except lead acid batteries; waste of copper and its alloys.; and iii. substances which are banned for import into India which specifically include material with or comprising of mercury, beryllium, arsenic, selenium, thallium, hexavalent chromium compounds, etc. as given in

Schedule 6.”¹⁴¹

Further, the MOEF & CL has constituted a High Level Coordination Committee (HLCC) to oversee the implementation of the same and matters connected thereof. The composition of HLCC comprises of members from the CPCB, MOEF and CL, Ministry of Finance, Ministry of Commerce and Industry, Ministry of Shipping, SPCB/PCC and subject experts.

3.5.2. Authorities for prevention and Control of Industrial Pollution under the Hazardous Waste Rules.

The MoEF and CL is the nodal agency at the central level for Policy formulation on HWM in India with the role of planning, promotion and co-ordination amongst various stakeholders and line departments and Authorities for effective HWM. The role of prevention and control of industrial pollution are vested with the CPCB at the central level and SPCB/PCC at State/UT level. The CPCB was first constituted in 1974, for implementing provisions of the Water (Prevention and Control of) Pollution Act, 1974. Thereafter, the CPCB is reconstituted time and again with the power to supervise and coordinate other streams of waste management in India. The State/UT’s Departments of Environment, SPCBs /PCC’s together constitute an administrative core of the HWM in India. A list indicating various authorities and their duties under the HWM Rules is indicated in following Table No.3.2

Table No. 3.2 List of authorities and their duties under the HWM Rules in India

Sr.No.	Designated Authorities	Functions and Duties
1	MoEF & CL	i. To frame policy on HWM ii. Polices and approvals for import, export and transportation of HW iii. R&D, Training, mass awareness and capacity Building iv. Publication of National Inventory of HW

¹⁴¹ Affidavit dated 13/06/2017 filed by the CPCB before the Supreme Court of India.

Sr.No.	Designated Authorities	Functions and Duties
2	CPCB	i. Co-ordination of various activities of SPCB's and PCC's. ii. Training and Awareness. iii. Laying of standards and specifications for treatment and disposal of HW. iv. Specify characterization of HW. v. Preparation of Guidelines for disposal of HW. vi. Registration of stakeholders
3	State Government and UT's and its various concerned Departments	i. Setting up of TSDF or CHWTDF ii. Publication of Inventory of HW
4	SPCB's and PCC's	i. Preparation of state Inventory of HW ii. Grant of authorization and registration iii. Ensuring compliance of conditions imposed. iv. Awareness, Training on 3R's in respect of management of HW v. Action against violators under the EP Act

Source: Primary

3.5.3. Action plan of management of HW under the Rules.

The HWM Rules basically make it mandatory to implement certain general and specific actions on part of the various stakeholders, enforcement authorities and line Departments. The responsibilities of various stakeholders, enforcement authorities and line Departments are indicated below:

3.5.3.1. Role and Responsibilities of Entrepreneurs/ Industries/Generator (Rule 4):

Rule 4 imposes following responsibilities on Stakeholders:

- a. To obtain Registration and Authorization, as the case may be, for generation of HW, and all other action as contemplated under the Rules
- b. Efficient, Effective and scientific handling, treatment and disposal of the
- c. To comply with all the terms & conditions stipulated by the SPCB and PCC while granting authorisation and registration.
- d. To obtain renewal of authorization before the expiry of the validity.
- e. To obtain Manifest for transport of HW

- f. To forward requisite information to SPCB or PCC on HWM.
- g. To maintain all records of generation of HW.

3.5.3.2. Role and Responsibilities of State Pollution Control Boards/PCC (Rule 5):

Rule 5 imposes following responsibilities on SPCB's and PCC's:

- a. To grant/refuse of registration or authorisation, as the case may be, for handling of HW
- b. To ensure that the generator and occupier fulfil all criteria laid down
- c. To conduct environmental public hearing
- d. To examine and approve the proposal for setting up of TSDF and CHWTDF
- e. To monitor function of the TSDF and CHWTDF
- f. To impose a fine under polluters, pay principle.
- g. To implement policies on 3 R in the field of management of HW
- h. Inspection of sites

3.5.3.3. Role & Responsibilities of State Government (Schedule VI)

Schedule VI imposes following responsibilities on the State Government:

- a. Setting up of TSDF and CHWTDF
- b. Funding and capacity building of such sites
- c. Acquisition or procurement of sites for setting up of TSDF and CHWTDF

3.5.3.4. Role and Responsibilities of Central Pollution Control Board (Schedule VII)

Schedule VII imposes following responsibilities on CPCB:

- a. Training, capacity Building, Mass communication and Coordination of activities of SPCBs and other stakeholders in HWM
- b. Identification of characterization of HW
- c. Preparation of guidelines for 3R in the field of HWM
- d. Registration and renewal of registration of Coprocessors, Recyclers
- e. Identification of new streams of HW for inclusion in Hazardous Wastes Rules
- f. Recommend norms, standards and specifications for scientific treatment and disposal of HW

- g. Any other function as may be assigned by the MoEF and CL
- h. Monitor the setting up and operation of TSDF and CHWTDF

3.5.3.5. Role & Responsibilities of Central Government (Rule 11)

Overall supervision regarding enforcement of the Rules was imposed upon the Central Government which includes:

- i. To grant permission for import of HW
- ii. Policy making
- iii. Co-ordination amongst the stakeholders

3.5.3.6. Various Guidelines issued by MOEF & CL for proper implementation of HW Rules.

In pursuance to the findings of the SC monitoring committee on HWM in India, the MoEF in the year 1991, issued guidelines to all the States/UT's, Industries, operators etc. for sound HWM management and handling of HW. The guidelines inter alia right from generation, secured storage of hazardous waste, transportation of HW from generator to place for scientific treatment and finally disposal sites. The said guidelines also set out a framework for the development of a planned information system for the transportation of HW. The norms for secured landfills are laid down. In 1995, additional guidelines for emergency plan were issued.

The various action initiated by the Government of India to meet these guidelines are indicated below¹⁴² :

- (i) Specific category of HW having component of like, mercury, cyanide, cadmium and arsenic are banned for export and import w.e.f. December 96.
- (ii) In the year 1998, CPCB has prepared a SOP providing scientific details on sources of HW, their properties, method of disposal and modes of recycling.
- (iii) It has been decided to impose a prohibition on import of HW into India containing various compound's and heavy metals and their intermediates /residues.
- (iv) Import of only specific categories of HW were specified with stringent regulation

¹⁴² Jalan, R. K. and Srivastava, V. K. "Incineration, land pollution control alternative– design considerations and its relevance for India. Indian Journal of Environmental Protection", 2012, p. 120-132.

norms of MoEF.

- (v) Awareness and training programmes were conducted for various stakeholder and enforcement agencies so as to get them acquainted with all facets of this modern time waste.
- (vi) Implementation of World Bank assisted project for setting up of disposal facilities in India
- (vii) Guidelines for reprocessing of certain heavy metals are laid down
- (viii) Guidelines for shipbreaking units are laid down
- (ix) Utilization of certain category of HW in recovery or metal extraction units.
- (x) Use of certain category of HW as Refused Derived fuel (RDF) in specific Industrial Units like Cement Kiln.
- (xi) To comply with the provisions of the BASEL Convention.¹⁴³

The following Table No. 3.2 depict the Role of Various Authorities under the HWM Rules:

Role and Responsibility under the Rules	Enforcing Authority			
	Centra Govt	State Govt	State Pollution Board	Central Board
Preparation of inventory of HW generators and processors	✓	✓	✓	✓
Grant of authorization for handling HW	-	-	✓	-
Inspection of facilities and HW sites.	-	-	✓	-
Cancellation of Authorization	-	-	✓	-
Demarcation of sites for HW disposal	-	✓	✓	-
Environmental Impact Assessment		✓	✓	
Identification of dump and stockpile sites		✓	✓	
Reporting system	-	-	✓	-
Permission for the import of HW in India	✓	-	-	-
Permits to exporters	✓	-	-	-
Directions to HW	✓	-	-	-
Intimation to Ports and Customs	✓	-	-	-
Inspection of records of Import	✓	-	-	✓
Examine Appeals	✓			

Table No. 3.2: Role of various Authorities under the HWM Rules

Source: Primary

¹⁴³ India signed the Basel Convention on 15 March 1990, ratified it on 24 June 1992 and acceded it on 22 September 1992.

3.6. JUDICIAL APPROACH- SUPREME COURT INTERVENTIONS ON NON-IMPLEMENTATION OF HWM RULES IN INDIA.

3.6.1. Petition complaining about the violation of fundamental rights.

3.6.1.1. Writ Petition (Civil) No. 657 of 1995

Although the HWM Rules were first notified in the year 1989, these Rules or their subsequent amendments were never implemented in letter and spirit. The non-implementation of HWM Rules resulted in indiscriminate & illegal dumping of hazardous waste on open areas leading to huge stockpiles on land, contamination of water bodies and soil and air pollution. Due to alarming situation created by illegal and indiscriminate dumping of hazardous waste coupled with continuous generation of HW had serious and irreversible damage to the environment, flora and fauna, health of animals and human beings. An NGO Research Foundation for Science, Technology, and Ecology preferred a petition before the SC under Article 32 claiming of violation of Article 14 and 21 of the Constitution of India¹⁴⁴. The petitioner claimed serious violations of the BASEL convention and HWM Rules 1989. During the pendency of this petition, the MoEF & CL has amended the Rules in 2000 and 2003.

Taking into account the huge ramification of subject matter and the violations pointed out by the petitioner and the quantum of HW generated in India the SC issued notices to all the State/UT Governments, MoEF & CL, CPCB, SPCB's/PCC's inter alia directing to identify the problem and assess the quantum of HW generated and disposed of in India. The SC also directed these authorities to analyse the suitability of measures adopted, conditions of disposal sites, and measure being taken to protect the Environment on account of indiscriminate and illegal dumping of HW in India.

Following is the gist of the directions issued by the SC in the above referred Petition:

Vide, order dated 5/5/1997, the SC directed that no authority shall grant any approval or authorisation for import of HW into India. Furthermore, the court directed all the states/UT Government to show cause why order of suspension of all HW generating units shall not be issued. In view of the magnitude of the problem and its impact, the State Governments

¹⁴⁴ Research Foundation for Science v. Union of India and Another, (2005) 13 SCC 186.

were directed to show cause why an order should not be issued directing closure of all units HW generating units for non-compliance of HWM Rules.

Vide order dated 4/8/1997 the SC noted that none of the State/UT Governments has taken any effective steps either complying to the provisions of the HWM Rules or the EPA or SC directions to place the requisite before the court within a prescribed time frame. The court also observed that these Governments has not provide the material facts concerning the subject matter. Accordingly, the SC constituted a High Powered Monitoring Committee under the chairmanship of Dr. MG Menon to examine all issues concerning the HWM in India and submit a report thereof.

3.6.1.2 Constitution of the High Power Committee by Supreme Court of India.

In this backdrop, the SC vide order dated 13/10/1997, a High Power Committee (HPC) was appointed under the chairmanship of Prof. MG Menon, Ex-Chairman of ISRO. The other members of the committee were Dr. Paritosh Tyagi, Ex- Chairman of CPCB, P.K Seth, K.R. Rangnathan, and Dr. Claude Alvares. The term of reference of the committee inter alia includes to examine all issues concerning the HWM in India and submit a detailed report and recommendations thereof, are indicated here below¹⁴⁵

1. Whether and to what extent the hazardous wastes listed in Basel Convention have been banned by the Govt. and to examine which other hazardous wastes, other than listed in Basel Convention and Hazardous Wastes (Management and Handling) Rules, 1989, required banning.
2. To verify the present status of the units handling hazardous wastes imported for recycling or generating/recycling indigenous hazardous wastes on the basis of information provided by respective States/UTs and determine the status of implementation of Hazardous Wastes (Management and Handling) Rules, 1989 by various States/UTs and in the light of directions issued by the Supreme court.
3. What safeguards have been put in place to ensure that banned toxic/hazardous wastes are not allowed to be imported?
4. What are the changes required in the existing laws to regulate the functioning of units handling hazardous wastes and for protecting the people (including workers in the factory) from environmental hazards?
5. To assess the adequacy of the existing facilities.

¹⁴⁵ “M.G.Menon “Report of the High Powered Committee on Management of Hazardous Waste”, Vol I, II,III, New Delhi, 2001.

6. What is further required to be done to effectively prohibit, monitor and regulate the functioning of units handling hazardous wastes keeping in view the existing body of laws?
7. To make recommendations as to what should be the prerequisites for issuance of authorization/permission under Rule 5 and Rule 11 of the Hazardous Wastes (Management and Handling) Rules, 1989.
8. To identify the criteria for designation of areas for locating units handling hazardous wastes and waste disposal sites
9. To determine as to whether the authorization/permissions given by the State Boards for handling hazardous wastes are in accordance with Rule 5(4) and Rule 11 of hazardous waste Rules, 1989 and whether the decision of the State Pollution Control Boards (CPCBs) is based on any prescribed procedure or checklist.
10. To recommend a mechanism for publication for inventory at regular intervals giving area-wise information about the level and nature of hazardous wastes.
11. What should be the framework for reducing risks to environment and public health by stronger regulation and by promoting production methods and products which are ecologically friendly and thus reduce the production of toxics?
12. To consider any other related areas as the Committee may deem fit.
13. To examine the quantum and nature of hazardous waste stock lying at the docks/ports/Inland Container Depots(ICDs) and recommend a mechanism for its safe disposal or re-export to the original exporters
14. Sterilisation and decontamination of ships before they are exported to India for breaking.

HPC submitted its comprehensive Report on 20/4/1998 to the SC. The Report had inter alia set out various industrial processes which generates HW. The report has concluded that the HWM situation in India is poor¹⁴⁶.

3.6.1.3 Order of the Supreme Court dated 14/10/2003

The SC vide order dated 14/10/2003 emphasized the following principles based on the comprehensive report of HPC an order on October 14, 2003. The legal principles on which

¹⁴⁶ Report of the High Powered Committee Full text is available in 'The Company Law Journal\ vol.1,2005, serial [101].

the order is based are¹⁴⁷:

1. In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.
2. Environmental concerns have been placed at the same pedestal as human rights concerns, both being traced to Article 21 of the Constitution of India. The rights to information and community participation for protection of environment and human health are also rights which flow from Article 21. The Government and authorities have thus to motivate the public participation. These well-shrined principles have been kept in view by the Court while examining and determining various aspects and facets of the problems in issue and the permissible remedies.
3. Applicability of the precautionary principle and polluter pays principle, which are part of the concept of sustainable development, is to be ensured in all decision making processes
4. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

3.6.1.4 Major Observations of the Supreme Court Monitoring Committee:

The HPC Report highlighted that around 80% of the HW generated in India by the State of Gujarat, Andhra Pradesh, TN and Maharashtra as the majority of Industries are set up in these states. The HPC recommended to constitute a monitoring committee for overall supervision and overseeing that HW generated is minimum and it is disposed of in a sound and efficient manner in all the States and UT's. The committee shall, also ensure the compliance of various Laws and Rules governing the subject matter including directions issued by the court.

¹⁴⁷ Dr.Padma, Hazardous Waste Management Policy and Implementation: The Indian Perspective, Indian Bar Review, vol.XXIX (i) 2002, p.125-19 .

In the light of the said recommendations, the SC constituted the Monitoring under the chairmanship of Dr. G. Thyagarajan, Director of CSIR to oversee that the direction of issued by it are implemented in latter and spirit¹⁴⁸.

3.7. MANAGEMENT OF HAZARDOUS WASTE IN INDIA: A NATIONAL DIMENSION

MOEF, CPCB and SPCB's /PCC's together form an administrative Core of HWM in India. Besides the HWM Rules these authorities are required to enforce various directives issued by the Supreme Court & NGT. The various State Government and Central Government Departments are required to work in tandem for effective HWM in India.

The highlights and compliances which has taken place in India subsequent to above referred development for effective HWM are summarized as under:

3.7.1 Initiatives by MOEF & CL, GOI

3.7.1.1. Inter-Sectoral coordination

The MOEF & CL is declared as the focal point in the Government of India for all matters relating to the environmental protection and connected matters. All directions issued to the central Government pertaining to HWM by the SC shall be implemented through MoEF and CL. For this purpose, the assistance and cooperation of various line Departments is required. Wherever, implementation is required directly by this Ministry the same is carried out through its wings like CPCP and top down approach comprising of SPCB/PCC and Environment Departments of States/UTs. Since the Ministry was designated as the Nodal Ministry, the role also includes to ensure coordination with all other line departments and Ministries of GOI.

The role and responsibilities of various line Departments and Ministries of GOI is summarized here below¹⁴⁹:

For example:

1. Imports and Exports of HW have to essentially go through Customs and Central Excise (Ministry of Finance).

¹⁴⁸ Harmeet Singh Sandhu, "Role of Judiciary in Evolution of New Principles of Environmental Jurisprudence", Law Journal, Guru Nanak Dev University, Vol. XVII, 2009, p. 135 .

¹⁴⁹ Bharat Dessai, "Enforcement of the Right to Environment Protection through PIL in India", Indian Journal of International Law, Vol.34, 1994, p.28-38.

2. Issues concerning the Toxic and Health impacts of HW on life and ecosystem are looked after by various line Ministries and line organisation Ministry of Health and various departments under it, Ministry of water Resources, CSIR, Indian Council of Medical Research, Department of BT, Department of Science and Technology, etc.
3. Labour safety and occupational health hazards while handling the HW in Industries is looked after by the Ministry of Labour.
4. Monitoring of Petroleum, Fertilisers, Oil, Surface Transport, Railways, Defence, and other sector which is the major source of generation of HW in India is monitored through the concerned central Ministry in GOI.
5. Framing of Acts, Rules, Regulation and all legal aspects pertaining to HWM are to be in consultation with the Ministry of Law and Justice.
6. Trade activities and imports and exports of HW are also look after by the Directorate General of Foreign Trade and Directorate General of Commercial Intelligence (Ministry of Commerce & Industries).

3.7.1.2. Disposal of illegally imported wastes

There were several instances of illegal import of HW in India in the guise of raw material for Industries, recycling, etc. The MoEF and CI has authorised the Revenue Authorities and Police to disposed of such HW in consultation with respective SPCB/PCC in a manner prescribed and to recover the amount towards disposal as arrears of land revenue¹⁵⁰

3.7.1.3. Creation of Mass Awareness

One of the crucial aspect of effective HWM is right to know. The key role played by MoEF is to sensitise people and stakeholders through various medium. Towards this MoEF has carried out mass communication and training programmes to make aware about this modern tome waste. Regular refresher programmes are also conducted for officials of enforcement agencies¹⁵¹.

¹⁵⁰ Kumar, A. and Samadder, S. R. "A review on technological options of waste to energy for effective management of municipal solid waste. Waste Management",2017, p.407-422 .

¹⁵¹ *Ibid*

3.7.1.4. R & D initiatives:

The responsibility is entrusted upon the MOEF & CL to undertake research and development initiatives towards various facets of HWM for its safe handling, treatment and disposal mechanism, public safety and hygiene, and futuristic initiatives including setting up of sophisticated state of art plants and implementation of best practices of developed nations. MoEF and CL has sponsored research in the various aspects like Effluent treatment plants, Common Effluent Treatment Plants, scientific Treatment of HW, cleaner technologies etc. through Government and private research centres. in research, particularly related to their specific areas of activity e.g. ETPs, CETPs, disposal facilities, clean and cleaner technologies, etc¹⁵².

3.7.1.5. Sustainable development initiatives:

The MOEF & CL is closely working with Ministry of Corporate Affairs and Finance Commission in the field of sustainable development. The spending of CSR funds in environmental protection is duly recognised. The setting up of waste energy plants are incorporated in the thrust areas of India. The concept of setting up of TSDF or CHWTDF which provides a common facility for Industries located in the region or area can disposed of their HW in a common site thereby saving a cost as well as land by opting for common facilities.

3.7.1.6. Testing Facility

The MOEF has launched a scheme for strengthening of SPCB's and PCC's so as to augment their testing facilities in line with research laboratories for testing of various pollutants, environmental parameters, purchase of sophisticated testing equipment's and setting up of state air and water laboratory. Under such, MoEF is providing a financial assistance to all SPCB's and PCC's to strengthen such testing facilities. The Ministry is also proving a training to staff of these laboratories which also include training and capacity building in international laboratories¹⁵³.

3.7.1.7. Location of Industrial Sites and Secured Landfills:

The MoEF has also issued guidelines to all the State's and UT's regarding the setting up of Industrial Estates or notified Industrial areas, EIA in respects of sitting of Industries,

¹⁵² *Ibid*

¹⁵³ *Ibid*

and guidelines governing setting up of secured landfill sites, TSDF and CHWTDF in India. The MoEF and CL has also considered the suggestions made by the HPC regarding framing of National Policy on this. The concept of setting up of TSDF or CHWTDF was evolved from the suggestions of HPC wherein a thrust is given to set up common facilities based upon the cluster approach rather than having the individual facility to ensure stringent compliance and cost effectiveness¹⁵⁴.

3.7.2 Institutional Framework- Role assigned to various other Government Departments.

3.7.2.1. Role of Customs under the Customs Act

The HWM Rules 2003 has banned the import of 29 items in schedule 8. The BASEL convention has banned 76 items. The MoEF and CL issues Notification regarding banning of additional items including Notification by the MoF to give effect to such prohibition under the Customs Act. Various complaints are receiving regarding the abandoned of shipment or vessels carrying banned HW and import of HW in the guise of raw materials and in such cases the role played by the Customs Department is crucial to prevent the entry of such cargos in coordination of Indian Navy and Coast Guards. Also the Custom department plays crucial role in disposing of seized HW¹⁵⁵.

3.7.2.2 Responsibilities of Ministries of Labour(MoL) and Ministry of Commerce & Industry(MoCI), Government of India.

The SC has approved the recommendations made by the HPC more particularly on occupational health and safety of workmen working in the Industries who are handling HW. In order to ensure the safety of workmen, MoL and MoCI has constituted a monitoring committee to work out compensation and other medical benefits for the workers engaged in handling of HW at any stage of HWM cycle workers¹⁵⁶.

3.7.2.3 Responsibilities of the Government of India

In terms of the directions issued by the SC, the Export and Import Policy shall be in line with the HW Rules. These directions are issued to ensure that the ban on import of certain

¹⁵⁴ *Ibid*

¹⁵⁵ For a Survey of various cases of environmental pollution under PIL in different High Courts of the Country and the Supreme Court, See Shastry , Pollution and the Environmental Law (1990) at p.17-33.

¹⁵⁶ *Ibid*

HW which are prohibited are implemented in all respect. Accordingly, the GOI has amended its Exim Policy¹⁵⁷.

3.7.2.4 Responsibility of Central Pollution Control Board, SPCBs and PCCs

MoEF and CL, CPCB and SPCBs/PCCs together constitute a core framework of waste management in India including HWM. SPCB's/PCC's are required to comply with the directions issued either directly or through CPCB. MoEF and CL, CPCB are also empowered to issue directions to SPCB's and PCC's under section 5 of the EPA.

The SPCBs/PCC's are directed by CPCB to submit an action plan towards details of HW disposal sites and remediation measures adopted. The details shall include the site conditions, air and water parameters in area, health indicators in the vicinity of stockpiles of HW, etc. The SPCBs and PCCs are directed to submit a detailed remediation plan and time line. So also directions are issued to all SPCB's/PCC's to suspend the operation of all such Industrial units which are operating without valid authorization issued under the HWM Rules¹⁵⁸.

3.8. A COMPARATIVE STUDY ON THE EFFECTIVE MANAGEMENT OF HW IN THE STATE OF GUJARAT: A SUSTAINABLE DEVELOPMENT APPROACH

The State of Gujarat is having highest number of Industrial Units in India and is also generating the maximum quantum of HW in India. As such a Gujarat Model is take up as a case study to analysed the situation of management of HW in this research.

Gujarat is the first state in India which has introduced and implemented the concept of common hazardous waste treatment stabilization and disposal facility (CHWTSDF) for group of Industries operating in a particular region. Out of 30 sites of CHWTSDF in India, Gujarat state has 10 such facilities. It utilizes GPS based real time/online tracking of all steps of HWM. It tracks transportation and disposal of hazardous waste from Industry to

¹⁵⁷ Maudgal, S. "Waste management in India. Journal of Indian Association for Environmental Management", 2009, p. 203-208.

¹⁵⁸ Satis c. Shastri, Notes and Comments "Environmental Ethics Anthropocentric to Eco-Centric Approach: A Paradigm Shift", Journal of the Indian Law Institute Oct-Dec 2013, p. 523.

final site in a fully secured online mode known as XGN-Mode. It has a database of 20,000 entities involved in the entire chain of HWM in Gujarat. With active participation of Gujarat PCB and Gujarat Chamber of Industries and Commerce the HW is used as a resource and for generation of power using captive co processing of waste¹⁵⁹.

Co-processing is the in house method used by Industries by utilizing HW as raw material or as a catalyst or source of energy or combination of both instead of mineral resources, fuels, etc. This concept is more successful and commercial viable in the sector of power, energy, chemical and steel units. The use of hazardous waste as alternative fuel and raw material in steel and cement plants has increased by 100 times between 2010, from 16000 TPA, to 1500000 TPA in 2019. The phase of treatment of HW is most complicated and needs detailed study and no standard practice can be adopted across the industry or category of waste¹⁶⁰.

The selection of most proper and appropriate technologies requires detailed analysis of chemical composition of waste, cost factor and social acceptance. Even after established guidelines issued by the CPCB, HWs still find their way to open spaces, dump yards, water bodies, fields and roadsides thereby posing serious environmental issues. Above all, there are failures on collection, handling, treatment, transportation and disposal of HW by MSME sector, who disposed of HW as municipal waste. Huge piles of HW are seen almost in all Industrial Estates or nearby in the State of Gujarat.

Active Role of Gujarat Government in Hazardous Waste Management: Amongst all SPCB's Gujarat PCB plays a proactive and efficient role in the management of HW in India. It is the first state to install TSDF and CHWTDF having 13 TSDF and 16 CHFTDF.

Disposal of Legacy waste: Gujarat PCB was the first SPCB in India to initiate action towards disposal of legacy waste dumps lying all over the state by carrying out an Inventory of illegal dumpsite in the year 2003. Around 40,000 MT of Hazardous waste was treated and securely stored in the landfill site. The said exercise is still continuing and as of 2019, 80% of the dump yards are cleaned up. The CHWTSDF in Gujarat are successful examples of PPP mode which are set up with capital investment incentives

¹⁵⁹ *Ibid*

¹⁶⁰ *Ibid*

provided by the Industries Departments and MoEF& CL. Gujarat Industrial Development Corporation has allotted a land bank at concessional rates, followed by investment by industrial units and financial institutes thereby constituted a revenue model which has helped in this development. Alang Soshiya Ship Breaking Yard located at Bhawnagar, Gujarat is the largest ship recycling yard in the world which generates around 5000 MTA of HW. The Gujarat Government has set up a separate facility for treating huge HW generated. The Gujarat Government has also set up a total 40 Common Effluent Treatment plants for treatment of liquid HW/ effluents¹⁶¹.

3.9. HAZARDOUS WASTE MANAGEMENT SCENARIO IN THE STATE OF GOA

3.9.1. An Overview

The hazard involved in the HW is universally the same. The MoEF & CL has notified the new rules in 2016 for safe and sound management of HW, but it should be strictly monitored under by the various enforcement and monitoring agencies at regional level. This is the decentralised approach approved by the Government of India as far as all categories of waste management is concerned. The Regulatory Framework in terms of protection of environment and human life from the ill effect of Hazardous Waste is framed by the Central Government. The management of the HW in the state of Goa is a subject matter under the administrative control of the Department of Environment, Government of Goa whose office is situated at Porvorim, Bardez, Goa. However, the HW Rules are enforced by the Goa State Pollution Control Board which is located at Patto, Panaji which is a statutory Board constituted under the provisions of the Air Act and Water Act.

As far as the grant of permissions for the Industries in the state of Goa is concerned, Department of Industries, Panaji is the nodal Department which grants permissions and various other incentives to the Industries either for setting up of new Industrial units or expansion in production capacities of existing units under the Industrial Development Regulation Act, 1961 and the Micro, Small and Medium Enterprises Development Regulation Act 2005. However, the functions such as creation of Industrial infrastructure, notified Industrial estates or parks etc. is carried out by the Goa Industrial Development

¹⁶¹ Gallagher, S., "India: the rising tide of e-waste", Pulitzer Center, Washington, DC, 2014. p.37-39.

Corporation.

Illegal dumping of the HW, littering and accumulation is not only illegal under the Hazardous Waste Management Rules but also amounts to nuisance, annoyance and other offences under the Indian Penal Code due to health, hygiene and safety aspects. Thus the Collector and District Magistrate by invoking the provisions of the CPC and CRPC is required to maintain the public order, health and hygiene in the District of the state. Further the Department of Health Services is required to maintain the health and Hygiene of the public under the Goa Public Health Act.

However, the predominant authority is the Goa State Pollution Control Board who is required to ensure that the environmental pollution and degradation is controlled and prevented under the Hazardous Waste Management Rules. The waste management strategy, role and responsibility of various stakeholders, powers and functions of enforcement authorities are same across all the States and UT's in India.

3.9.2. Industrial Scenario in Goa:

Industrial profile of Goa State:

Goa has registered an impressive industrial development since its formation as a separate state in 1987. But Industries have also set up since 1970. The industrial sector at present comprises over 200 large industries and over 6000 micros, small and medium industries (MSME's). Over the years, Goa has diversified its industrial base substantially. Initially the industrial development was confined only to five major Industrial estates namely Verna, Cuncolim, Kundaim, Pilerne and Tivim and some isolated locations such as Vasco and Ponda. Today, both the districts of the state have witnessed industrial development to varying degrees¹⁶².

The area of Goa is 3705 sq km with a population of 14, 58,545 as per the 2011 census comprising of around 44% of area as forest region, eco sensitive and Coastal Zone etc. Thus actually the Industrial area in Goa is only around 10% of the Total Area. Besides Mining, Agriculture, and Tourism, the Industrial sector has played a crucial role in the economic development of the State. The Industrial Sector also employs around one lakhs

¹⁶² World Bank, (2018), "Improving the Investment Climate in India," World Bank, Washington DC.

persons thus this sector also acts like a major employer. Being International Tourist Destination, availability of skilled labour, technical knowledge pool and hassle free governance, Goa is also inviting the Investors to set up new Industries in the State. Due to absence of any specific land use policy and restrictions¹⁶³

In early seventies the Industrial base was mostly restricted to units manufacturing pharmaceuticals products, manufacturing industries auto parts, Steel Units, food processing etc. Whereas in the span of last 30 years the Industrial Scenario has completely changed with the State having Industries in nearly all the sectors. Due to unregulated Industrial activities, the Industrial processes such as chemicals, cements, pesticides, fertilizers, steel etc. which are polluting and hazardous waste generating units are started at rampant pace in Goa. Today the total Hazardous waste generated in Goa is 45000 MTA. The Industrial Sector is taken up as a thrust and priority area in Goa due to its pivotal role in Economy and Employment in the state. However, while doing this the fact has been ignored that the Human Health and Environment has been always given a step mother treatment. The ill effect of rapid and haphazard industrialization has put undue strain on natural resources and the pollutants have seriously degraded the Ecology and Environment of State¹⁶⁴.

Development of Industrial Estates in Goa and its Importance:

The land use pattern of the State of Goa provides for utilization of land for the purpose of carrying out of Industrial activities in the state of Goa. The Industry can be set up in a notified area called as Industrial Estate or in private land. However, in Goa state, more emphasized is on starting of Industries in the Industrial estate due to various factors such as availability of common infrastructure such as Power, Water supply, roads and network connectivity, etc. The Government of Goa has constituted a body called Goa Industrial Development Corporation (GIDC) whose primary role is to set up Industrial Estates in Goa. At present there are 22 Industrial estates in various locations of Goa. Every Industrial estate comprises a number of Industrial plots which are allotted to the applicant industrial units and thereafter the individual Industrial Units set up their plants after obtaining requisite

¹⁶³ Population of Goa -1,457,723 available at <http://pib.nic.in/prs/2011/latest/31mar.pdf>, Area of Goa – 3,702 sq.km available at <http://geography.about.com> last visited on 28/12/2019.

¹⁶⁴ Sukanta K.Nanda, Environmental Law, Central Law Publishers, Allahabad, Third Edition, 2013, p.10 .

permissions from the Authorities¹⁶⁵.

3.9.3. Regulatory Framework for management of Hazardous Waste in Goa:

The enforcement mechanism for enforcement of the Hazardous waste which are central Rules and provisions for penalties and offences under the Environment Protection Act, 1986 are standard across the Country. The mechanism and regulatory framework is briefly explained here below¹⁶⁶:

3.9.3.1 Goa State Pollution Control Board (GSPCB):

As provided under the HW Rules, the entire monitoring and enforcement of the HW Rules in the CIE lies with the GSPCB. As required under the rules, the Industry generating the HW is required to handle and disposed of the said waste in a safe and scientific manner. Although the mode and manner has not been laid down by the Ministry of Environment and Forest, Government of India has carried out various studies and accordingly issued guidelines in respect of various modes of disposal and the entire responsibilities pertaining to the monitoring of these guidelines are entrusted to the GSPCB.

Although the controlling authority of GSPCB is the Department of Environment, Government of Goa, the Board is fully autonomous in its functioning. The GSPCB which is constituted under the Water Act and the Air Act is headed by the Chairman who is appointed by the State Government. The Board comprises 15 other members who are from various fields such as Industries, Trade, Administration, Ecology etc. The office of the GSPCB is situated at Patto, Panaji,Goa.

The Role and Responsibilities of the GSPCB in the state of Goa are indicated here below:

- (i) GSPCB shall grant/refuse authorization to occupier or operator of the facility-
Rule5

¹⁶⁵ Report of 2018- Performance Audit Government of Goa by CAG, p. 29-35.

¹⁶⁶ M.V.Zaytseva, —Ecological Problems”, Conference Paper of Fifth International Conference on International Environmental Law Organized by The Indian Society of International Law, New Delhi, 8-9 December, 2007, p.87-89.

- (ii) GSPCB shall conduct public hearing in the region while granting permissions for certain scheduled projects.
- (iii) GSPCB shall approve the layout & design of the Hazardous Waste Treatment and disposal Facilities (TSDF).
- (iv) GSPCB shall monitor the setting up and the operation of the TSDF or CHFTDF
- (v) GSPCB empowered to levy fine and collect the entire cost of the damage caused to the environment by the occupier/ operator under the provisions of the EPA.
- (vi) GSPCB is empowered to refuse authorization for non-compliance.
- (vii) GSPCB is empowered to file a criminal case for non-compliance which attracts punishment up to 5 years imprisonment with or without fine of Rupees One Lakh under the EPA.
- (viii) Chairman, Goa State Pollution Control Board is empowered to issue closure direction to the violating Industries under Section 5 of Environment (Protection) Act 1986.

3.9.3.2 Department of Environment, Government of Goa.

The Department of Environment is the nodal Department in terms of matters related to the Environment and Ecology of the State. However, the role of this Department is merely an administrative in nature This Department also formulates the State Environment Policy, and framing of the Goa specific sitting guidelines for Industries. The Department of Environment is the administrative controlling department of the GSPCB and the role include approval for manpower, constitution of the Board, etc which are not very significant. The GSPCB is required to keep inform the Department of Environment about the state of environment due to operation of Industries etc. who in turn apprise the state Government and as per the instructions of the state government issued necessary directions under section 5 of the Environment Protect Act to the GSPCB, Industries and other agencies.¹⁶⁷

As per the Rule12, Department of Environment and Forest shall be the nodal Ministry to deal with the trans-boundary movement of the hazardous wastes and to grant permission for transit of the hazardous wastes through any part of India. Further as per the Rule 13 (2), the import of Hazardous waste from any country shall be permitted only for the recycling

¹⁶⁷ Citizen Charter of Department of Environment, Government of Goa, 2018, p.16-23.

or recovery or reuse but, not for disposal Rule 13 (1). Rule 13 (4) no import or export of the hazardous waste specified in the Schedule VI shall be permitted. The Importer shall apply to the State Pollution Control Board 120 days in advance and also apply for permission to transport Hazardous Waste¹⁶⁸. The GSPCB shall examine the application and recommend to the Department of Environment, who is the sanctioning authority¹⁶⁹.

The Department is headed by the Director who is appointed by the State Government who directly functions under the Minister for Environment and Principal Secretary (Environment). The office of the Department is situated at Saligao, Bardez –Goa.

3.9.3.3 Department of Industries, Government of Goa:

Department of Industries, Government of Goa is the parents Department in respect of development and regulation of Industries in the State of Goa. The initial permissions for setting up of new Industrial units, expansion of existing units, etc. are granted by this Department. Further the State Industrial Policy is prepared by this Department for promotion and development of Industries in the State of Goa.

The Department is headed by the Director who is appointed by the State Government who directly functions under the Minister for Industries and Secretary (Industries). The office of the Department is situated at Panaji –Goa¹⁷⁰.

3.9.3.4 Goa Industrial Development Corporation (GIDC)

The GIDC plays an important role in providing the basic infrastructure for Industries in the State of Goa in terms of establishment of Industrial estates, growth centres, industrial zones, power and water supply, industrial plots, etc. The task of setting up of common facilities for treatment and disposal of hazardous waste is assigned to the GIDC.

The Corporation is headed by the Chairman who is appointed by the State Government. The Managing Director is the chief executive officer of the Corporation who directly functions under the Chairman. The Department of Industries is the controlling Department

¹⁶⁸ *Ibid*

¹⁶⁹ *Ibid*

¹⁷⁰ Citizen Charter of Department of Industries, Trade and Commerce, Government of Goa, 2018, p.57-59.

of the GIDC. The office of the GIDC is situated at Patto, Panaji –Goa¹⁷¹.

3.9.3.5 Department of Health, Government of Goa:

The role of the Health Department is to maintain the health and hygiene of the people in the State. However as far as the Industrial sector is concerned, the Health Department also plays an important role in terms of maintaining health and Hygiene in the Industrial area under the Goa Health Act. This Department also assesses the water quality of various water bodies in the vicinity of CIE due to dumping of Hazardous waste.

The Department is headed by the Director who is appointed by the State Government who directly functions under the Minister for Health and Secretary (Health). The office of the Department is situated at Panaji –Goa¹⁷².

3.9.3.6 Department of Labour and Employment, Government of Goa:

The Health and safety wing of the Department of Labour deals with the safety of the labours who handle Hazardous waste at factory premises.

The Department activities can be divided broadly into two wings pertaining to Labour and Employment. Labour wing is responsible for the implementation of 28 Labour Laws (Central & State) with a view to establishing and maintaining peace in the Industrial Establishments. Employment wing is responsible for Registration, Sponsoring and giving Vocational Guidance to the interested candidates and collection of Employment Market Information. Its Objective, Deciding rules and regulations for worker welfare, labour training and human empowerment, safety of labours, Industrial Hazard, etc.

The Department is headed by the Commissioner who is appointed by the State Government who directly functions under the Minister for Labour and Secretary (Labour). The office of the Department is situated at Patto, Panaji –Goa¹⁷³.

3.9.3.7. Inspectorate of Factories and Boilers, Government of Goa:

The main objective of the Department is the implementation of the Factories Act, 1948 and the rules there under, the Indian Boilers Act 1923, and certain provisions of the Environment (Protection) Act 1986. The concerned officials of this Department are

¹⁷¹ Citizen Charter of GIDC, Government of Goa, 2018, p.15-29.

¹⁷² Citizen Charter of Department of Health and Emergency services, Government of Goa, 2018, p.26.

¹⁷³ Citizen Charter of Department of Labour, Government of Goa, 2018, p.34-39.

required to visit the CIE and ensure that a factory has to go through all the formalities with respect to approval of site and building plans. One of the significant points which is considered by the Inspectorate at this stage is the location of the factory in relation to the surrounding units or other developments nearby, in order to verify whether it poses any danger to the other units or vice-versa. Safety of the workers, as well as local residents is also taken into consideration while approving the factory site.

The Factories Act prescribes for pre-employment and periodical medical examinations of workers employed in certain hazardous processes. The periodicity and the nature of medical examinations vary according to the nature of process to which an individual worker is exposed to. Considering the fact that a healthy worker is a productive worker, and taking into account the latest Supreme Court decisions with respect to medical examination of workers in factories, all the workers are subjected to pre-employment and periodical medical examinations.

The Department is headed by the Chief Inspector who is appointed by the State Government who directly functions under the Minister for Factories and Boilers and Secretary (Factories and Boilers). The office of the Department is situated at Altinho, Panaji –Goa.

3.9.3.8 Collector and District Magistrate (North/South Goa District):

There are two Districts in the State of Goa. The Collector and District Magistrate of North/South are heading the individual district. Besides he is a chairman of State Disaster Management Authority who is required to ensure that all the Industrial Units in the jurisdiction of his district have prepared and maintain the onsite and offsite Disaster Management plan so as to ensure that the Industries are well equipped to tackle any possible calamity due to Hazardous Waste. The role of Collector is also to ensure that the area is nuisance free from the ill effect of open dumping of hazardous waste. Further any closure directions issued to the Industrial Units by the GSPCB is enforced through the District Collector.

Besides this the Collector is required to discharge various other functions such as maintaining health and hygiene, safety, prevention of nuisance and annoyance etc. in the District. Presently the office of the Collector and District Magistrate (North/South Goa

District) is located at Panaji and Margao respectively. The office is headed by a Collector and who is assisted by three Additional Collectors¹⁷⁴.

3.10. STATUS OF HWM IN CUNCOLIM INDUSTRIAL ESTATE, GOA—A CASE STUDY

3.10.1 Cuncolim Industrial Estate-A profile:

The history of Cuncolim Industrial Estate goes back to 1971 when it was formed by the Goa Industrial Development Corporation (GIDC) in the erstwhile Goa Daman and Diu, the Union Territory. Initially this Industrial estate was an ideal site for setting up of steel manufacturing Units. But gradually due to less regulations being neglected site by the State Government agencies this Industrial Estate was known for various chemicals. Pesticides, leather work and other polluting metal Units. Established in 2007, it spreads over an area of around 4 lakhs m² in the jurisdiction of the Cuncolim Municipal Council at around 30 km from the Margao City. At present there are 278 Industrial Units in this Industrial Estate, out of which 260 Units are categorized as Hazardous waste generating Units. The distinguishing feature of the Cuncolim Industrial Estate is its infrastructure created with the participation of the Industries itself. Three features stand out; first, a large and well-built road network, second, an underground electrification system and third, a water supply. But despite this excellent infrastructure it is disturbing to note that some components of the original plan have yet to be implemented, particularly those that deal with environmental protection. The two main missing infrastructure components are the Combined Effluent Treatment Plant (CETP) and a landfill site, which are crucial for disposal of industrial waste and environmental protection. Developing countries like China and India have experienced and witnessed adverse effects of environmentally hazardous industrial production and have progressed to the idea of Eco-Industrial parks which incorporate all environmental protection aspects¹⁷⁵.

Overall, the pace of industrial progress at CIE has been has but no efforts being taken to control environmental pollution and prevention of Hazard due to haphazard growth and violations of the Hazardous Waste Rules.

¹⁷⁴ Citizen Charter of Revenue Department, Government of Goa, 2018, p.13-18.

¹⁷⁵ Index Report of 2018 Government of Goa by CAG, p.56-65.

Though the focal point of the study is CIE but the area extends well into East and west side of this Industrial estate i.e. various villages those are falling in the study region are villages such as Assolna, Vellim, Darmapur, etc. Villagers are regularly exposed to various kinds of pollutants that are coming out from the industries operating in the CIE region.

3.10.2 Location and Extent:

Cuncolim Industrial Estate is situated in the Heart of the Cuncolim City area in the South Goa district area of the state of Goa. . It can be reached by the Road Situated in the State Highway (NH-17Margao to Cuncolim Road. Cuncolim is located at latitudes 15°10'N 73°59'E¹⁷⁶ and longitudes 17°N 73.98°E. It has an average elevation of 18 metres (59 feet). As of 2011 India census, Cuncolim had a population of 28,458¹⁷⁶.

3.10.3. Socio Economic Features:

The Cuncolim city area and the adjoining villages around the Cuncolim Industrial estate are predominantly belonging to the Scheduled Tribes community whose livelihood is based upon the Agricultural and Horticulture activities carried out by them. Of late people are also employed by various Industries operating in the CIE.

3.10.4 Geographical Features:

Cuncolim is known for its many natural rivulets and lakes in the catchment areas of the Quepem River which is a perennial river here. Many villages in the area are situated on alluvium and weathered bedrock. Amidst the CIE, the Balli stream, one of the tributaries of the Quepem river, has been identified as a paleo-channel that is composed of clay-silt-sand.

The region experiences a tropical climate with continuous rainfall. The area gets two monsoons in varying degrees, the Southwest monsoon from end of June till August, and Northeast monsoon from September till November. May is the hottest month with a mean daily temperature of about 40°C. December is the coldest month with a mean daily temperature of about 29°C¹⁷⁷.

Rice is the main food crop with pulses, ragi and other food crops are also grown. Main

¹⁷⁶ *Ibid*

¹⁷⁷ *Ibid*

cash crops are coconuts, cashew nuts, areca nuts, sugarcane and fruits like pineapples, mango and bananas. Besides this horticulture activity such as local vegetables are also grown in various pockets.

3.10.5. Regulatory Structure for enforcement of the Hazardous waste rules in the CIE.

The regulatory framework for enforcement of the Hazardous waste rules in the CIE is the same which is provided for the South Goa District. In spite of the fact that the CIE is the only critically polluted industrial estate in the state of Goa and also considering the fact that there is a big hue and cry in the State on account of the severe environment pollution, the State Government has not framed any specific framework or regulatory mechanism to address the growing concern of hazardous waste in CIE¹⁷⁸.

3.10.6. Issue of Critically Polluted Industrial Estates including CIE before the Supreme Court of India

The cognizance of alarming situation created by unregulated generation and unscientific dumping of hazardous waste across the Industrial Estates and open spaces resulting in serious and irreversible damage to the ecology and also public health, was taken up by the Hon'ble Supreme Court in WP No. 657/1995(C)¹⁷⁹, and directions were issued for preparation of a comprehensive report on illegal hazardous waste dump sites, inventory of generation of such waste, National Inventory for Rehabilitation of Hazardous Waste

3.11 CONCLUSIONS:

The hazardous waste is a contribution of growing manufacturing Industrial sector in India. Due to the toxic or hazardous characteristics associated with this category of waste, it poses a serious and immediate impact on the environment. The rapid growth in the manufacturing sector in the country has ripple effect in terms of generation of huge quantum of HW. The safe and scientific management of HW involves a highly scientific and techno-legal approach. Since 1980's environmental degradation due to hazardous waste has become the major concern across the World and has invited the attention of even

¹⁷⁸ Annual Report of Goa-PCB(2018-19), Goa, 2018, p.18-27.

¹⁷⁹ Research Foundation For Science v. Union of India and Another, (2005) 13 SCC 186; see also 2007 (8) SCC 583, 2007 AIR(SC) 3118.

UNO. In the days to come it would be a major challenge with changing technology and with major thrust of Industries on maximization of production capacities leading to threat to very existence of life and ecosystem. Presently 60% of the rivers in India are flowing with hazardous waste released through industrial processes. Industries located in various parts of India are causing water and air pollution. The water quality around dump yards is rendered unsuitable for any purpose. All natural resources are at threat which may imperil all kinds of life on the Earth.

Nearly all States and UT's in India have always promoted diversified industrial sectors with major impetus on manufacturing Industries with further thrust on large scale and heavy Industries. Equally Micro, Small and Medium scale enterprises are contrasting contributed to 30% of total generation of HW in India. Disasters like Chernobyl and Bhopal are evidence of the grave environmental hazards. In reality Measures for Environmental protection have been given too little consideration by Industries over the maximization of profit. The levels of water pollution and air pollution are beyond the permissible limits in many cities of India. The high incidence of increase of chronic ailments like respiratory and pulmonary diseases, skin ailments, kidney failures, cancers etc. are attributed to exposure to air and water pollutants due to HW. These pollutants impair the soil and also seeps into the groundwater table during surface runoff thereby affecting the quality of the ground water even in the remote places in India.

The pollution due to HW is the most fatal compared to any other form of pollutant or pollution which goes on increasing day by day. It often remains out of reach of the law due to a variety of reasons and intricacies associated with the management of HW thereby posing significant threats to Environment in India. However, safe and scientific management of HW like that of the State of Gujarat, will be an ultimate solution for protection of environment and resource security. If effective action plans are not enforced urgently, with the rise in generation of HW the same will lead to major environmental problems in India.

One more critical aspects of HWM involved is remediation of critical sites which are used as dumping yards for several years which in turn has head to compromise of public health. Clear and decisive action is required to divert this legacy waste to TSDF or CHWTF or remediation of such through process like bioremediation or chemical treatment.

An integrated national plan or protocol along with a coordinated approach and public participation is very much required for the successful and efficient management of HW.

CHAPTER-IV

Effectiveness of Implementation of the Hazardous Waste Management Rules in India with A Special Reference to The Cuncolim Industrial Estate, Goa: A Critical Analysis

CHAPTER IV

4.1. INTRODUCTION

The Government of India through the MOEF & CL has notified the Hazardous Waste Management Rules from 1989 onwards with the specific objective to ensure safe and scientific handling, control production or generation, transportation and finally safe and secured treatment and disposal of HW in India. The emphasis is also laid on safe packaging, storage and transportation of HW in India. The aim is to ensure reuse, re-processing, effective collection, safe conversion of HW so as to make the HW inert or deactivated permanently. Further Rules offered provisions for sale, destruction and disposal of Hazardous Waste in a safe, secured and scientific way. These Rules were first introduced in the year 1989 and have been subsequently amended the years 2000, 2003. Thereafter the MOEF has notified the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 by superseding the earlier Rules and notification thereof. These Rules were subsequently revamped in the year 2016 and notified as the Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2016 which were subsequently amended in the years 2016, 2017, 2018 and 2019 and are in force.

The Rules of 2016 categorically defines and distinguishes the term “Hazardous waste” and “Hazardous substance” separately. Whereas, the present research is restricted only to HW generated due to the Industries operating in notified Industrial areas which includes Industrial estates, industrial corridors & industrial parks, special economic zones. Whereas the component of hazardous substance and HW generated due to any other process or forming part of E waste and Biomedical waste and Industries located elsewhere are not considered and covered in this study and are categorically excluded being having a minimal importance.

The HWM Rules spell out corresponding roles and duties upon various authorities such as MoEF & CL, CPCB, SPCBs, State Government’s, PCC’s, Union Territories, Director General of Foreign Trade, Port and Excise and Custom Authority. Whereas, SPCB’s and PCC’s are specifically empowered with greater role concerning wider sphere of safe and scientific management of Hazardous wastes in India in terms of control over its generation, storage, handing, transportation, treatment and finally safe disposal. The rules also

specifically direct all the state governments and UT's to provide infrastructure to set up HW treatment facilities which also include CHWTDF. The Rules of 2016 also provide that there shall be a registration of generator, and also make provision for skill development. The Rules inter alia also empowered the Central Government to provide machineries and equipment's and payment for workers who are engaged in the collection of HW in India. These Rules shall be also read together with the directions issued by CPCB, SPCB's and directions issued by the SC and NGT from time to time. The MoEF & CL, CPCB and SPCBs together form the administrative core of HWM in India.

4.2 INDUSTRIAL PROFILE OF INDIA

4.2.1. An Overview

India is emerging as one of the fastest growing economies during last three decades. The Industrial sector is dominant factor which is always given a boost through various schemes and policies in India. Manufacturing sector in India itself contributes to the extent of 16% of GDP (30% by overall Industries) and provides almost 18% of India's total employment and hence compilation of industrial statistics is significant for research study as well as policy-making. Promoting industrial growth especially manufacturing sector through various Plans and policies has been the government's priority throughout. Industrial manufacturing is the most important factor contributing the Indian economy with wide and diverse manufacturing units operating in India which includes pharmaceuticals, equipment's, automobiles, chemicals, machinery, rubber, cement, chemicals, fertilizers, plastic, engineering goods, electronics, textiles, food processing, steel and so on¹⁸⁰.

No doubt this sector has given a global recognition to India. Further, through "Make in India" programme the GOI has targeted to increase the share of GDP through the Industrial manufacturing sector to 25% by 2022 and to create 100 million new jobs by 2022. Business conditions in the Indian manufacturing sector appears to continue to remain encouraging. India has become one of the most attractive destinations for investments in the manufacturing sector¹⁸¹.

¹⁸⁰ Economic Survey 2019-2020, Vol I, Ministry of Finance, Government of India, p.28-38.

¹⁸¹ *Ibid*

India is an attractive hub for foreign investments in the manufacturing sector. Several mobile FMCG, heavy engineering, phone, luxury and automobile brands, among others, have set up or are looking to establish their manufacturing bases in India.

The manufacturing sector of India has the potential to reach US\$ 1 trillion by 2025 and India is expected to rank amongst the top three growth economies and manufacturing destination of the world by the year 2022. The implementation of the Goods and Services Tax (GST) regime may contribute further growth in GDP of US\$ 2.5 trillion economies along with a population of 1.32 billion people, will coupled further boost to this sector¹⁸².

With impetus on developing industrial parks & corridors and SEZ, the government aims to ensure holistic development of the nation. The corridors would further assist in integrating, monitoring and developing a conducive environment for the industrial development and will promote advance practices in manufacturing. As generation of HW is directly proportional to growth of manufacturing Industries and also to expansion of manufacturing capacities of existing industries the result will be a huge increase in generation of HW in India.

4.2.2 Major Manufacturing Set up Industries in India

The Indian Engineering sector has witnessed a remarkable growth over the last 3 decades due to variety of factors including creating of infrastructure, policies on ease of governance and ease of doing business and market demand including consumerism. The manufacturing sector, especially pharmaceuticals, drugs and dies, leather and tanneries, chemicals, heavy engineering, power, steel, cement, fertilizers, sugar, FMCG, automobile, Electronics continues to be the sunshine sector of India's economy and likely to touch US\$ 1 trillion by 2025.

4.2.3 Setting up of Notified Industrial Areas for sitting of Industries in India

The development of India into an industrialized country is a slow but continuous process. Under colonial rule, India followed a non-industrial model. After Independence the thrust has been on Industrialization towards alleviating poverty and self-sufficiency and basically to shift from agriculture which was solely depend on Rain. The Industries (Development

¹⁸² Citizen Charter of GIDC, Government of Goa, 2018, p.23-25.

and Regulation) Act 1951 was first step towards this although complete sector was regulated with licenses.

Various Plans and Policies introduced by the GOI has accelerated GDP growth from 3.4 % 5 % during the period from 70's to 80's. The revolutionary economic reforms were taken by GOI in the year 1991 which comprises of open to trade and commerce, FDI, removal of legal restrictions of the IDRA. The major Industries which set up a base during this period are telecoms, Electronics, heavy industries, etc., all of which are HW generating Units. FDI rose from \$180 M to \$1.3 B in 1995, \$2.4 B in 1997, and \$3.5 B in 1998.¹⁸³

The industrial estate is, historically, a British concept and this term is used in most of the countries. India preferred to use the British concept in planning the built-up form of industrial infrastructure, inclusive of industrial sites and buildings. The term Industrial Estate has come to be used for a group of Industries or units in an area set up by the Government sharing common facilities like roads, drains, water and power connection. The Industrial estate combines in itself some of the important schemes of assistance to small industries and provides a tool for integrated development¹⁸⁴

It is noteworthy to mention here that the connotations Industrial estate, Industrial Park, Industrial zones, and Industrial area are having similar meaning with some difference. Industrial Park area comprises of a certain number of industries of different types in a common area. The park is developed with all common utilities, services and facilities required by industries of different types where restrictions on the type of tenants allowed in the park and insistence on performance characteristics, architectural controls and other features that will ensure a park-like character and compatibility with surrounding areas. Industrial Zones are areas in which the land is restricted to industrial uses. The zones normally do not provide specific industrial needs. An industrial zone is merely an area of raw land set aside for industry"¹⁸⁵. Industrial Area is a track of land developed according to plan to provide with suitable infrastructure facilities for a group of industrial enterprises. An industrial area is a parcel of improved land subdivided into plots for the accommodation of industrial establishments and offered for sale or lease. It can be an effective stimulant to

¹⁸³ Industrial Census of Goa, 2018 by Industries Department, Government of Goa, p.35-43.

¹⁸⁴ *Ibid*

¹⁸⁵ Goa Investment Policy, 2018 notified on 2/7/2018, p.7-14.

industrial development, especially in the large and medium-scale sectors". Currently another term in used is Industrial Townships. These are similar to industrial areas in regard to the provision of basic facilities and services. Industrial estate is one of the most effective instruments for the promotion of industrial development. Industrial estates create the necessary climate in a developing country where small and medium enterprises find better chances of development. As a result of this, new establishments would come into existence to avail themselves of these benefits. Industrial estates are regarded as an effective means of encouraging and supporting the initiation, expansion and modernization of small-scale industries¹⁸⁶.

4.2.4. Setting up of Special Economic Zones for sitting of Industries in India

Special Economic Zones (SEZs) Scheme in India was a concept adopted by GOI in 2000 through China with an objective to establish the special zones or areas where goods and service of export nature could take place free from any restrictions of law and monitoring mechanism with a duty and tariff free tax structure. An SEZ is a geographically demarcated region that has economic laws that are more liberal than the country's typical economic laws and where all the units therein have specific privileges. SEZs are specifically delineated duty-free enclaves and are deemed to be foreign territory for the purposes of trade operations, duties and tariffs. The principal goal is to increase foreign investment. Through the introduction of SEZs, India also wants to enhance its somewhat dismal infrastructural requirements, which, once they have been improved, will invite even more foreign direct investment. As far as trade and commerce are concerned, SEZs are regarded as international territory. Local raw materials bought by producers within SEZs are regarded as exports whereas those goods that are produced in SEZs and sold in the DTA (Domestic Tariff Area) are regarded as imports¹⁸⁷.

In India, similar to SEZ concept a special zone was set up in Kandla in 1965 followed by the export processing area at Santa Cruz in 1973. Subsequent various such kind of areas or zones were set across north India. Under the SEZ EXIM Policy in 2000 the existing zones or areas at Kandla, Surat, Santa Cruz, were converted into SEZs and subsequently in the year 2003-4 other such zones were converted into SEZ. In 2003, other existing EPZs namely, Noida, Falta, Chennai, Vizag were also converted into SEZs. In order to boost

¹⁸⁶ *Ibid*

¹⁸⁷ *Ibid*

setting up of SEZ in India and give impetus to manufacturing set up in India enacted the SEZ Act and Rules in 2006¹⁸⁸.

4.3. INDUSTRIAL SCENARIO IN GOA

4.3.1. Industrial profile of Goa State: -

Goa has registered an impressive industrial development since its formation as a separate state in 1987. But Industries are also set up only since 1970. The industrial sector at present comprises of over 200 large scale industries and over 4000 micros, small and medium industries (MSME's). Over the years, Goa has diversified its industrial base substantially from mining and agriculture. Initially the industrial development was confined only to four major Industrial estates namely Verna, Cuncolim, Kundaim and Tivim and some isolated locations such as Vasco. Today, both the districts of the state have witnessed industrial development in varying degree¹⁸⁹.

In early seventies the Industrial base was mostly restricted to units manufacturing pharmaceuticals products, manufacturing industries auto parts, Steel Units, food processing etc. Whereas in the span of last 30 years the Industrial Scenario has completely changed with the State having Industries in nearly all the sectors. Due to unregulated Industrial activities, the Industrial processes such as chemicals, cements, pesticides, fertilizers, steel etc which are polluting and hazardous waste generating units are started at rampant pace in Goa. Today the total Hazardous waste generated in Goa is around 45000 MTA. The Industrial Sector is taken up as a thrust and priority area in Goa due to its pivotal role in Economy and Employment in the state. However, while doing this the fact has been ignored that the Human Health and Environment has been always given a step mother treatment. The ill effect of rapid and haphazard industrialization thereby generation of HW has put undue strain on natural resources and the pollutants have seriously degraded the Ecology and Environment of State¹⁹⁰.

4.3.2. Development of Industrial Estates in Goa and its Importance:

The land use pattern of the Sate of Goa provides for utilization of land for purpose of caring out of Industrial activities in the state of Goa. The Industry can be set up in a notified area

¹⁸⁸ *Ibid*

¹⁸⁹ Economic Survey 2019-2020, Vol I, Government of Goa, p.7-13.

¹⁹⁰ Citizen Charter of GIDC, Government of Goa, 2017, p.35-39.

called as Industrial Estate or in private land. However, in Goa state, more emphasized is on starting of Industries in the Industrial estate due to various factors such as availability of common infrastructure such as Power, Water supply, roads and network connectivity, etc. The Government of Goa has constituted a body called as Goa Industrial Development Corporation (GIDC) whose primarily role is to set up Industrial Estates in goa. At present there are 24 Industrial estates in various locations of Goa. Every Industrial estate comprises of number of Industrial plots which are allotted to the applicant industrial units and thereafter the individual Industrial Units set up their plants after obtaining requisite permissions from the Authorities¹⁹¹.

4.3.3. Cuncolim Industrial Estate-A profile:

The history of Cuncolim Industrial Estate goes back to 1971 when it was formed by the Goa Industrial Development Corporation (GIDC) in the erstwhile Goa Daman and Diu, the Union Territory. Initially this Industrial estate was ideal site for setting up of steel manufacturing Units. But gradually due to less regulations being neglected site by the State Government agencies this Industrial Estate was known for various chemical. Pesticides, leather work and other polluting metal Units. Established in 2007, it spreads over an area of around 4 lakhs m² in the jurisdiction of the Cuncolim Municipal Council at around 30 km from the Margao City. At present there are 278 Industrial Units in this Industrial Estate, out of which 260 Units are categorized as Hazardous waste generating Units¹⁹².

The distinguishing feature of the Cuncolim Industrial Estate is its infrastructure created with the participation of the Industries itself. Three features stand out; first, a large and well-built road network, second, an underground electrification system and third, a water supply.

4.4. RESEARCH METHODOLOGY ADOPTED BY THE RESEARCHER

4.4.1. Introduction to Methodology:

A sample of 2000 factories/Industrial units generating HW was selected which were to spread across India represent the 10 broad Industrial sector which are generating around

¹⁹¹ *Ibid*

¹⁹² See Industrial Census of Goa, 2019, p.46-49.

70% of the total HW in India. So also a sample of 1000 HW generating industries operating in Goa and 100 units from the Cuncolim Industrial Estate(CIE) is selected for the purpose of the in depth analysis. 10 broad industrial sectors include sector of Steel, Chemicals, Metallurgical, Pharmaceutical, Textile, Plastic, Leather, Electronics, pesticides, and Metal Fabrication which are amongst the 70 % of the total HW generating Units in India. The data pertaining to number of Industries, quantum of HW generated and action on part of various authorities, compliance on part of the Industries and authorities as regards to the HWM Rules, impact on ecology and environment in the vicinity of the notified Industrial Zone during last ten years are collected and analyzed.

For an assessment of implementation of the Hazardous Waste Rules in India and in the State of Goa, structure survey and qualitative interviews were conducted. Structured surveys were developed using industrial estate performance indicators extracted from literature review. These were used for collecting data from entrepreneurs and other stakeholders. In-depth interviews with the officials of the Goa state pollution control Board, Department of Environment and other departments including those of various Industries, member of NGO, public, NGT, police etc. were carried out along with structured surveys. In-depth interviews were also conducted of representatives of Industries Associations and Industries top management and representatives of its various departments. Qualitative interviews were conducted of Government officials of Industries Department, GIDC, Labour department, MOEF & CL, CPCB, DGFT, Customs etc. who are enforcement agencies along with the representatives of NGT, MC & SC.

Field work was carried out in the month of October to December (during the year 2018 and 2019). Interaction and interview of all the stakeholder was held in June and September. Data is also collected by filing applications with various authorities under the Right to Information Act. Separate questionnaires were designed for the authorities, NGO/Public and for the Industries to understand various multidimensional perspective of the implementations of the Rules as well as impact on Ecology and Environment. Various test report in terms of water quality and air quality are examined by the researcher along with the annual reports on HW and Industries prepare by the Central Government & State / UT Governments.

The following figure summarizes the key stages in the empirical study:

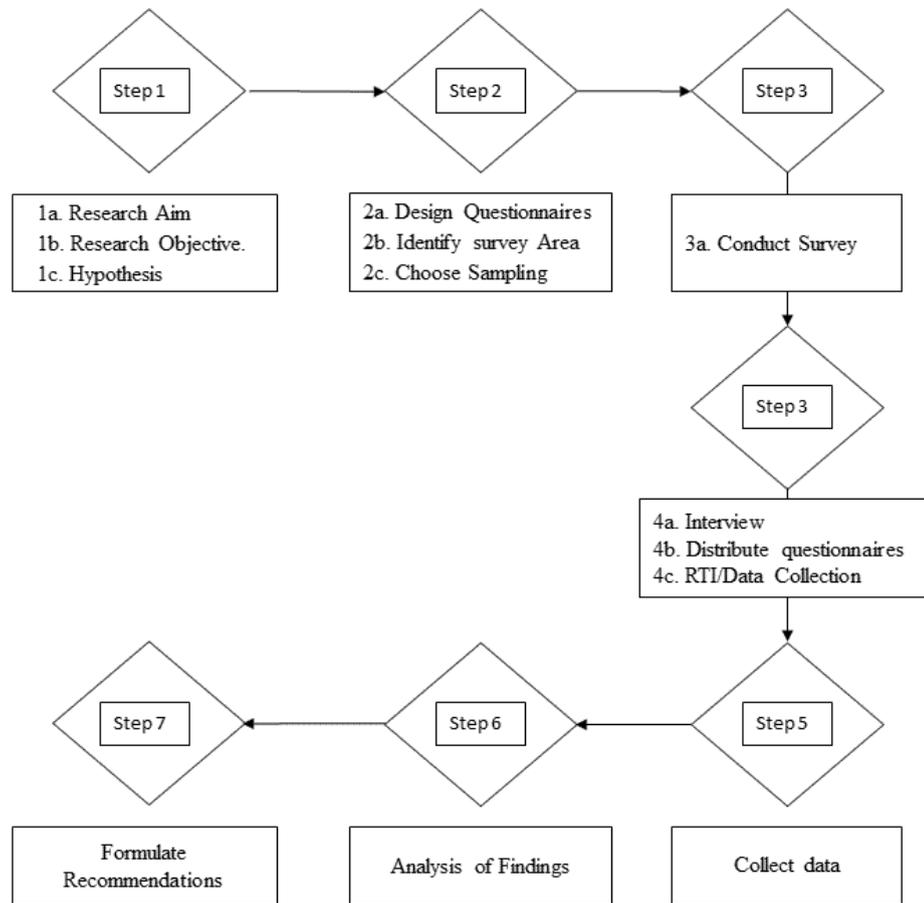


Fig. 4.1: Summary of stages for the Empirical Study
Source: Primary

The methods chosen specifically relate to the aims and objectives and Research Questions identified in the research study. It is shown in table 4.1. here, qualitative interview and participant observation data was combined with quantitative survey material to test the arguments and hypothesis.

Table No. 4.1: Methodology for the Research.

Objectives	Methods	Output
To collect primary data's and understand the current hazardous waste management policies and practices in India, Goa and Cuncolim Industrial Estate.	Interview with Authorities Interview with Waste manager. Site visits/ Participant observation RTI Application Study of various Status Reports, Annual Returns, etc	Current waste management policy The waste generation data. Information about Hazardous waste disposal, legal and regulatory framework Status of HW in India.
To understand the perception of staff, authorities, Industries etc towards hazardous waste management	Interview with waste manager. Site visits/ Participant observation	Status of Implementation of HWM Rules. Status of Action/Inaction on part of authorities/stakeholders.
To analyse the status of Implementation of the HWM Rules	Participant Observation Quantitative survey Follow up Questions Statistical Analysis of data	Stakeholders interest towards HW management. Level of comfortableness towards current Rules. Difficulties faced by stakeholders Extent of violations of Rules
To analyze the impact of violation of the HWM Rules on Ecology and Environment, etc	Participants Observations Group Discussions Questionnaire survey Critical analysis of data/Statistical Analysis based on descriptive statistics and inferential statistics.	Selection of technology and Legal approvals Peoples knowledge and views towards various treatment technologies, HW status, etc
Conclusion and Suggestions	Critical Analysis of Data and drawing of inference Study of best practices	Conclusion-Proving of Hypothesis Suggestions for improvement

(Source: Primary)

4.4.2 Meeting and Discussions with Enforcement Authorities and various Stakeholders

The Researcher has met the representatives of various National Level and state Level Enforcement Authorities and members of various Stakeholders on several occasions during last five years and also had series of interactions with representatives of Industries, Industries Association, CAG, Department of Custom and Central Excise, DGFT, CPCB/SPCB/PCC, MOEF and CL, Expert Members of NGT, etc.

4.4.3 QUESTIONNAIRE/SURVEY

The Researcher after carrying out the overall assessment on the data/information needed for analyzing the compliance to HWM rules notified from 1989 onwards, prepared a serious of questionnaire for collecting feedback and comments. The questionnaire also implicitly addressed the issues such as enforcement of provisions of HWM Rules, and duties performed by the regulatory authorities. These agencies were identified as CPCB/SPCB/PCC, DGFT, Customs and Central Excise, NGT, Directorate of Environment, Industries, Labour Commissioner of all the State/UT Governments and other stakeholders. These questionnaires were sent to the respective agencies by email and also by hand delivery for spot response.

4.4.4 Field Visits to Various Notified Industrial Zones

The Researcher also conducted field visits in Gujarat, MP, UP, Rajasthan, Karnataka, Telangana, AP, Maharashtra, Kerala and Tamil Nadu which are designated as highly Industrialized States. The Researcher has also visited various CHWTDF including certain CETP's and critically Polluted Industrial Estates and few contaminated sites located across various places in India.

Information submitted by CPCB/SPCB/PCC, DGFT, Customs and Central Excise, NGT, Directorate of Environment, Industries, Labour Commissioner of all the State/UT Governments were duly examined and gap analysis is carried out.

The data/ information compiled through serious of questionnaire, surveys, meetings, interactions, and field visits form the basis of the research and overall assessment of the effectiveness of the HWM rules notified from time and again. Further the same is also analyzed for identifications of possible shortfalls, key issues involved and finally to make

practical and realistic suggestions in the field of legal control and effective HWM in India.

4.5 EMPIRICAL INVESTIGATIONS

4.5.1 Sample size:

The sample size of the Research is indicated in the following Table No. 4.2

Table No 4.2: Awareness of the Hazardous Waste Management Rules(Size of various Sample's)

Sr. no	Stake Holder profile	Sample Size	
		India	Goa
1	Judges /Judicial officers	8	2
2	Members of NGT	4	0
3	Officials of MOEF & CL	10	0
4	Officials of CPCB	12	0
5	Officials of SPCB'S	40	15
6	Other officials of Central Government	20	6
7	Other Officials of State Government	0	20
8	Management Representative of Industries	80	60
9	Plant Heads of Industries	1000	500
10	Line staff of Industries	1000	300
11	Police Personnel	50	40
12	Students	100	80
13	Consultants	20	7
14	General Public	1000	400
15	Others including Experts , doctors, Advocates etc.	100	100

Source: Primary

4.5.2. Status of Notified Industrial Zone in India vis-à-vis Common Hazardous Waste Treatment and Disposal Facilities/TSDF set up in these notified areas.

For the purpose of present research and in order to do in depth study researcher conducted a detailed study in various of Notified Industrial Zone in India vis-à-vis Common

Hazardous Waste Treatment and Disposal Facilities set up in these areas. The details of notified industrial areas vis-à-vis HWTDF set up in India are collected and analyzed. The details are captured in following Table no. 4.3. The information collected has been analyzed, interpreted through tabulation and cross tabulation.

Table No. 4.3: Status of Notified Industrial Zones & CHWTDF Set Up in India

Sr. No	Industrial Zone	No. of Zones as on 31/12/2019		Quantum of HW generated in 2018-19 (in MMTA)			No. of CHWTDF/TSDf Set up		
		India	Goa	India	Goa	Cuncol in Estate (CIE)	India	Goa	CIE
1	Industrial Estate	3360	24	5	0.3	0.2	28	0	0
2	Industrial Corridors and Parks	200	0	2	0	0	6	0	0
3	Special Economic Zone (SEZ)	363	0	1	0	0	4	0	0
4	Private Industrial Estate and other notified areas	180	3	2	0.05	0	2	0	0
	TOTAL	4103	27	10	0.35	0.2	40	0	0

Source: Primary

The above data is depicted in the following Pie Chart (Fig. No. 4.2 and Fig No. 4.3) below:

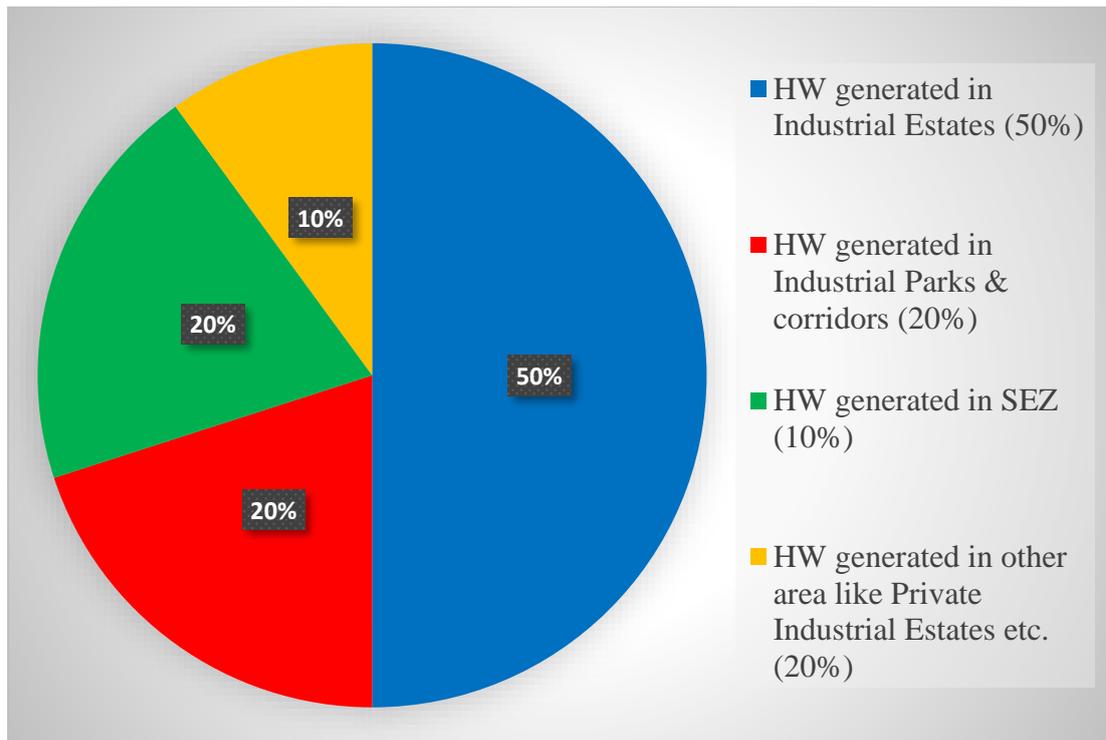


Fig No. 4.2 Notified Industrial Area wise share of generation of HW in India

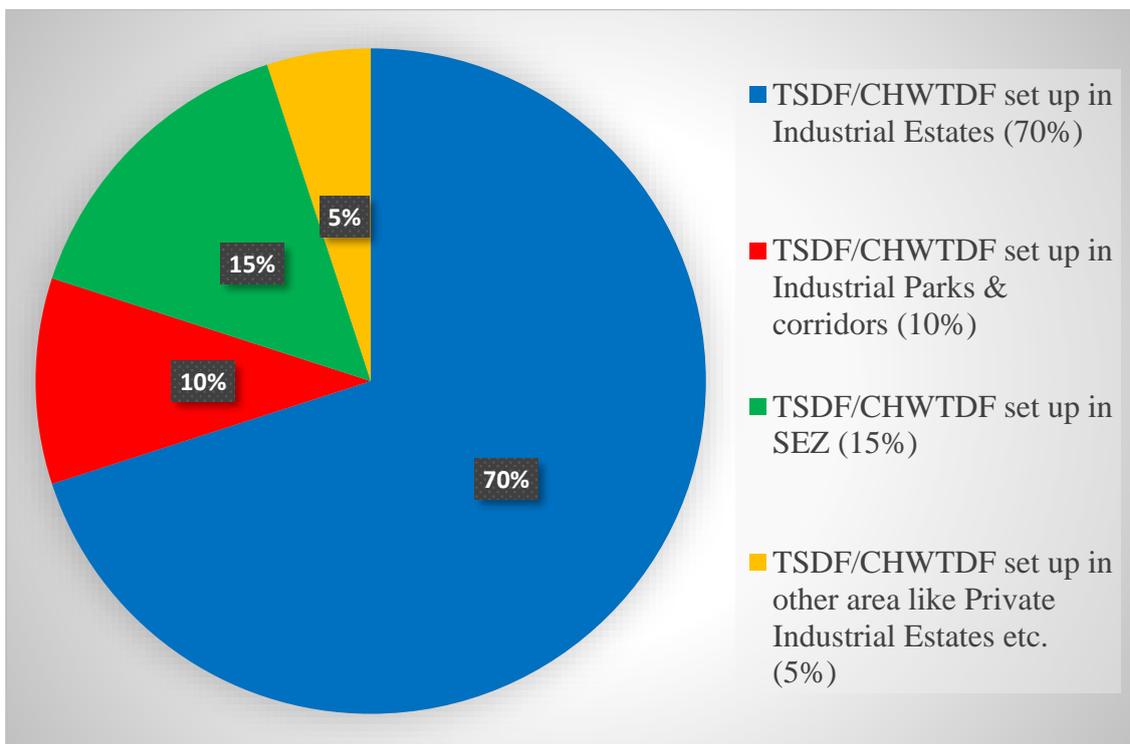


Fig No. 4.3 CHWTDF/TSD set up on various notified Industrial Area's in India

Quantity of hazardous waste generation in Country is around 10 million metric tonnes (MMT) tons during 2018-19, of which the quantum generated in the notified areas i.e.

Industrial Estate's, Industrial Corridors & Parks, SEZ and other areas is 05 MMTA (50%), 02 MMTA (20%), 01 MMTA (10%) AND 02 MMTA (20%) respectively. whereas, the quantum of HW generated in Goa in 23 Industrial Estate and Cuncolim Industrial Estate of Goa is 30,000 MTA (3% of total HW generated in Goa) respectively.

Comparing with the number of notified industrial zones in India to that of infrastructure for management of HW ie. Common Hazardous Waste Treatment & Disposal Facilities (CHWTDF) or Treatment and Disposal Facilities (TSDF) is concerned, the scenario is very discouraging. Majority of TSDF/CHWTDF are in Industrial Estates, however the ratio is very low ie. only 28 such facilities set up in 3360 number of Industrial Estates. This ratio is very low in case of SEZ, Industrial Parks & other areas.

4.5.3. Quantum of HW generated & treated by Industries in India

(a) Status of HW generated in India during last 10 years

The notified industrial estates which houses maximum industries in India and so is the largest source of generation of HW followed by industrial parks / corridors, other areas and SEZ's. The common facilities available for disposal by way of TSDF or CHWTDF are very low which indicates that treatment and disposal of HW is low and also infrastructure facilities set up for disposal of HW are on lower side.

Table No. 4.4 :- Quantum of HW generated in India during last 10 years				
YEAR	Quantum of HW generated (in MMTA)	Quantum of HW treated (in MMTA)	Quantum of legacy HW remained untreated (in MMTA)	Disposal rate. (%)
2009-10	2	0.25	4	12
2010-11	3	0.39	7.5	13
2011-12	4	0.6	10	15
2012-13	5	0.90	14	18

YEAR	Quantum of HW generated (in MMTA)	Quantum of HW treated (in MMTA)	Quantum of legacy HW remained untreated (in MMTA)	Disposal rate. (%)
2013-14	5.5	1.1	18	20
2014-15	5.8	1.4	22	23
2015-16	6	1.5	26	25
2016-17	7	1.8	32	25
2017-18	9.5	2.7	38	28
2018-19	10	3.1	46	30
% Increased/ Decreased	+20% Average	+ 7 % Average	+20% Average	+10 % Average

The trend analysis of HW disposed during last ten years is depicted in the following Bar Chart (Fig. 4.4):

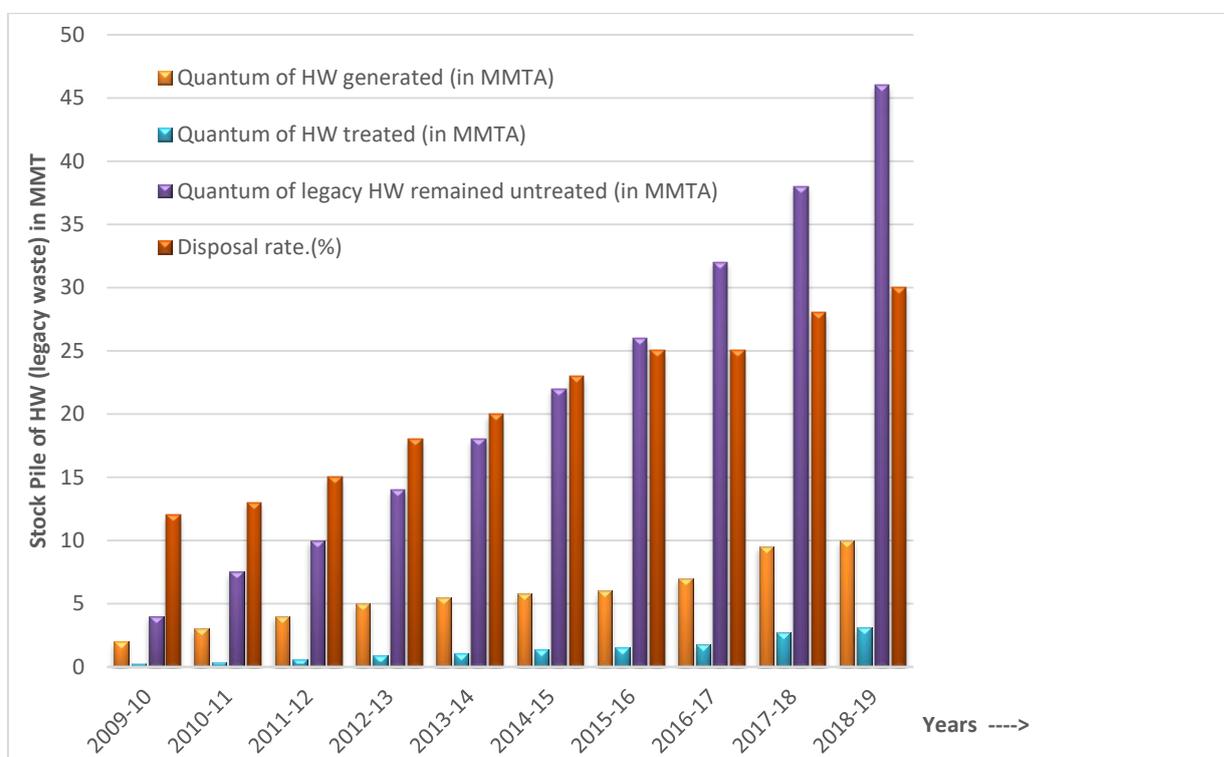


Fig. No.4.4: Trend of HW disposal in terms of HWM Rules in India

The trend of legacy waste (HW) exists in various stock piles located in India is plotted in following line chart (Fig. 4.5)

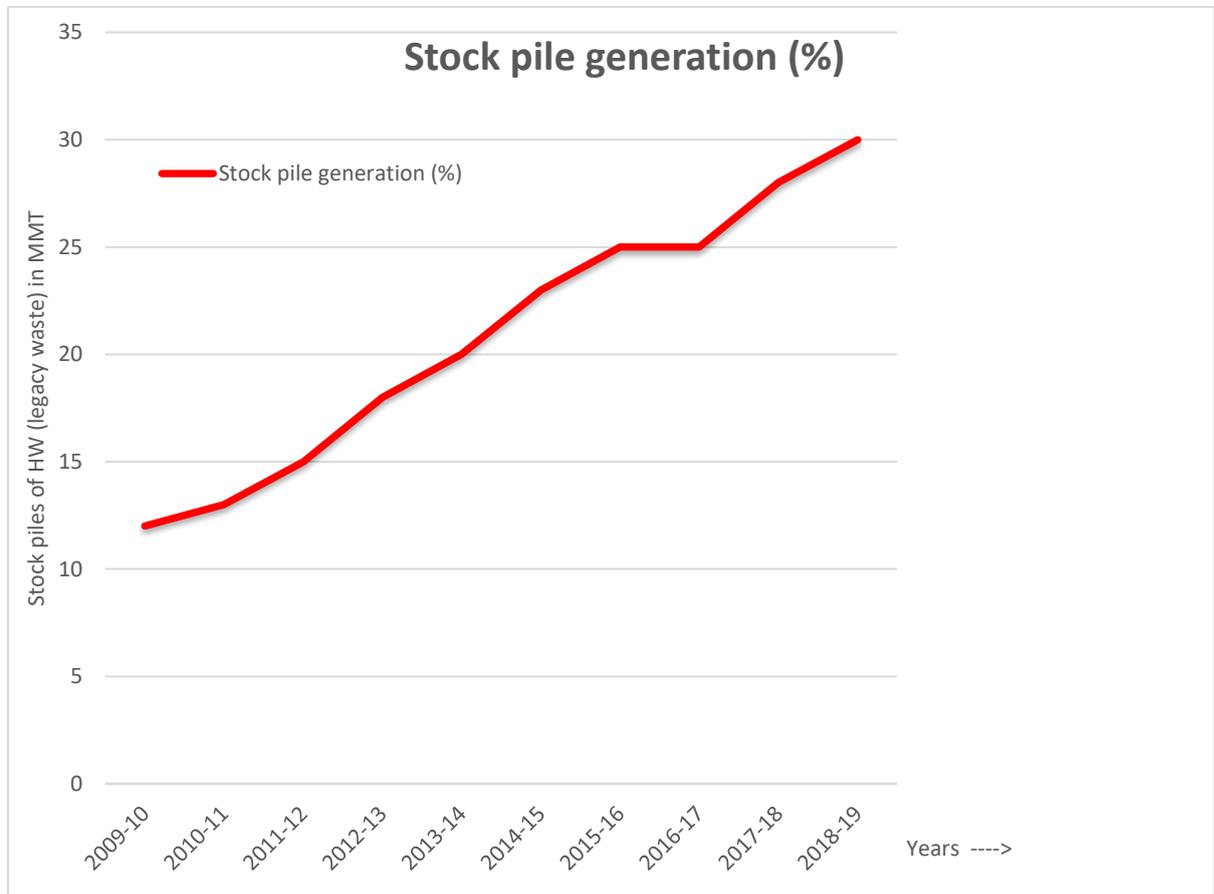


Fig. No.4.5: Trend of legacy waste (HW) lying in India

The number of stock pile in India is showing an incremental growth. Further there is a growth in which is a matter of concern.

(b) Status of Quantum of HW imported vis-a vis treated during last 10 years in India

The quantum of HW imported into India during last 10 years vis-à-vis its disposal is indicated in following table.

Table No. 4.5: - Quantum of HW imported vis-a vis treated during last 10 years in India				
YEAR	Quantum of HW imported (in MMTA)	Quantum of HW treated (in MMTA)	Quantum of HW remained untreated (in MMTA)	Disposal rate. (%)
2009-10	0.1	0.03	0.07	30
2010-11	0.2	0.03	0.17	15
2011-12	0.3	0.03	0.27	10
2012-13	0.4	0.04	0.36	10
2013-14	0.5	0.05	0.45	10
2014-15	0.6	0.05	0.55	8.3
2015-16	0.6	0.05	0.55	8.3
2016-17	0.7	0.1	0.60	14
2017-18	0.8	0.1	0.70	12.5
2018-19	1	0.2	0.80	20
% Increased/ Decreased	+ 90 % Average	-	-	+20 % Average

Source: Primary

(c) Analysis of disposal of complaints:

The trend of analysis of complaint disposal in India during last ten years is depicted in the following table (Table No. 4.6) and Bar Chart (Fig. No. 4.6)

Table No. 4.6: Details of complaints of violations of HW Rules in India

Sr. No.	Financial Year	Complaint Status				Quantum of Loss assessed by Cord pooler & Auditor General
		No. of Violations	No. of Disposal	Disposal Rate	No. of Human Health	
1.	2009-10	250	20	8%	NA	NA
2.	2010-11	290	23	8%	NA	NA
3.	2011-12	340	30	9%	NA	NA
4.	2012-13	410	37	9%	30	Rs. 40 Crores
5.	2013-14	458	41	9%	60	Rs. 60 Crores
6.	2014-15	580	64	11%	89	Rs. 95 Crores
7.	2015-16	1179	154	13%	305	Rs. 110 Crores
8.	2016-17	2018	340	16%	783	Rs. 180 Crores
9.	2017-18	4150	750	18%	835	Rs. 345 Crores
10.	2018-19	4795	1165	24%	1132	Rs. 518 Crores
Total		12722	2473	15%(Avg)	3144	Rs.1248 Crores

Source: Primary

The number of violations of the HW Rules is showing incremental growth every year by 15% (average). Whereas, the rate of disposal of complaints is alarming and low ie. 15% only. The pictorial representation in the form of Bar Chart indicating the increase in number of violations, meagre rate of disposal of complaints in India could be seen below:

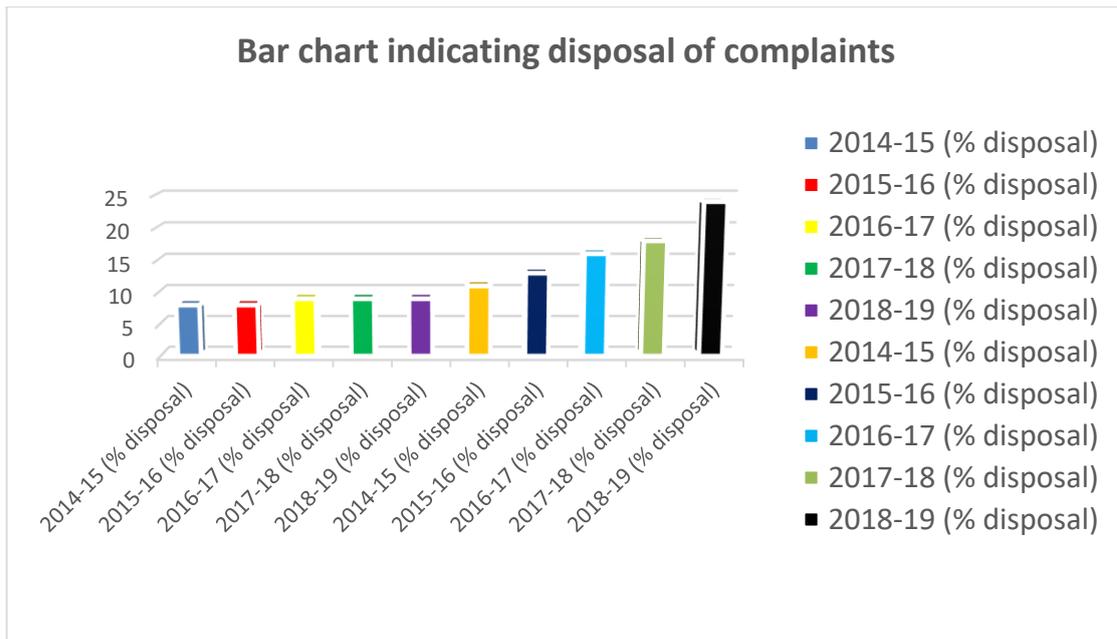


Fig No. 4.6: - Status of disposal of complaints during last 10 years

4.5.4: State wise details of HW generated in India

The state wise share (major contributor) of HW generated in India during FY. 2018-19 is indicated in Fig No. 4.4.

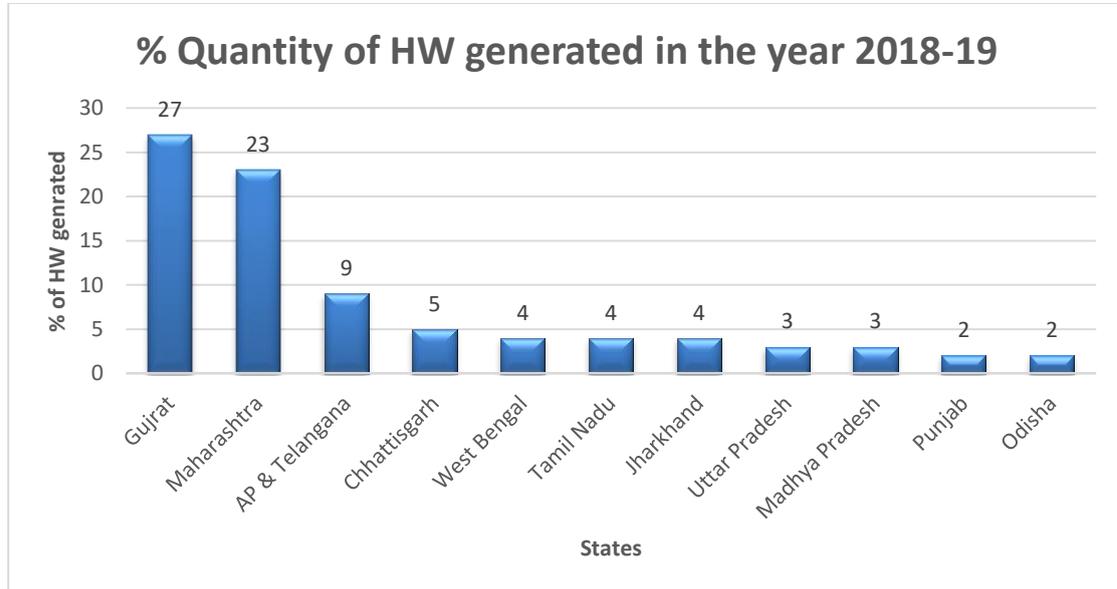


Fig No. 4.7: % Quantity of HW generated in the year 2018-19

The total component of HW generated in India is 14% of the total waste (all category of waste) generated in India. The State of Gujarat is having highest number of HW generating Industries and also major HW generating State in India to the extent of 29% of the total HW generated in India. The other major generating HW states in India

includes Maharashtra (23%), Andhra Pradesh & Telangana (9%), etc.

4.6 ASSESSMENT OF INFRASTRUCTURE FOR MANAGEMENT OF HW IN INDIA

The adequate infrastructure for sound, effective and efficient HW includes setting up of TSDF or CHWTDF in various notified Industrial areas or in any other places which are identified by the respective State/UT's. The following two Tables (Table No. 4. 6 and Table No. 4. 7) indicate the overall infrastructure scenario in various states of India. The assessment is also carried out w.r.t. the directions issued by the NGT for compliance of the HWM Rules.

4.6.1 Status of compliance of directions issued for safe, effective and efficient HWM in India

The NGT vide directions dated 30/07/2019 passed in the matter of Shri. Rajiv Narayan Vs. U.O.I. has inter alia directed all the State and UT Government to comply with all the provisions of the HWM Rules 2016 and set up a common facility (TSDF or CHWTDF) in a time bound manner for a safe and scientific disposal of HW in India. The details of status are compiled and indicated in following Table No. 4.6

Table No 4.6: Status of common facilities set up for disposal of HWM in India

Sr. No	States/UTs	Compliance of directions pertaining to setting up of CHWTDF or TSDF				Compliance by SPCB and PCC with regard to action taken on violating industrial		
		NGT directions dated 30/07/2018		C.P.C.B directions dated 12/06/2018		NGT directions dated 30/07/2018	C.P.C.B directions dated 12/06/2018	
		State Environment Dept	SPCB and PCC	State Environment Dept	SPCB and PCC	SPCB and PCC		
A.	States/UTs not set up CHWTDF							
1	Andaman & Nicobar	NA	NA	NA	NA	NA	NA	

Sr. No	States/UTs	Compliance of directions pertaining to setting up of CHWTDF or TSDF				Compliance by SPCB and PCC with regard to action taken on violating industrial	
		NGT directions dated 30/07/2018		C.P.C.B directions dated 12/06/2018		NGT directions dated 30/07/2018	C.P.C.B directions dated 12/06/2018
		State Environment Dept	SPCB and PCC	State Environment Dept	SPCB and PCC	SPCB and PCC	
2	Arunachal Pradesh	×	×	×	×	×	×
3	Bihar	×	×	×	×	×	×
4	Chandigarh	×	×	×	✓	×	✓
5	Delhi	✓	✓	NA	NA	×	NA
6	Assam	×	×	×	×	×	✓
7	Sikkim	✓	×	×	✓	×	×
8	Meghalaya	×	×	×	×	×	×
9	Manipur	×	×	×	✓	×	✓
10	Mizoram	×	✓	✓	✓	×	✓
11	Nagaland	×	✓	×	×	×	×
12	Tripura	×	×	×	✓	×	✓
13	Jammu & Kashmir	×	×	×	×	×	×
14	Lakshadweep	✓	×	NA	NA	×	NA
15	Chhattisgarh	×	✓	×	×	×	✓
16	Goa	×	×	×	×	×	×
17	Puducherry	×	×	✓	✓	×	✓
18	Gujrat	✓	✓	✓	✓	✓	✓
19	Maharashtra	✓	✓	✓	✓	✓	✓

Sr. No	States/UTs	Compliance of directions pertaining to setting up of CHWTDF or TSDF				Compliance by SPCB and PCC with regard to action taken on violating industrial		
		NGT directions dated 30/07/2018		C.P.C.B directions dated 12/06/2018		NGT directions dated 30/07/2018	C.P.C.B directions dated 12/06/2018	
		State Environment Dept	SPCB and PCC	State Environment Dept	SPCB and PCC	SPCB and PCC		
20	Tamil Nadu	✓	✓	✓	✓	✓	✓	
21	Andhra Pradesh	✓	✓	✓	✓	✓	✓	
22	Telangana	✓	✓	✓	✓	✓	✓	
23	Karnataka	✓	✓	✓	✓	✓	✓	
B.	States/UT having landfill site but no common incinerator							
24	Odisha	✗	✓	NA	NA	✓	NA	
25	Himachal Pradesh	✗	✗	NA	NA	✗	NA	
26	Kerala	✗	✗	NA	NA	✗	NA	
27	Punjab	✗	✗	NA	NA	✗	NA	
✓ - Complied; ✗ - Not Complied; NA – Not Applicable(directions not issued)								

The Status of disposal of HW (state wise) is depicted in Bar Chart Fig No. 4.9 & Fig No.

4.9

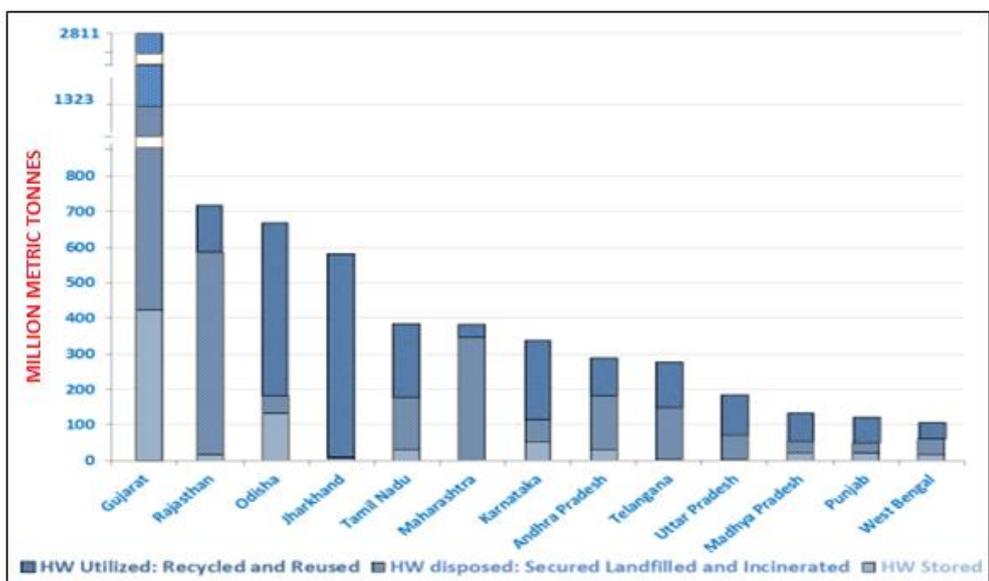


Fig. 4.9: Status of Disposal of HW vis-à-vis Generation in India

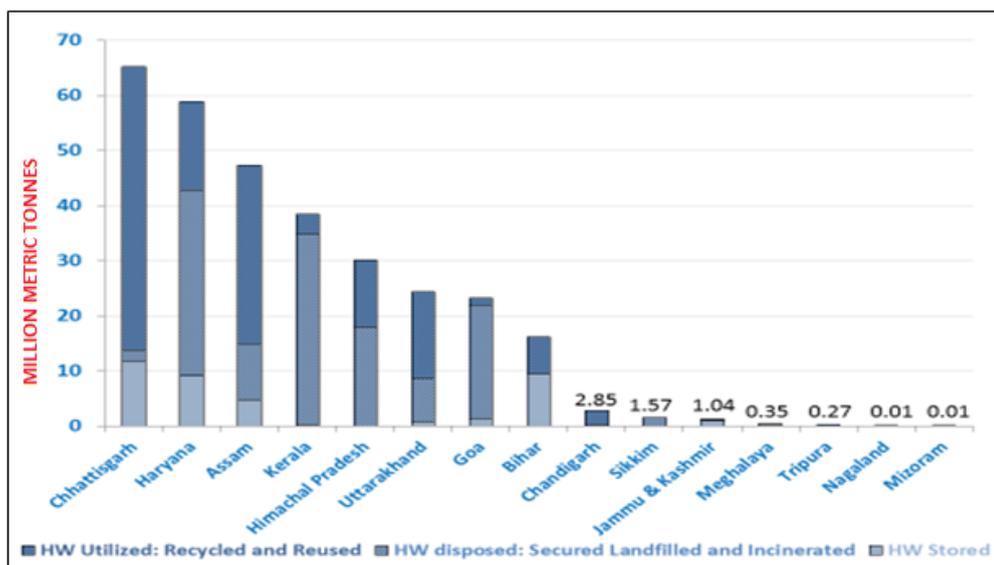


Fig. 4.10: Status of Disposal of HW vis-à-vis Generation in India(Contd)

The Fig No. 4.9 and 4.10 depict the present status of generation of HW vis- a-vis its disposal. The State of Gujarat is leading the States which is major generator of HW in India and is also adopting a state of art facilities and set up TSDF and CHWTDF in terms of the directions of the Supreme Court as well as the NGT. The state of Goa has not set up any TSDF or CHWTDF and the rate of disposal is also low (overall 40%)

The comparative analysis for the period of 2017-18 & 2018-19 is indicated in Fig. No. 4.11

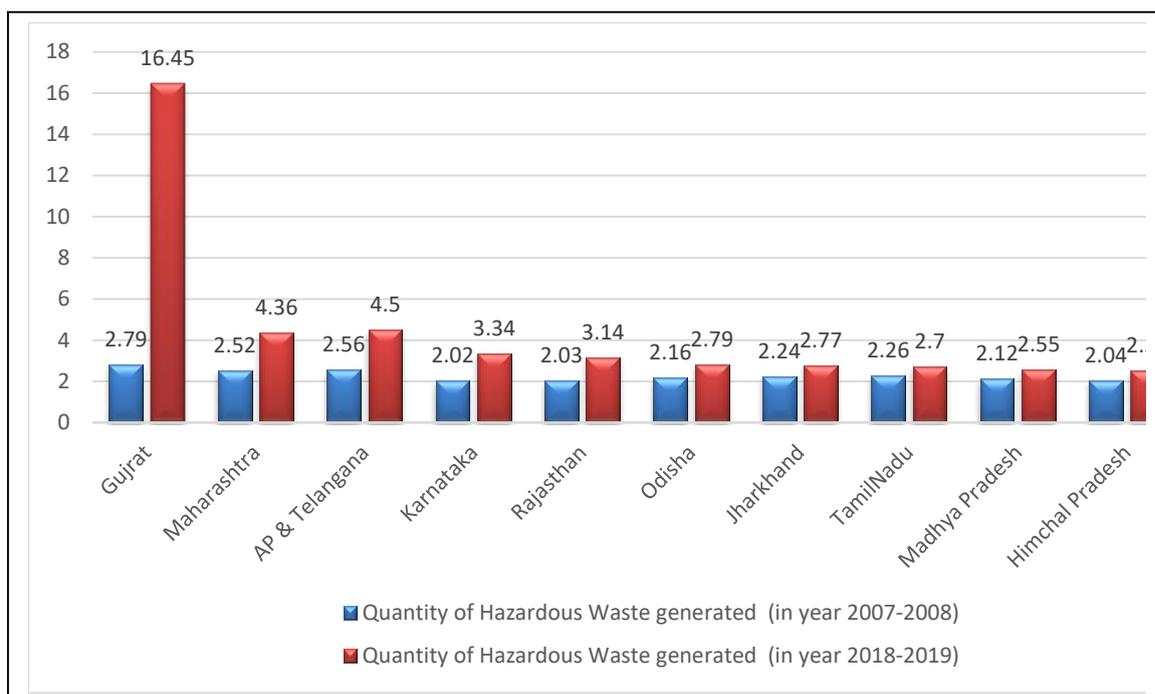


Fig No.4.11: Comparative analysis of HWM in India

4.7 TRACKING OF MOVEMENT OR TRANSPORTATION OF HW IN INDIA

One of the crucial segment in effective and efficient HWM is tracking the movement of HW from the generator to disposal site. The following Table No. 4. 7 indicate the status of HWM Practice followed in India (as on 31/12/2019)

Table No. 4.7 Tracking of movement or transportation of HW in India

Sr.No	States/UTs	HWM Practice	Status of CHFDF
1.	Andaman & Nicobar	No HW generating Industrial units	Not set up
2.	Arunachal Pradesh	Very less Industrial Units	Not set up
3.	Andhra Pradesh	Secured Storage	Set up (but inadequate)
4.	Assam	1. HW generated are recycled, processed, captive storage, incinerated. 2. Part of HW is given to cement plants.	1. Land Identified for setting up of TSDF. 2. Expression of Interest Floated calling for bids for selection of operator.

Sr.No	States/UTs	HWM Practice	Status of CHFDF
5.	Bihar	Common facility of UP is used. Part of HW is sent to Cements Units for co-processing	No action taken to set up TSDF or CHWTDF
6.	Chandigarh	Common facility of Punjab is used. Part of HW is sent to landfilling	No action taken to set up TSDF or CHWTDF
7.	Chhattisgarh	Common facility of MP is used. Part of HW is sent to landfilling and part to cements units for co-processing	1. Land Identified for setting up of TSDF. 2.Expression of Interest Floated calling for bids for selection of operator.
8.	Delhi	2 No of Incinerators are installed.	1. Land Identified for setting up of TSDF. 2. Expression of Interest Floated calling for bids for selection of operator.
9.	Goa	Part of HW is sent to Talaja Plant at Mumbai and part is secure stored	Land Identified for setting up of CHWTDF at Pissurlem Industrial Estate, North Goa Environmental Clearance is obtained Process is at standstill on account of objection from locals
10.	Himachal Pradesh	No HW generating Industrial unit	-

Sr.No	States/UTs	HWM Practice	Status of CHFDF
11.	Jammu & Kashmir	Common facility of UP is used. Part of HW is sent to landfilling and part to cements units for co-processing	Land Identified for setting up of CHWTDF at Pissurlem Industrial Estate, North Goa Environmental Clearance is obtained Process is at standstill on account of pending approval from the statutory authorities
12.	Kerala	Incinerable waste is treated in incinerator. Other waste is stored securely in landfill	CHWTDF is being set up
13.	Lakshadweep	No HW generating Industrial Units	No action Taken
14.	Manipur	Open dumping	No action Taken
15.	Meghalaya	Secured storage in land fill sites	No action Taken
16.	Mizoram	Secured storage in landfill site	Setting up of TSDF is not feasible due to terrain and hilly profile. Option available is to share CHWTDF of neighboring states.
17.	Nagaland	No HW generating Industrial Units.	No action taken
18.	Odisha	Secured storage in landfill site	CHWTDF is set up
19.	Punjab	Captive incinerators are set up. Also landfill sites are available .	CHWTDF is set up
20.	Puducherry	Incinerable HW are being Karnataka and Land fillable HW are being sent to facilities at Tamilnadu	No action Taken
21.	Sikkim	Treated at CHWTDF at West Bengal	No action taken
22.	Tripura	Secured stored in landfill	No action taken

Source: Data compiled by the Researcher through the Annual reports of PCB/PCC up to 31/12/2019

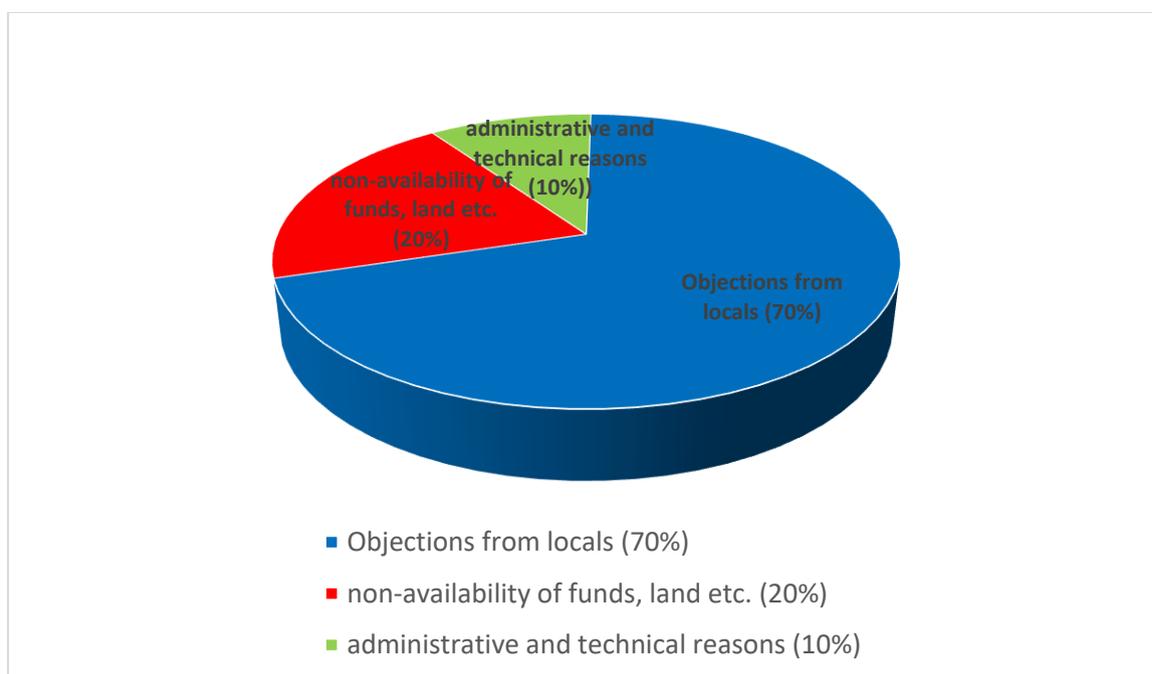
4.7.1 Rate of Disposal of HW generated in India: A defeat of concept of Recycle and Reuse of HW India: - Analysis of the statistical data

- i. The Analysis of data collected by the Researcher recalled 15 States/UTs have no common facilities like TSDF or CHWIDF and 04 States do not have common incinerators. It is also observed that 10 States / UT Government have not initiated any action to comply with the directions of the Supreme Court and NGT, New Delhi. Thus the directions of the Supreme Court of India and so also the CPCB to set up the CHWTDF in each State is not complied with.
- ii. Only State of Goa, Gujrat, Tamil Nadu and Odisha have prepared a plan for setting up of common CHWTDF specifying timeline in accordance of directions of CPCB (although the same is not as per the time line of 3months laid down by the NGT)
- iii. UT of Chandigarh is sharing a CHWTDF set up Panjab and Sikkim is sharing facilities of West Bengal. Whereas, Puducherry has shared common facilities set up by Tamil Nadu, Bihar is sharing facilities with Uttar Pradesh. However, inspite of the fact that substantial cost is involved in sharing the CHWTDF in terms of transportation of HW, no serious efforts made by these states to have its own CHWTDF.
- iv. State of Assam, J & K have identified the site but no further efforts taken to purchase or acquire the same. UT of Chhattisgarh has issued expression of interest for selecting the operator to set up CHWTDF under BOOT basis.
- v. Other North East States have not taken any steps to set up TSDF or CHWTDF for the reasons specifying that these states are not having HW generating Industries. However, these states also generate HW materials.
- vi. In the state / UT like Andaman & Nicobar, Lakshadweep there are no hazardous waste generating industrial units. Delhi is setting up CHWTDF at Bawana site and same will take around 2 years to complete.

The reason for not setting TSDF or CHWTDF mentioned are 1. Objections from locals (70%), non-availability of funds, land etc. (20%), administrative and technical reasons

(10%) (Refer Fig. No. 12)

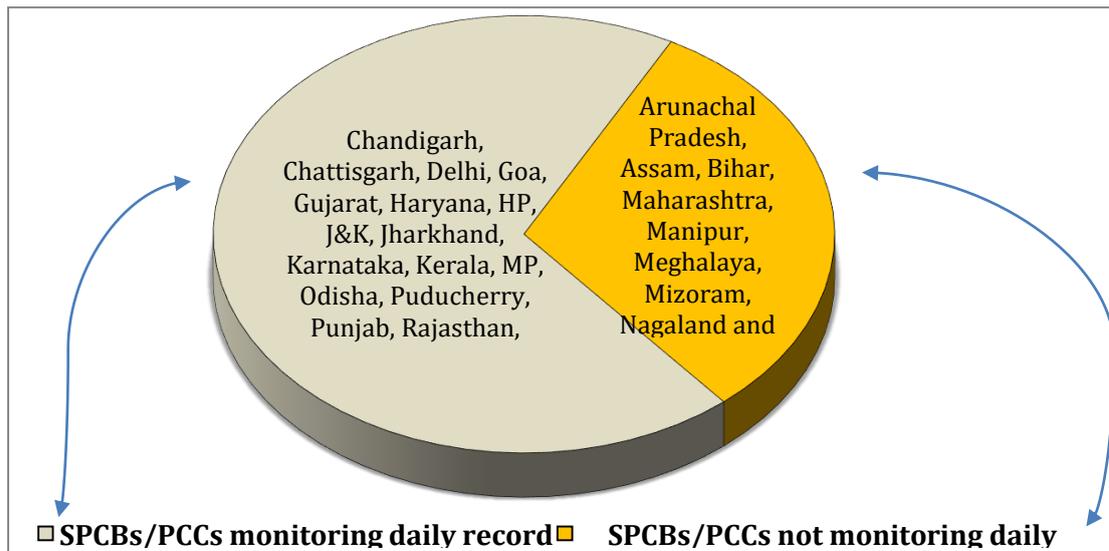
Fig. No. 4.12: Reason for not setting common facilities in India



The Tracking of movement of hazardous waste from source to its destination is universally accepted principle of HWM and the same duly incorporated in the HWM Rule as Rule 19, Rule 20(1) and Rule 20(2). The Rule 20 provides that “the occupier handling hazardous or other wastes and operator of disposal facility shall maintain records of such operations in Form 3. The Form 3 lays down format wherein date wise records require to be maintained about handling and management of hazardous wastes by the authorized occupier”. The Rule 19 lays down provisions of “Manifest System (Movement Document) in various colour code form. Whereas, Form 10 travels along with the HW from source to destination. It also acts as an intimation of the same to the sender, transporter, receiver and the concerned SPCB/PCC at various stages such as at the time of handing over the waste to transporter and transporter to the receiver”.

This concept of tracking of the HW is effective only if records are maintained date and time wise on a daily basis. In all the States and UTs, the occupiers/ generators of HW are not maintaining date-wise inventory of HW thereby violating the Rule 20 (1).

Figure 4.13: Status of monitoring of tracking of Movement of HW by SPCBs/PCCs



Flow of manifest document in Rule 19 i.e. Form 10 “which contains details of waste description & quantity, senders, transporters, receivers, acknowledgements by transporters and senders, etc.) as prescribed under the Rule 19 are not maintained by any of the States and UT’s thus the Rule 19 of the HWM Rules is grossly violated in India as there is no tracking of HW movement in India leading to even transportation of HW illegally.

4.7.2 Assessment of Duties performed by State/UT Government as assigned under the HWM Rules

The State Governments has been entrusted with authorizing any Departments under it to allocate an industrial plot for (i) setting up of recycling and reprocessing facilities (Rule 5(1)), (ii). health & safety of workers (Rule 5(2)) and preparation of integrated HWM plan (Rule 5(3)).

It has been observed that actions have not been taken on the above (except identification and notification for common TSDFs in few States) by the State/UT Govt. and there is lack of awareness among them in this regard.

4.7.3 Capacity Building Enforcement Authorities and other agencies (trained adequate manpower, laboratory, budget)

Capacity building in CPCB/SPCBs/PCCs in terms of availability of trained manpower, equipment and other logistics are compiled in following table: -

Table No. 4.8: - Capacity Building in Enforcement Authorities

Sr. No.	Particulars of Capacity Building	Enforcement Authorities		
		CPCB	NGT	SPCB/CPCB
1	Inadequate Manpower (non-filing of vacant post)	✓	X	X
2	Non availability of instruments for testing of pollutants, contaminated sites etc.	✓	NA	✓
3	Adequate Infrastructure, Budget, etc.	X	X	X
4	Speedy Approvals by the Government to the proposal submitted	X	X	X
5	Regular Training, site Visits, etc	✓	NA	X

X- No; ✓ -Yes

Source: Primary

4.8.ANALYSIS OF EFFECTIVENESS OF REGULATORY FRAMEWORK IN IMPLEMENTATION OF HWM RULES IN CUNCOLIM INDUSTRIAL ESTATE, GOA.

4.8.1. Regulatory Structure for enforcement of the Hazardous waste rules in the Goa and CIE.

The regulatory framework for enforcement of the Hazardous waste rules in the state of Goa and CIE comprises of a standard model which is existing or followed all over India i.e. GSPCB to enforce the HWM Rules 2016 and other Departments to assist it for enforcement of the said rules. In spite of the fact that the CIE is the only critically polluted industrial estate in the state of Goa and also considering the fact that there is a big hue on cry in the State on account of the severe environment pollution, the State Government has not framed any remediation plan to clean up the HW lying unattended at around 6 stock piles.

4.8.2 Status of Implementation of HWM Rules in Cuncolim Industrial Estate (CIE):

This research aims to explore the effectiveness of the implementation of the Hazardous Waste Rules by various Industries, Authorities and its impact thereof on Ecology and Environment in respect of the Cuncolim Industrial estate. It critically evaluates five aspects: Status of implementations of Hazardous Waste Management Rules by Industries operating in the CIE, Role played by the various Regulatory authorities in implementations of the HW Rules, Impact on the Environment and ecology due to the HW, and the effectiveness of the HW rules and its adequacy

1. Total Number of Hazardous Waste Generating Units operating in the Cuncolim Industrial Estate:

As per the Information collected from the office of the Field manager, Cuncolim Industrial Estate under the Right to Information Act there exists 278 industrial units in the Cuncolim Industrial Estate. The said data is also verified from the data provided by the Industries department and Goa State Pollution Control Board. Out of these 278 Units, the hazardous Waste generating units are 180 whereas other units are generally warehousing, container service Units, ice plants, Fish meal plants, etc. which are service sector Units. Thus it is seen that the substantially large number of units in the Cuncolim Industrial Estate are generating Hazardous waste.

The Table No.4.9 indicates the data pertaining to the HW generating Units in CIE.

Table No. 4.9: Total no. of HW generating Units in CIE

Sr.No.	Total number of Industries operating in CIE	Total Number of HW generating Industries	Other Units
1	278	260	18

(Source: Primary)

The following figure depicts that the 93.52 % of the Industries situated in the CIE are generating the Hazardous waste.

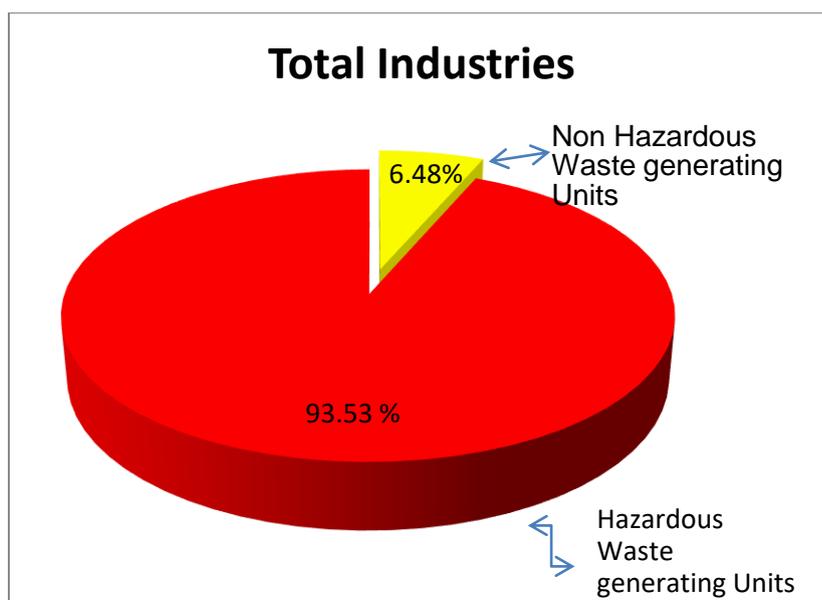


Fig 4.14: Total number of Hazardous Waste Generating Units in CIE

2. Total Quantum of HW generated in the Cuncolim Industrial Estate:

On perusal of the Annual Report published by the Goa State Pollution Control Board titled "Status of Hazardous Waste in the State of Goa" pertaining to last 10 years ie. From 2008 to 2012, the Total waste generated by various Industries during last ten years is indicated here below:

Table No. 4.10.: Total Quantum of HW generated in last 10 years in CIE.

Sr.No.	Year	Total No. of HW generating Units	Total Quantum of HW generated (in Metric Tones)	Total Quantum of HW Treated and disposed of (in Metric Tones)
1	2008	156	12000	2000
2	2009	182	14000	3000
3	2010	207	18000	4300
4	2011	234	22000	7500
5	2012	260	25000	9000
6	2013	263	32000	7500
7	2014	265	35000	7000
8	2015	266	37000	7400
9	2016	268	38000	7500
10	2017	270	40000	7900

Sr.No.	Year	Total No. of HW generating Units	Total Quantum of HW generated (in Metric Tones)	Total Quantum of HW Treated and disposed of (in Metric Tones)
11	2018	275	42000	8500
12	2019	278	45000	8400

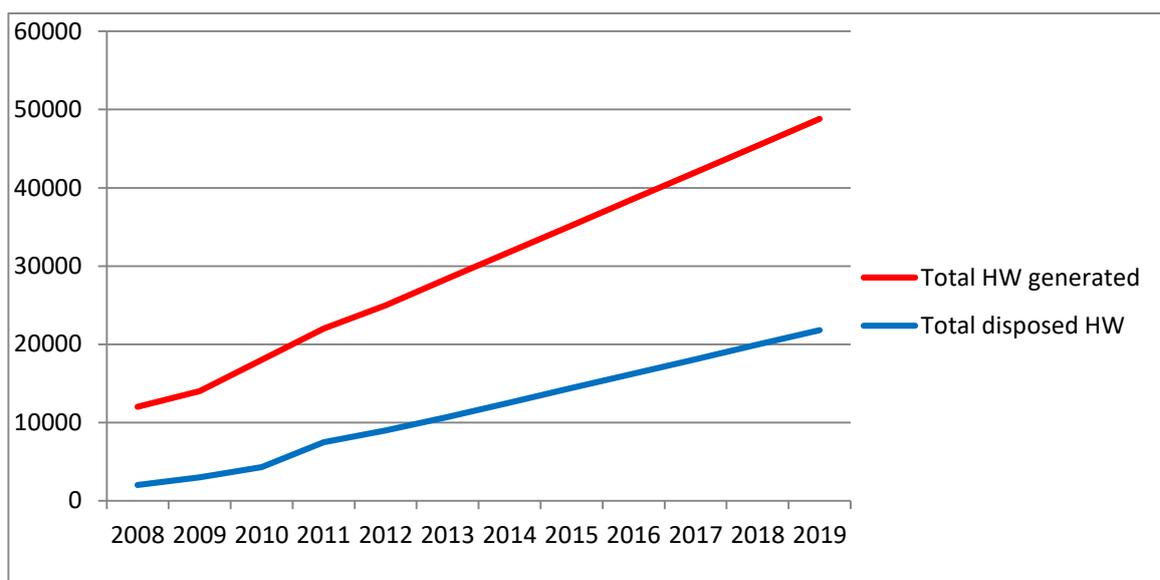
(Source: Primary)

By and the Goa Industrial Policy 2003 and Goa Investment Policy 2014 has given big boost to the Industrial scenario in the State of Goa. Various Industrial units has shown keen interest in setting up of the Industries in the State of Goa due to various tax incentives including financial incentives in terms of subsidies etc. This has also resulted in the setting up of new Industries in the Cuncolim Industrial estate. The State Government do not have any clear cut guidelines as far as setting up of kind of Industries in a specific region. The Cuncolim Industrial Estate has been traditionally being looked as a place for setting up of all red category Industries. Although the Government also emphasized on employment oriented Industrial units but this has resulted into unregulated setting up of large number of Hazardous Waste Generating Industries in Cuncolim area.

Having obtained data from the year 2008, this study has tabulated the data pertaining to the HW generated by various Industries till 2018. This has been done so as to enable the ascertainment of the trends of such growth of HW generated in CIE.

The tabulated data obtained was further subjected to analysis and represented graphically in a line chart in Fig. 4.15 for better appreciation of the trend.

Fig 4.15: Trend of HW generated in CIE during last 10 years.



Source: Primary

The above chart indicates that only 20 % of the total waste generated by various Industries at CIE is treated whereas 80% of the waste is laying unattended by the Industries. Further every year this 80 % of untreated waste is carry forward to the next year. It is estimated that around 5lakhs MT of HW is presently lying untreated at six locations of the CIE which itself make it evident that the HW Rules are blatantly being violated. The graph also shows that the trend from the year 2007 to 2019 is showing an increasing trend of generation of HW in CIE. The downward trend of disposal of HW is a serious concern since the growth of generation of HW is linear whereas the disposal rate is very slow. This indicated that the Hazardous Waste Management Rules are blatantly violated. Due to moratorium imposed in 2016 and also as no vacant industrial plot available for allotment no new industry is set up in CIE since 2017.

3. Implementation of HW Rules by the Industries: Scientific Treatment and disposal of Hazardous Waste by Industries operating in the Cuncolim Industrial Estate:

The Rule 4 of the Hazardous waste inter alia provides that any Industrial Units generating the Hazardous Waste shall be responsible for the safe and environmentally sound handling, treatment and disposal of the Hazardous Waste. The mode of handling, treatment and disposal of Hazardous waste in a safe and environmental sound measures are provided by the Ministry of Environment and Forest and State Pollution Control Board. This measure

includes transportation of Hazardous Waste either to the place within a State or outside the State where there are such facilities for treatment and disposal of waste. In the State of Goa there are no such facilities being set up by the third parties, whereas such facilities are available in the State of Maharashtra, Gujarat, Karnataka, Kerala, Tamilnadu etc.

Since the Rules provides for the transportation of such waste outside the state of Goa by obtaining the Authorization from the concerned State Pollution Control Board as well as Goa State Pollution Control Board, one of the practice followed by the Industrial Units is to transport the Hazardous waste generated in the units to such treatment facilities outside the state of Goa. One of such facility where the Hazardous Waste is send for disposal is Taloja facility at Mumbai. As per the Information provided by the Goa state Pollution Control Board out of 260 Industrial Units, only 15 Units are sending their waste for treatment outside the State of Goa ie to Taloja, Mumbai being the closest facility available and in terms of the Memorandum of Understanding(MOU) signed between the State of Goa and Maharashtra.

Considering the huge transportation cost involved in transportation of waste outside the state of Goa, the other mode being adopted by the Industries in Goa including those which are set up in CIE is to set the own treatment facility by the Industries itself. While setting up such facility the Industrial Unit is required to identify the land which is used for treatment and scientific disposal of hazardous waste and required to obtained permission from the Goa state Pollution Control Board. The Goa State Pollution Control Board verifies the suitability of land and technology being adopted by the concerned Industrial Unit for the safe and scientific handling and treatment of the Hazardous Waste and then grants the permission in terms of the Authorization to the applicant in terms of the rule 6 of the Hazardous Waste Rules. The said rules do not provide for any specific mode of treatment but has left whole discretion upon the concerned State Pollution Control Board. Due to which neither the Industrial Units adopted any standard method of disposal not the Goa State Pollution Control Board has devised any method. Thus there is a total dilemma over this issue.

The below mentioned table indicates the Statistics regarding the status of mode of disposal of HW by various Industries operating in the Cuncolim Industrial estate:

Table No. 4.11: Status of mode of disposal of HW in CIE

Sr.No.	Mode of Disposal	No. if Industries who have adopted this Mode	Whether HW Rules are Violated?
1	No disposal Mode/Open Dumping	231	Yes
2	Transported to other states for disposal	10	No
3	In house disposal	8	No
4	Common treatment & disposal by more than 2 Industries	6	No
5	Send to other Industrial Estate for disposal	5	No
	Total	262	

(Source: Annual report of GSPCB on HW for last 10 years)

Having obtained data from the year 2008, this study has tabulated the data pertaining to the mode of disposal of HW generated by various Industries till 2019. This has been done so as to enable the ascertainment of the trends of safe and scientific disposal of HW generated in CIE.

The tabulated data obtained was further subjected to analysis and represented graphically in a pie chart in Fig. 4.16 for better appreciation of the trend.

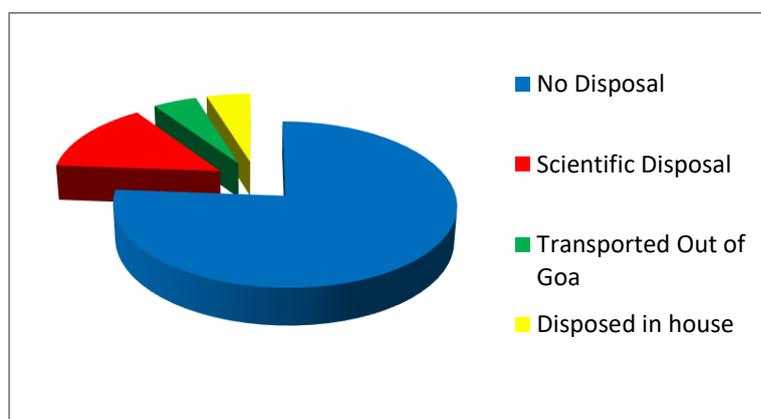


Fig 4.16: Status of safe and scientific disposal of HW in CIE

The figure 4.16 indicates the quantum of HW being disposed of as per the provisions of the HW Rules. The figure clearly shows that 80% of the HW being generated is not disposed of at all. Such waste is dumped either in open spaces, low lying area or any other spaces in the jurisdiction of Cuncolim Area in gross violations of the HW Rules thereby pose threat to Human being and Environment.

Thus it is crystal clear that the majority of Industries ie. to the extent of 80% are not handling and disposing the HW in a safe and scientific manner thereby grossly violating the Rule 4 of the HW Management Rules.

4.8.3. Enforcement of HWM Rules in Cuncolim Industrial Estate, Goa: An Analysis

1. Awareness of the Hazardous Waste Management Rules.

The HWM rules notified by the MOEF & CL, Government of India are the only specific rules which governs the HW Management in India. The rules are also applicable to the State of Goa. Besides these are no other legislation, Rules etc. required to be framed by the State Government.

The concept of HW management is not new to the State since the Industrialization is started in Goa in early sixties and the problem of the HW and its ill effect are faced by the State for long time. Considering this fact, the researcher has made attempt to find out whether the authorities to ascertain the awareness and knowledge of these rules by the Industries, authorities and public. In order to collect said data, the researcher has circulated the questionnaires among the officials of the Industries, public, NGO, and officials of the various authorities such as Department of Environment, Goa State Pollution Control Board, etc. Being the subjective matter, the researcher has also interacted with them through personal interaction, interviews.

The Table 4.12 & 4.13 are drawn based upon the feedback received to the Questionnaire regarding the awareness of the HW Management Rules by various participants. One of the objectives of the survey is to provide indicators on the level of knowledge and awareness of HWM Rules.

A series of questions were asked to gain an accurate understanding of the level of knowledge and awareness. First, respondents were asked if they had ever heard or read about hazardous waste. Second, respondents were asked to rate their knowledge of HW and rules.

The data so collected is tabulated in Table No.4.12. and Table No. 4.13

Table No. 4.12: Awareness of HWM Rules (Ever heard of or read about Hazardous waste)?

Response	Industries	Dept of Environment	GSPCB	Other Authorities	Public	NGO
Yes	40%	90%	80%	5%	2%	20%
No	60%	10%	20%	95%	98%	80%

(Source: Primary Data Collected through Questionnaire)

Table No. 4.13: Self-assessment of Knowledge about HWM Rules.

Response	Industries	Dept. of Environment	GSPCB	Other Authorities	Public	NGO
High	30%	50%	30%	5%	5%	5%
Moderate	20%	10%	20%	5%	5%	15%
Low	20%	30%	20%	15%	10%	20%
Know Nothing	30%	10%	10%	75%	80%	60%

(Source: Primary Data Collected through Questionnaire)

The questionnaire circulated among the representative and officials of management of the Industries indicates that 60 % of the Industries are unaware of the specific HW Management Rules being framed so as to dispose of the HW in a safe and scientific manner. The Department of Environment which is the key Department of the State Government as far as framing of environmental policies, etc. is concerned. However, 50%

of the scientific and Technical staff of this department are having substantial knowledge about the Rules. Similarly, with the other authorities such as Goa State Pollution Control Board. As far as public residing in the vicinity are concerned, nearly 98 % of the surveyed public do not aware of the HWM Rules. Even NGO (80%) which are otherwise vibrant in Goa as far as mining issues are concerned are also not aware of the Rules.

The Hazardous Waste Management is highly technical and scientific subject matter. As such assessment is done through questionnaire and interview method to ascertain the level of knowledge of the Rules. The results were surprising. Even though the participants who are well informed about the Rules are not aware about the Rules in details. The level of knowledge among the scientific and technical staff of the authorities such as Department of Environment and Goa State Pollution Control Board is moderate. Thus insufficient knowledge of the concept of management of HW has led to poor enforcement of the Rules in CIE.

2. Site Inspection by the authorities to verify the compliance of the HWM Rules and illegal dumping of HW in CIE.

The issue of illegal and indiscriminate dumping of Hazardous waste by various Industries in Cuncolim Industrial Estate has made lot of hue and cry in the vicinity for last fifteen years. Various complaints were made by the public, NGO and even some of the Industries regarding water pollution, degradation of ecology, dying of crops, death of pets and farm animals, etc.

Having obtained data from the year 2008, this study has tabulated the data pertaining to the number of complaints pertaining to the Environmental Pollution, etc by the Goa state Pollution Control Board due to operations of the various Industries till 2019. From the said list the specific complaints regarding only hazardous waste dumping are examined. This has been done so as to enable the ascertainment of the specific complaints regarding the illegal dumping of HW in CIE. This data is reflected in Table No. 4.14.

Table No. 4.14: Complaints received during last 10 years by various authorities regarding Dumping of HW in CIE

Particulars of Complaints	Complaints Receiving Authority			
	Department of Environment	GSPCB	Department of Industries	Other Authorities
Total Complaints Received	120	150	80	60
General complaints	24(20%)	30(20%)	32(40%)	18(30%)
Complaints pertaining to dumping of HW	96(80%)	120(80%)	48(60%)	42(70%)

(Source: Information Collected under the RTI Act from Authorities for last 10 years)

The Tabulated data obtained was further subjected to analysis and represented graphically in a pie chart in Fig No. 4.17 for better appreciation of the trend. The average of complaints received by all the authorities used for the analysis and calculations of trend.

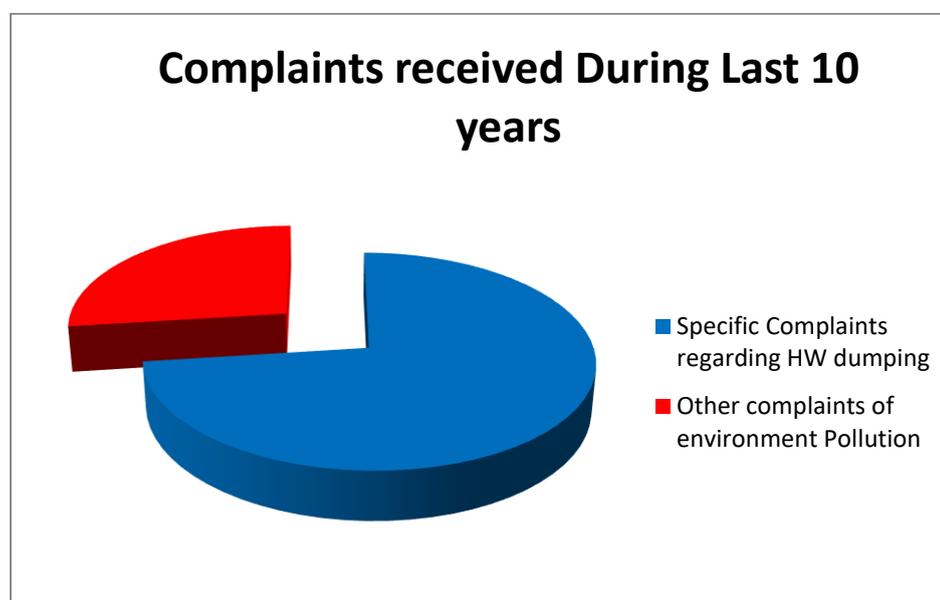


Fig 4.17.: Status of Complaints of Environmental Pollution received by various authorities during last 10 years in CIE.

The impressive industrial growth figures fail to hide the grim realities of environmental pollution. While, the state governments are only bothered about industrial growth, the civil society is struggling to draw public attention to the impending danger to the environmental

and public health. Factories have been dumping thousands of tons of hazardous wastes in the open. Not only has this polluted the groundwater but it has also damaged fertile lands.

It is evident from the above chart that the issue of Environmental degradation in general due to the operations of the Industries in CIE are predominant. The analysis shows that out of total complaints received by the various authorities regarding issues pertaining to the Environmental Pollution such as Water pollution, destruction of crops, death of animals, air pollution, sewage etc. during last 10 years, more than 70% of the complaints pertains to the illegal and indiscriminate dumping of the HW by various Industries operating in the CIE.

Considering that such a number of complaints received by the authorities it is expected that the Authorities inspect the Units and area in question and take appropriate action under the Rules to control and prevent the Environmental pollution in CIE.

Having obtained data from the year 2008 to 2019, this study has tabulated the data pertaining to the number of site inspection carried out by the concerned authorities subsequent to the receipt of the complaints or surprise inspection to verify and ascertain the compliance of rules, etc . This data is reflected in Table No. 4.15.

Table No. 4.15: Inspections carried out during last 10 years by various authorities in the matter regarding Dumping of HW in CIE.

Particulars of Inspection	Authority who conducted site inspection			
	Department of Environment	GSPCB	Department of Industries	Other Authorities
Total Number of Inspections conducted	0	56	12	20
Site Inspections on receipt of complaints	0	51(90%)	12(100%)	20(100%)
Surprise site Inspection	0	5(10%)	0	0

(Source: Information Collected under the RTI Act from Authorities for last 10 years)

The Tabulated data obtained was further subjected to analysis and represented graphically in a bar graph in Fig. 4.18 for better appreciation of the trend. The average of complaints received by all the authorities, average number of site inspections carried out by authorities and average surprise inspections carried out are used for the analysis and calculations of trend.

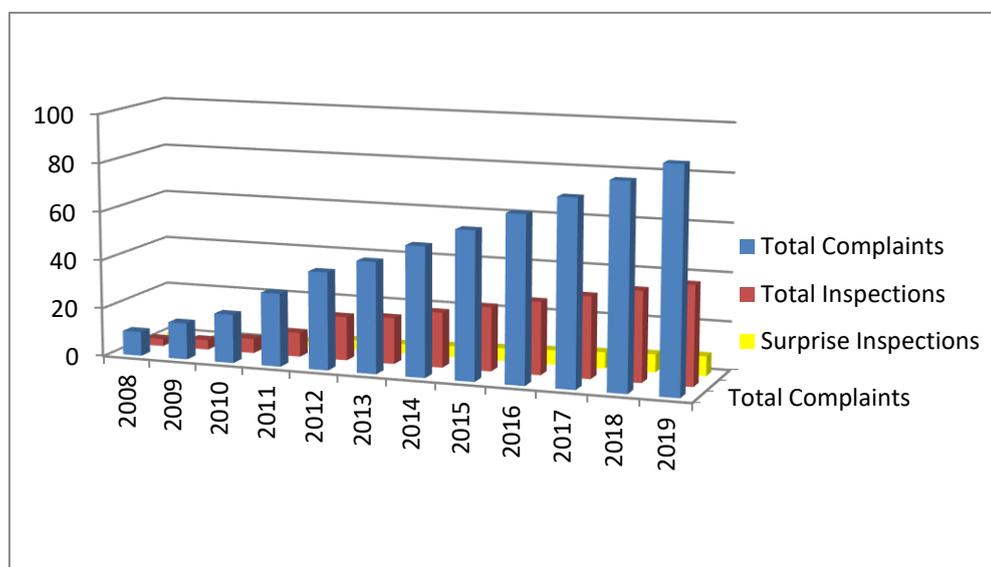


Fig No. 4.18: Trend of complaints received by Authorities in CIE

The Goa State Pollution Control Board is one of the main Authorities who is required to initiate action under the law on receipt of the complaint. Having obtained data from the year 2008 to 2019, this study has tabulated the data pertaining to the number of site inspection carried out by the GSPCB subsequent to the receipt of the complaints to verify and ascertain the compliance of rules, etc. and take action thereafter. This data is reflected in Table No. 4.16.

Table No 4.16: Trend of complaints received regarding HW via-a vis site inspection carried out by GSPCB during last 10 years in CIE

Sr.No.	Total No. of complaints received by the GSPCB during last 10 years	No. of inspections carried out by GSPCB subsequent to receipt of complaints	No. of complaints unattended
1	150	51(33%)	99(77%)

(Source: Annual report of GSPCB of last 10 years)

The Tabulated data obtained was further subjected to analysis and represented graphically in a pie chart in Fig. 4.19 for better appreciation of the trend.

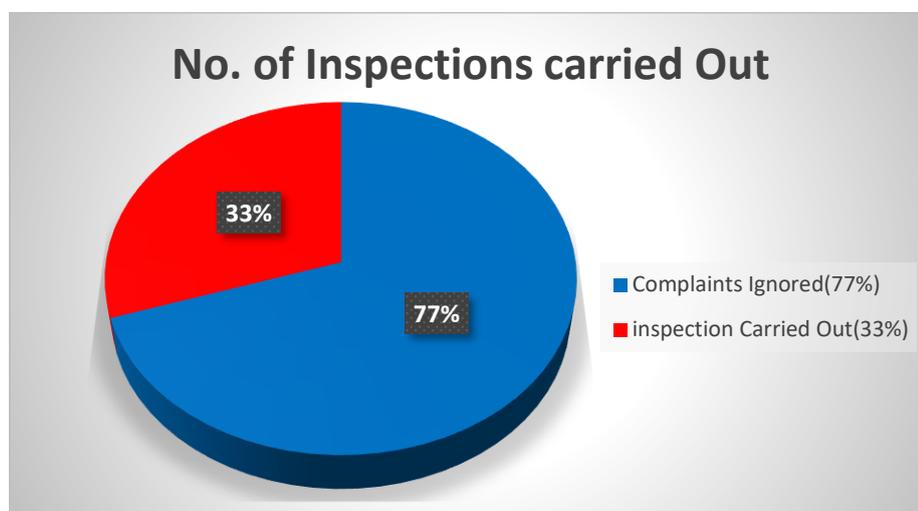


Fig No. 4.19.: Trend indicating average complaints received, Inspection carried out and surprise inspections conducted by various authorities during last 10 years in CIE.

The statistical analysis of data pertaining to the average (weighted average) of complaints received during last 10 years regarding hazardous waste dumping, pollution due to HW etc by the Authorities, average number of inspections carried out by the authorities vis-à-vis surprise inspections carried out by them are plotted on the bar chart (Fig. 4.5). The analysis indicates that:

Total numbers of complaints received by the authorities regarding illegal dumping of HW, environmental pollution due to HW etc are on increasing trend during last 10 years. The complaints received from the general public staying in the vicinity are higher (70%) followed by the NGO (20%) and Industries & others (10%).

Total numbers of Inspections carried out by the authorities subsequent to the receipt of the complaints are not satisfactory. The Department of Environment has not carried out even a single inspection of CIE during last 10 years. Whereas they have only forwarded the complaints to the Industry concerned or to other authorities for further action. They have not initiated any action on the complaints. During personal interview with the Director of the Department he has cited the reason of shortage of staff.

The GSPCB has carried out site inspection only on receipt of the complaints. It is observed that only 33% of the total complaints are addressed by the GSPCB, whereas the rest of the 77% of the complaints are outright rejected by the GSPCB. The questionnaire circulated among the GSPCB officials to ascertain the reason for rejection of the complaints by the officials. It is informed that due to shortage of staff the GSBCB cannot address each and every complaint and only carry out the inspection in complaints of serious nature. However, the officials failed to inform the definition of the serious complaint.

The other authorities such as Collector & DM (South Goa District), Health Department, Labour Department, Inspectorate of Factories and Boilers, MoEF etc has also followed the practice of referring the complaints to the GSPCB only for necessary action.

The Authorities hardly conduct any surprise inspections of the CIE region to ascertain the status of environment, violations if any etc. The questionnaire circulated among the officials of various Industries, Authorities, public etc to ascertain the frequency of surprise inspection carried out by the various authorities in CIE in respect of issues pertaining to the HW. The analysis revealed that none of the authorities including the officials of Department of Environment, Government of Goa has carried out a single surprise inspection during last 5 years. During last 10 years, the GSPCB has carried out only 5 site inspections in the CIE region.

The questionnaire circulated among the officials of various Industries, Public and NGO to ascertain the fear of authorities regarding surprise inspection revealed that the Industries are aware that the Authorities hardly conduct any surprise inspection of the region to verify the compliance of the HWM Rules. As such it is crystal clear that there is no fear of the authorities regarding any action being taken in case of violations.

4.8.4. Action Taken by the Authorities during last ten years.

Having obtained data from the year 2008 to 2019, this study has tabulated the data pertaining to the action taken by the concerned authorities subsequent to the receipt of the complaints or surprise inspection against the violator company. This data is reflected in Table No. 4.17

Table No 4.17 Action Taken by the Authorities in respect of the complaints received regarding illegal dumping of HW, etc.

Particulars of Action	Authority who initiated action			
	Department of Environment	GSPCB	Department of Industries	Other Authorities
Directions to prevent Violations	5	20	15	10
Show cause Notice	0	30	10	5
FIR filed	0	3	0	0
Personal Hearing Given	0	12	3	1
Closure of Unit	0	5	2	0

(Source: Primary)

The Tabulated data obtained was further subjected to analysis and represented graphically in a pie chart in Fig. No. 4.20 for better appreciation of the trend.

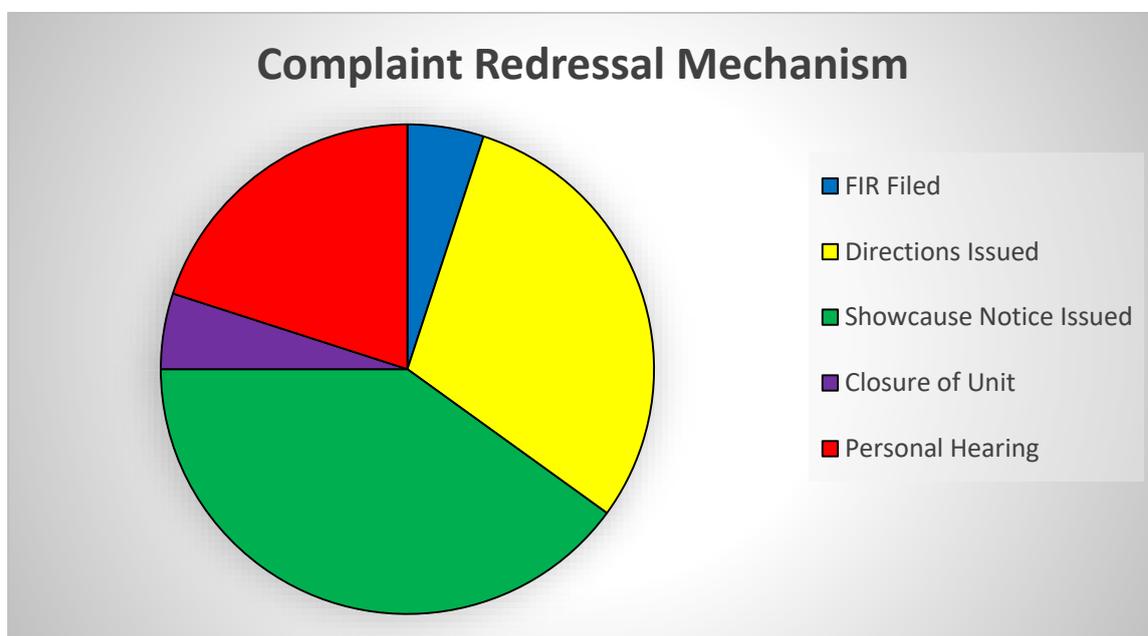


Fig No. 4.20: Complaint Redressed Mechanisms

The action taken by the various authorities is analyzed and indicated below:

It is observed by the researcher that the easiest method implemented by the various

authorities including GSPCB that on receipt of a complaint regarding illegal dumping of the HW, pollution due to HW etc. a plain direction is issued to the concerned violator to rectify the system, restoration of land to original position, etc. and the violators are also asked to submit the compliance report. The trend shows that in 30 % of the cases the authorities has issued such directions.

Show cause Notice: The authorities also issues show cause notices calling explanations from the violators so as to explain why action as deemed fit should not be initiated against them. The trend shows that in 40 % of the cases the authorities has issued such notices.

Personal hearing: The subject matter being scientific and nature, the authorities asked the violator to remain present before it along with technical presentation and details. However, it is observed that such hearings are often postponed and drag for month and no action being taken and on many occasions the violations continued. The trend shows that in 15 % of the cases the authorities has issued such notices.

Filing of FIR against the Violators: It is observed that only in 2012 the GSPCB has filed the FIR against 3 violators before the Cuncolim Police Station under section 16 and 17 of the Environment Protection Act. However, no person is booked under the Act for want of evidence.

Closure of Unit: Under extreme conditions the GSPCB has closed five units and Department of Industries has closed 3 units in last 10 years considering the gross violations of the HWM Rules, etc.

4.8.5 Impact on Ecology and Environment.

This research aims to explore the effectiveness of the implementation of the Hazardous Waste Rules by various Industries, Authorities and its impact thereof on Ecology and Environment in respect of the Cuncolim Industrial estate. It also critically evaluates further aspects such as Impact on the Environment and ecology and public health due to the HW, and the effectiveness of the HW rules and its adequacy

1. Impact of HW generated in CIE on surrounding ecology and environment

The researcher has studied the overall impact of the HW generated in CIE upon the

surrounding ecology and Environment of the cuncolim area over the ten-year time period. For this matter, the researcher has collected data under the Right to Information Act 2005 from various authorities such as Department of Agriculture, Water Resource Department, Forest department regarding status of environment and ecology during last 10 years on account of the HW being dumped in indiscriminate manner over long time period in past. Even the status report prepared by the private research organizations, annual report of various Departments is examined in detailed. The questionnaire is circulated among the public, NGO etc. to gather information regarding status of environment in their region. This data is also cross checked with the officials of Departments to ascertain the facts.

2. Impact on Water bodies in CIE region:

The Data is collected from the canal officer of the water Resource Department of Cuncolim through personal interview, examination of officials report of last five years titled “Water Quality in Quepem Taluka, Goa” has been examined. Having obtained data from the year 2008 to 2018, this study has tabulated the data pertaining to the number of water bodies existing in the radius of 5 km of CIE region and their status. This data is reflected in Table No. 4.18.

Table No. 4.18. Status of water bodies in CIE Region

Sr. No.	Particulars of Water bodies in CIE region	Total No. of water bodies	No. of water bodies destructed on account of HW
1	Lakes	1	1
2	Public Wells	38	34
3	Perennial springs	2	2
4	Estuaries	1	1
5	River line, etc	1	1
	TOTAL	43	39

(Source: Report “Water Quality in Quepem Taluka, Goa” for last 10 years by canal officer, Cuncolim-Goa.)

The Tabulated data obtained was further subjected to analysis and represented graphically in a pie chart in Fig. 4.21 for better appreciation of the trend.

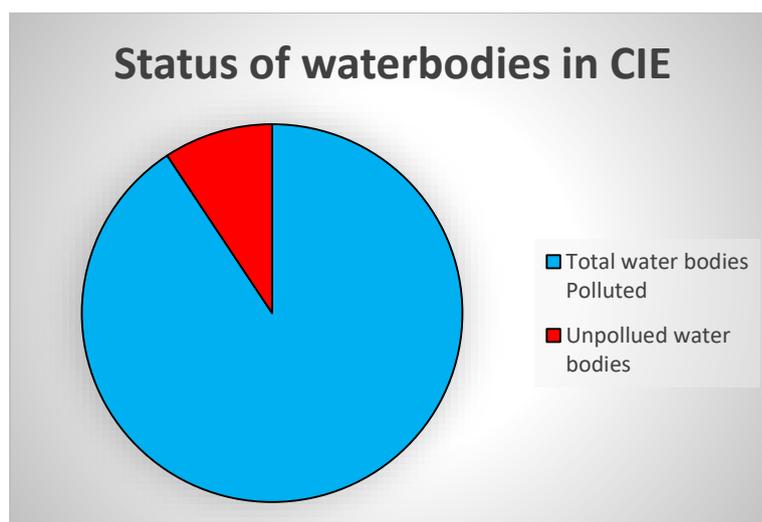


Fig No. 4.21: Status of water bodies in CIE

The Cuncolim region is basically a mixture of city and village area falls in the eco sensitive region of Western Ghats. The agriculture and horticulture is main occupation of the region besides villagers are working in the factories. The people in the area were traditionally depend on the various water bodies in the region for water for their household as well as agriculture activities. However, during last ten years it is reported that the water bodies in region including grown water is contaminated with heavy metals percolated through the HW being dumped all over the region. The researcher has found that nearly 90% of the portable water bodies are polluted on account of contamination due to indiscriminate dumping of HW by the Industries. It is also observed that due to this the people in region has abandoned the water bodies and instead relying upon the public tap water system provided by the state Government.

3. Impact on Agriculture, Horticulture in CIE Region:

The Data is collected from the Zonal Agricultural Officer(ZAO) of the Agriculture Department of Cuncolim through personal interview, examination of officials report of last ten years titled “Agriculture Production in Quepem Taluka, Goa” and the Economic Survey of last ten years has been examined. Having obtained data from the year 2008 to 2019, this study has tabulated the data pertaining to the crop production in the radius of 5 km of CIE region and their status. This data is reflected in Table No. 4.19.

Table No. 4.19. Status of Crop Production in CIE Region during last 10 years

Sr. No.	Particulars of major crop	Total decrease of crop production in last 10 years
1	Rice	60%
2	Cashew	60%
3	Coconut	40%
4	Local vegetables	50%
5	Areca nut	40%
	Average Gross Produce Reduction	50%

(Source: Report “Agriculture Production in Quepem Taluka, Goa” for last 10 years by Zonal agriculture officer, Cuncolim-Goa.)

The Tabulated data obtained was further subjected to analysis and represented graphically in a line chart in Fig. 4.22 for better appreciation of the trend.

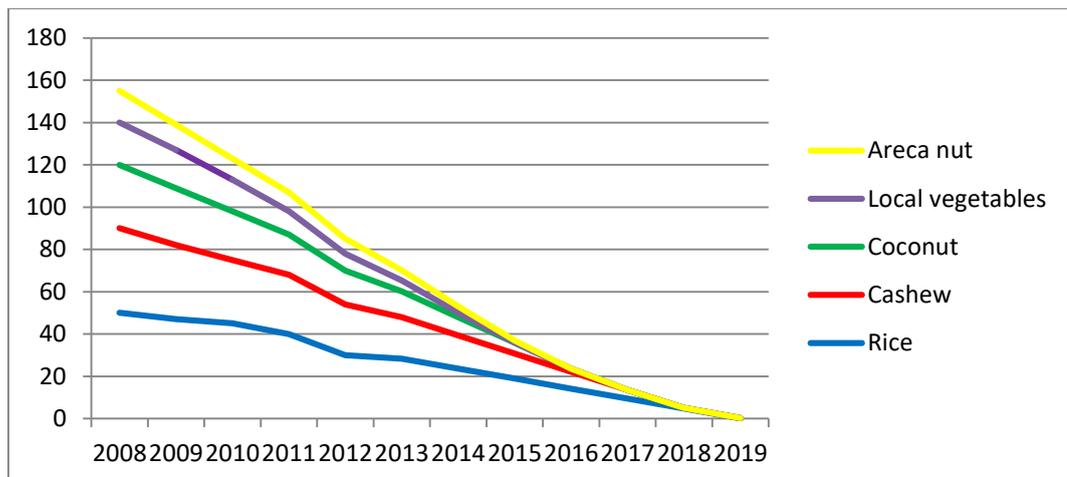


Fig No. 4.22: Trend of reduction in crop production in CIE region during last 10 years.

The Cuncolim region is basically an agricultural area with thrust are being paddy field, coconut, cashew, etc. The agriculture and horticulture is main occupation of the region besides villagers are working in the factories. The people in the area were traditionally depending on the various water bodies in the region for irrigation purpose. However, during last ten years it is reported that due to the pollution of water bodies in region including ground water, the agriculture crop production including horticulture crop is substantially decreased due to HW being dumped all over the region. The researcher has

found that there is a decrease in 50 % of average gross produce in crop production in last 5 years. It is also observed that due to this the people in region has started abandoned the agriculture activities and instead relying upon the public distribution system of the Government.

4. Impact on Health of Animals, Fish etc

The Data is collected from the Veterinary Officer of the Animal Husbandry Department of Cuncolim , and Department of Fisheries , through personal interview, examination of officials report of last five years titled "Annual Report of Milk Production" and the Economic Survey of Goa, "Fishing Survey of Goa" of last five years has been examined . Having obtained data from the year 2008 to 2019, this study has tabulated the data pertaining to the animal mortality, reduction in Milk production and fish mortality in the radius of 5 km of CIE region and their status. This data is reflected in Table No. 4.20.

Table No. 4.20. Status of Mortality of Animals, Fish and reduction of Milk production during last 10 years in CIE Region

Sr. No.	Particulars	Total increase during last 10 years
1	Mortality of Animals	30%
2	Reduction in Milk Production	40%
3	Fish Mortality	40%

(Source: Economic Survey of Goa for last 10 years)

The Tabulated data obtained was further subjected to analysis and represented graphically in a line chart in Fig. 4.23 for better appreciation of the trend.

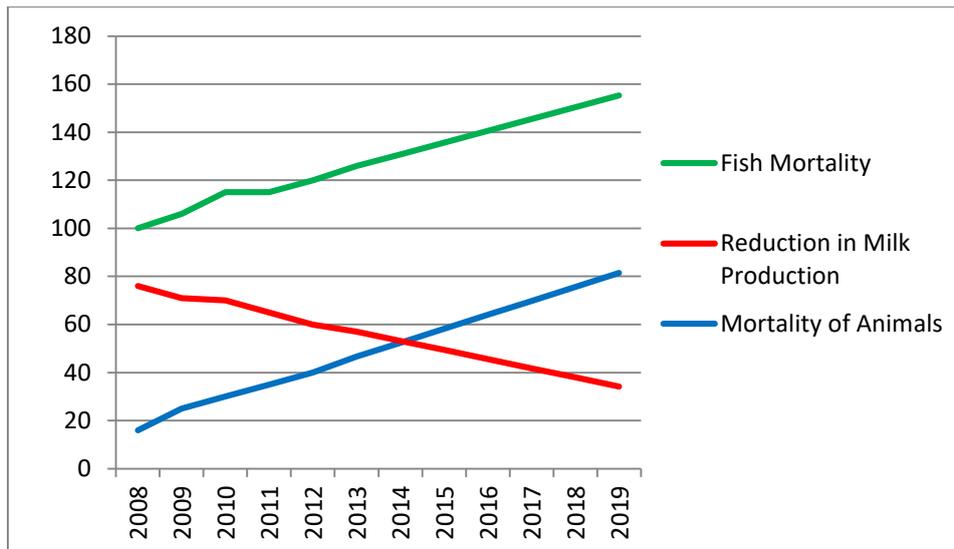


Fig No. 4.23: Trend of Mortality of Animals, Fish and reduction of Milk production during last 10 years in CIE Region

The Hazardous waste dumped in indiscriminate manner has seriously affected the livelihood of the people living in the vicinity of the Cuncolim Industrial estate region. The statistical analysis of the data collected from personal interview with the officials of the Fisheries Department, Animal Husbandry Department and Economic Survey of Goa reports pertaining to last five years are used by the researcher. The statistical data analysis indicates that the mortality of animals such as pets, poultry birds. etc. has been increase in last 5years.The mortality of animals has been increase by 30 % which has also lead to reduction in milk production by 40 %. Further the fish mortality has been also reduced by 40% over last ten years' time period.

The research shows that due to blatant violations of the HW management rules by the Industries and failure on part of the Authorities to enforce and implement the said rules has led to indiscriminate and illegal dumping of the HW in all vacant spaces of the region. Moreover, the HW is being dump near human habitation, water bodies etc. which has affected the Ecology as well as the Human life. The water bodies are highly polluted. Crop production, horticulture production has been decrease. Growth of plants is retarded. The human life is at peril. Number of chronic ailment is increase in the area. All these problems have been arising on account of the unscientific and unsafe handling and disposal of the hazardous waste by the Industries operating in the Cuncolim Industrial Estate.

5. Impact on Health and Hygiene of People:

The Data is collected from the Health Officer of the Health Department of Cuncolim, and through personal interview, examination of officials report of last five years titled” Annual Report of State Health Mission” and the Economic Survey of Goa, of last five years has been examined. Having obtained data from the year 2008 to 2019, this study has tabulated the data pertaining to the certain parameters of Health in the radius of 5 km of CIE region and their status. This data is reflected in Table No. 4.21.

Table No.4.21: Health Indicators of CIE region for last 10 years.

Sr. No.	Parameter of Human Health and Hygiene(Number of patients)	Total increase during last 10 years
1	No of OPD patient	40%
2	Chronic Illness	40%
3	Skin diseases	30%
4	Respiratory diseases	30%
5	Other diseases	20%

(Source: Annual reports of Goa State Health Mission, Directorate of Health Services, Government of Goa)

The Tabulated data obtained was further subjected to analysis and represented graphically in a line chart in Fig. 4.24 for better appreciation of the trend.

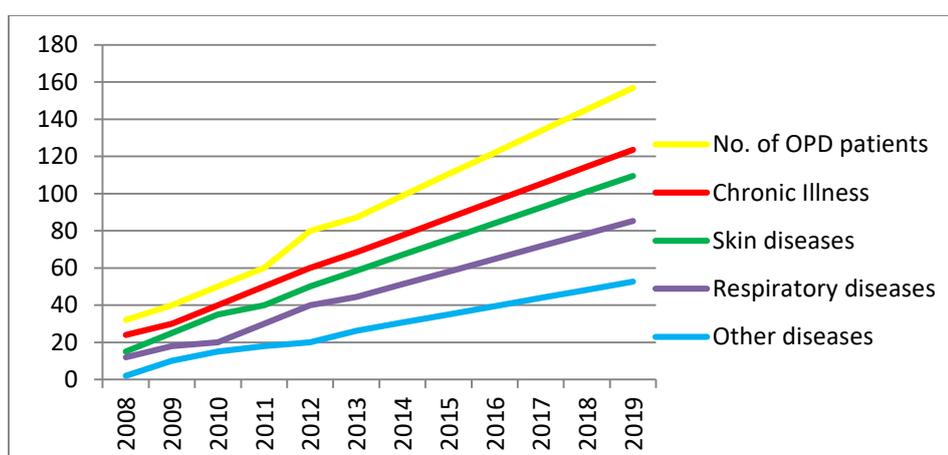


Fig. 4.24: Change in Health Indicators during last 10 years in CIE region

The Hazardous waste dumped in indiscriminate manner has seriously affected the health

and hygiene of the people living in the vicinity of the Cuncolim Industrial estate region. The statistical analysis of the data collected from personal interview with the officials of the Health Department, and the Economic Survey of Goa reports pertaining to last five years are used by the researcher. The statistical data analysis indicates that the certain kind of health related problems are being noticed such as chronic ailments, respiratory problems, problems due to drinking of polluted water etc. The patient visiting the OPD of Health Centre Cuncolim has been drastically increased to the extent of 40% in last 10 years. The percentage of increase in number of patient with chronic illness has been increase by 40 %. Also the percentage of increase in number of patient with skin diseases and respiratory disease has been increase by 40 % which has also lead to reduction in milk production by 30 %. There is a rise of 20% in patient suffered from the other diseases due to close contact of HW during last ten years' time period.

4.8.6. The Analysis

The Industries operating in the CIE generates considerable amount of generation of HW which comprises of around 70 % of the total HW generated in the State of Goa. The reason for such a huge quantum of HW generation in one Industrial estate out of all 22 Industrial Estate is due to unregulated permissions granted to red category polluting Units in CIE. Nevertheless, this Industrial Estate was earlier away from human habitation but in early nineties human habitation started growing in the vicinity.

Due to no control over this industrial estate there were many HW generating started in this area. However most of the units are either small scale or Medium scale proprietary or partnership units started by Individuals. There are no technical personnel being employed by these units. The result is hardly any Units knows about the specific Rules to deal with the HW which has further resulted in unsafe and unscientific dumping of HW in the area which has put the life and Environment at peril in the area.

There exist huge dumps of HW in CIE at various locations. Besides this the day today waste generated by the units is being added. The subject matter of HW Management is highly scientific and technical in nature. Majority of Industries do not have special cell to handle and treat this waste. Neither had they engaged any technical staff for the specific purpose. The situation is even worst with the authorities such as GSPCB, Department of Environment etc. These authorities do not have any special section or cell to deal with the

matter regarding HW. The complaints received are not properly addressed. The reason being cited most of the time is shortage of Staff.

The Authorities such as Department of Environment, Labour Department, Collector & DM (South), Industries Department, etc. has hardly acted upon the complaints of illegal dumping of the HW in CIE area. They preferred to forward the complaints to the GSPCB citing that the matter comes under the purview of the GSPCB. Even in those cases where serious violations are observed by the GSPCB, no concrete decision is being taken. In majority of the cases it has issued the plain directions to the companies to comply with the Rules. No further inspections are carried out to ascertain the compliance of the directions. Recently FIR is being filed to push the buck.

Thus it is crystal clear that the authorities empowered to control, prevent and eradicate the hazard, environmental pollution, destruction of ecology, etc are miserably failed to act against the illegal and indiscriminate dumping of the Hazardous waste being dumped by various Industries in Cuncolim Industrial Estate region. The concerned hazardous waste Industries to the extent of 80% of them have not treated and disposed of the HW in safe and scientific manner thereby grossly violated the Hazardous Waste Management Rules.

4.9 ADEQUACY OF THE EXISTING HAZARDOUS WASTE MANAGEMENT RULES TO ADDRESS AND TACKLE THE ISSUES AND PROBLEMS ARISES OUT OF THE UNSAFE MANAGEMENT OF THE HAZARDOUS WASTE IN INDIA: GENERAL ASSESSMENT

4.9.1. Adequacy of the HWM Rules to tackle the problems faced by the HW.

The Ministry of Environment and Forest, Government of India has notified the Hazardous Waste Management Rules from 1989 onwards with the objective to put in place an effective mechanism in India to regulate the generation, collection, storage, transport, treatment and disposal of hazardous wastes both indigenously generated and imported . However, considering the fact that growing concerns arises in last ten years due to illegal dumping of the HW in India and also taking into account that all over the country there is a growing debate over the problems of HW the researcher has sought opinion of representatives of stakeholders to test the adequacy of the Rules to ascertain the adequacy

of these rules.

The Researcher has sought the opinion of Authorities and stakeholders which are directly associated with enforcement and management of HW in India such as Goa State Pollution Control Board, Department of Environment, Department of Industries, GIDC and NGT through questionnaire with respect to specific aspect ie adequacy of the present HW management Rules to tackle the problems in CIE region. The Table 4.20 indicates the responses given by various stakeholders to the question put forward to them regarding the adequacy of the existing Rules to combat the problem of the HW.

Table No. 4.22: Adequacy of the existing HWM Rules

Response		Q. How adequate are the HWM Rules to tackle the growing problems of HW in CIE?					
	Department of Environment	GSPC B	Judicial Members of NGT	GIDC	Department of Industries	Public, NGOs	Industries
Very Adequate	5%	5%	0 %	0 %	5%	5%	5%
Somewhat Adequate	10%	5%	0 %	0 %	10%	5%	10%
Less than adequate	20%	20%	0 %	15 %	20%	25%	25%
Not adequate	65%	70%	100 %	85 %	65%	65%	60%

(Source: Primary)

The Tabulated data obtained was further subjected to analysis and represented graphically in a pie chart in Fig. 4.25 for better appreciation of the trend by calculating the weighted average of all the responses

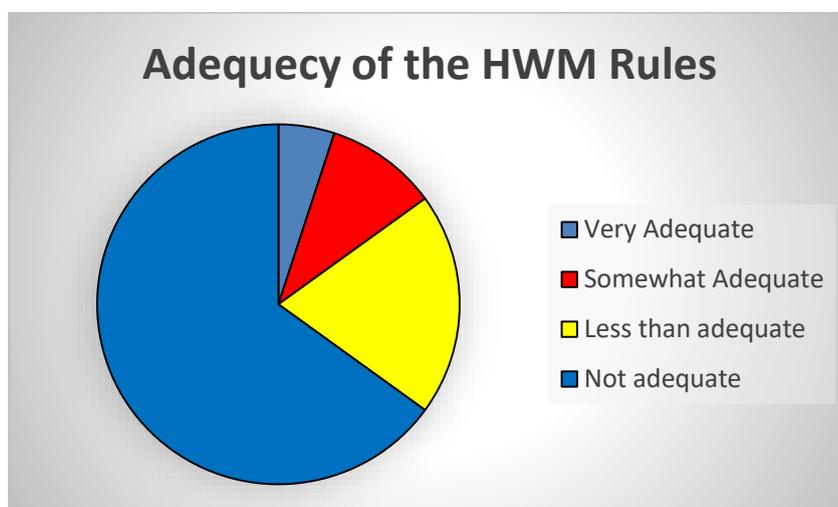


Fig. 4.25: Adequacy of the HWM Rules

Taking a bench mark of less than adequate to analyzed the adequacy of the HWM Rules, the responses shows that 85 % of the participants feels that the Rules are not adequate to tackle the growing problems of the HW in India.

4.9.2. Major amendments required in HMW Rules for effective management of HW in India

Before issue of notification of framing any Rules under the EPA, MOEF & CL issues a draft Notification through official Gazette inviting objections and suggestions from all persons and stakeholders who are likely to be affected by the same giving sixty days' time period to submit comments and objections, etc. The comments obtained under the RTI Act indicates that public has made suggestions to MOEF & CL. The major suggestions inter alia include Proviso for complete moratorium or ban on import of any kind of HW in India for 5 years, priority for disposal of legacy waste, Extended Producers Responsibility Provisions, Submission of Bank Guarantee to SPCB while seeking Authorization and Third Party Independent Inspection of Industries and disposal facilities. All these comments, suggestions are further analyzed seeking feedback of various stakeholders and enforcement authorities and indicated in following table:

Table No. 4.23: Adequacy of the existing HWM Rules

Response	No. of Respondents	%
Complete moratorium or ban on import of any kind of HW in India for 5 years	2000	90 %
Priority for disposal of legacy waste	2000	100 %
Extended Producers Responsibility Provisions	2500	80 %
Submission of Bank Guarantee to SPCB while seeking Authorisation for timely compliance	3000	75 %
Third Party Independent Inspection of Industries and disposal facilities	2000	70 %
Provision for Suspension of Operation by SPCB in case of violation as a stop gap measure	2000	80%

All though the responses received from the participants indicates that the Rules are inadequate to tackle the growing situations in the CIE region on account of the HW, the researcher has further analyzed the loopholes in the HWM rules by finding the possible reasons for failure to provide remedy and desired results by the Rules.

4.9.3. Failure to provide specific standard Technology as approved by the Government for management of the HW:

It is pertinent to note that the HWM only provides (Rule 4) that the operator i.e. Industry etc shall treat and disposed of the HW in safe and scientific manner. This provisions have been blatantly violated by the Industries and instead various Industries has resorted to handing over of waste to recyclers or storage of waste in the guise of recycling or secured storage.

The Researcher has sought the feedback of Authorities such as Goa State Pollution Control Board, Department of Environment, Department of Industries, CPCB etc. through questionnaire with respect to specific aspect ie Whether HWM Rules required to specify that whether the Technology as approved by the Government for disposal HW should be

adopted? The Table No. 4.24 indicates the responses given by various stakeholders to the question put forward to them regarding the adequacy of the existing Rules to provide the standard technology for management of HW.

Table No. 4.24: Inadequacy of the HWM Rules

Response	Q. Whether HWM Rules required to specify that the Technology as approved by the Government for disposal HW should be adopted?					
	Judicial Officers	Department of Environment	GSPCB	Department of Industries	Public, NGO	Industries
Yes	0 %	5%	5%	5%	5%	5%
Not aware	0 %	5%	5%	5%	60%	5%
No	0 %	5%	5%	5%	25%	5%
Rules should have specific provisions	100 %	85%	85%	80%	10%	85%

The Tabulated data obtained was further subjected to analysis and represented graphically in a pie chart in Fig. 4.26 for better appreciation of the trend by calculating the weighted average of all the responses. The majority i.e. 85 % of representatives of stakeholders were of the opinion that the Rule should not have a general statement that the HW generated by the Industries shall be disposed of in a safe and scientific manner and rather a specific provisions need to be incorporated wherein the generator is put to strict responsibility to obtain approval from the Government in respect of specific technology for effective HWM.

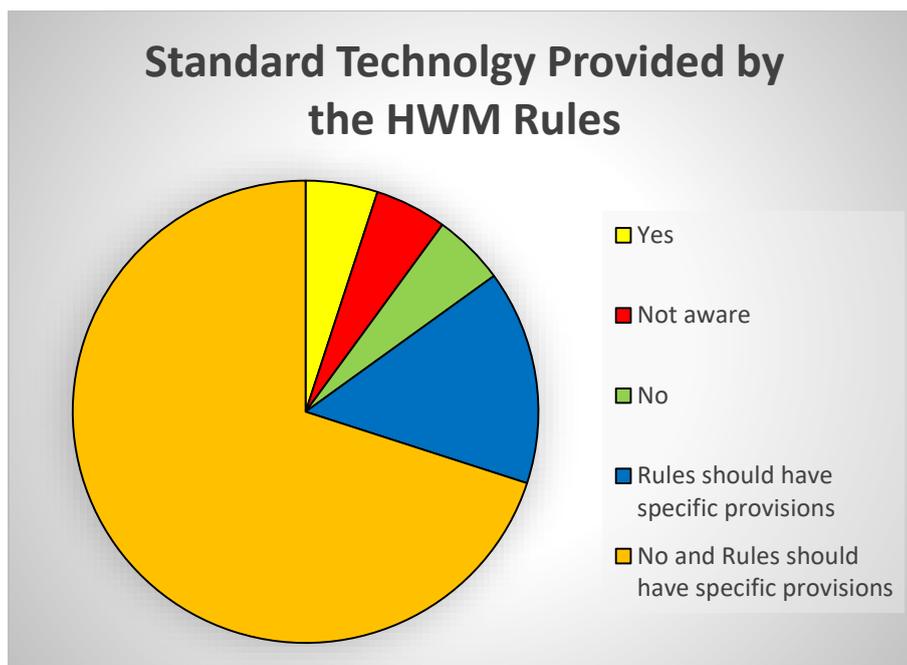


Fig No. 4.26: Inadequacy of the HWM Rules

Analyzing the responses received from the stakeholders and authorities, the majority of the participants (85%) feels that the Rule 4 should have been provided very specific technologies for scientific treatment of the HW. During the personal interview with the chairman of GSPCB, Directors of Department of Environment and Department of Industries they have further stated that this Rule should be specifically amended to provide the specific technology to be used by the operator or Industry. If such specific amendment is carried out it shall put the responsibility upon them to carry out the management of the HW in terms of the standard operating system. This will also enable the authorities to enforce the provisions of the Rules in later and spirit.

4.9.4. Non Availability of the Penalty Clause in the HWM Rules.

The HWM rules notified from 1989 does not have an offence and penalty clause, as such the violator need to be booked under section 16 and 17 of the Environment Protection Act,1986(EPA). However, provisions are of general nature for all kind of offence pertaining to the environmental violations. Due to this circumstance the present HWM Rules are often criticized as toothless Rules.

The Researcher has sought opinion from the Authorities such as Goa State Pollution Control Board, Department of Environment, Department of Industries, Members of NGT and Judicial Officers through questionnaire with respect to specific aspect ie Whether non

availability of the offence and penalty clauses leads to ineffective management of HW in India ? The Table 4.25 indicates the responses given by various representatives of the Enforcement Agencies to the question put forward to them regarding the same.

Table No. 4.25: Need for offence and Penalty Clause in HWM Rules

Q. Whether non availability of the offence and penalty is detrimental to effective management of HW in India ?							
	Judicial Officers	Department of Environment	GSPCB	Department of Industries	Public, NGO	Police	Lawyers
Yes	100 %	90%	90%	80%	35%	95%	95%
Not aware	0%	5%	5%	5%	45%	0%	0%
No	0%	5%	5%	15%	20%	5%	5%

(Source: Primary)

The Tabulated data obtained was further subjected to analysis and represented graphically in a pie chart in Fig. 4.26 for better appreciation of the trend by calculating the weighted average of all the responses



Fig No. 4.26: Need for offence and Penalty Clause in HWM Rules

The responses received by the Researcher through questionnaires and personal interactions with the officials of the NGT, Goa state Pollution Control Board, Goa Police, Department of Environment, MOEF & CL etc. are analyzed further to evaluate the deterrent effect of the present HWM Rules so as to book the violators for the offences such as illegal dumping

of the HW, causing nuisance and annoyance, causing environmental pollution and above all for violating the provisions of the Rules. The researcher noticed that the participant officials/representatives to the extent of 90% opined that due to non-availability of the offences and penalty clause in the present HWM Rules framed from 1989 onwards, the authorities cannot specifically book any violators in India for violations of HWM Rules in the respective area or jurisdiction and instead has to rely upon the general provisions of the EPA.

Though there have been several incidents on record of non-compliance of HW Regulations resulting in discharge of HW in environment, the powers vested with the CPCB/SPCBs/PCCs for recovering environmental damages under Rules 23(1) has not been invoked.

Only three States namely Maharashtra, Telangana and Madhya Pradesh have reported prosecution actions under Section 15 of EP Act, 1986. There are hardly few cases where the SPCBs/PCCs have invoked provisions related to revocation and/or refusal of authorization in view of the observed non-compliances.

Inspection report, mostly is not attached along with the authorization granted. Wherever inspection reports have been attached such reports lack in required information for appraisal.

SPCBs/PCCs shall invoke the powers conferred under clause 23 (1) and (2) of the Rules, against the violators. CPCB has already issued guidelines for Liability assessment, for invoking Rule 23(1) and (2) of HW Rules. CPCB shall also take consequential actions under Rule 23.

As per the said guidelines wherever directions under section 5 of the E(P) Act have been issued by CPCB, noticing environmental damages. party due to improper handling and management of the hazardous and other wastes, and non-compliance respectively. CPCB has already issued guidelines for Liability assessment, for invoking Rules 23(1) and (2) of HW Rules. CPCB shall also take consequential actions under Rule 23

As per the said guidelines wherever directions under section 5 of the E(P) Act have been issued by CPCB, noticing environmental damages. The habitual and serious defaulters

shall be prosecuted under provisions of the Environment (Protection) Act, 1986. Other alternative regulatory actions including refusal and revocation of Authorization can also be explored following the due process.

Non-compliance to be documented while processing authorization for renewal or inspections in order to invoke powers of refusal or revocation of Authorization as per Rules.

4.10. OVERALL ANALYSIS

In India, the amount of generation of HW is increasing rapidly with the rate of 20% per annum due to setting up of new Industrial Unit, expansion and up gradation of existing units thereby defeating the very basic objective of minimization or reduce of HW in terms of the HWM Rules. Moreover, the HWM framework is not well defined. The legacy waste lying all over India is 30 MMT which is unattended and out of which during last ten years only 1 MMT of legacy HW is disposed and out of which 0.7 MMT is disposed of by Gujarat state alone.

It is observed that, only 30% of the total HW generated in India is actually being disposed of in terms of HWM Rules and around 70% of the total waste is unattended leading to gross violations of the HWM Rules India. The scenario in the State of Goa is not different. Only 40% of the total HW generated in India is disposed of in terms of the Rules and around 60% of the total generated HW is lying unattended leading to serious violations of the Rules in the State. In the Cuncolim Industrial estate which is only critical polluted Industries there exists a legacy waste dump of around 40000 MT of HW which is not treated and lying idle for more than 5 years.

The disposal scenario in CIE is very poor and only 20% of HW generated in CIE is disposed of and rest 80% is dumped like an abandoned waste. So also 100% of the waste imported in Goa is utilized by this Industrial estate alone as a raw material and for metal recovery by around 20 Industrial Units. The resulting toxic impact due to ineffective HWM can be reduced or substantially minimized through safe and scientific HW management practices involving setting up of common facilities like TSDF or CHWTDF with active private-sector participation. The Public participation is nearly nil in setting up of TSDF or

CHWDF. The Order of effective HWM shall be in priority order, waste avoidance having precedence over reduction; recycling, treatment and finally disposal. The Industry and Public who are the key stakeholders in entire chain of HWM needs to be taken into confidence while devising the entire framework of HWM in India so as to tackle the growing protest. The entire strategy shall be focused around the principle of reduction of waste and ultimately safe and scientific management of HW with active participation of all stakeholders

In brief the HWM scenario in India is as below: -

1. No. of HW generating industries in India: 43938
2. Total generation of HW in India: 10 Million Metric Tons Per Annum (MMTA)
3. Land fillable waste: 4.200 Million Metric Tons Per Annum(MMTA)
4. Incinerable waste: 0.800Million Metric Tons Per Annum(MMTA)
5. Recyclable waste: 4.000 Million Metric Tons Per Annum(MMTA)
6. Legacy waste lying: 30 Million Metric Tons Per Annum(MMTA)
7. Disposal rate of HW in India: 30%
8. Total generation of HW in Goa: 35000 MTA
9. Legacy Hazardous Waste lying in Goa :550000MTA
10. Disposal rate of HW in Goa: 40 %
11. Total Generation of HW in CIE: 20000 MTA (57% of total HW generated in Goa)
12. Legacy Hazardous Waste lying in CIE: 40000 MTA
13. Disposal rate of HW in CIE: 20%

(Source: Primary)

The Hazardous Waste Management Rules 2016 are the only specific rules available in India to deal with the handling, treatment and disposal of the Hazardous waste. The researcher has found through the statistical analysis that the present HW management Rules failed to tackle the growing problems of illegal and indiscriminate dumping of the HW in CIE region and the serious issues arises thereof pertaining to the environmental pollution, health and hygiene etc.

CHAPTER-V
Conclusion and Suggestions

CHAPTER V

5. CONCLUSIONS AND SUGGESTIONS

With the rapid growth of Industrial sector especially manufacturing sector in India the generation of HW will be an inevitable scenario posing serious threats to ecology and environment due to challenges and concerns associated with its safe and scientific disposal mechanism. This has become a global issue and even the developed countries are struggling to handle it. Situation is not different in India but alarming. Non availability of an accurate, reliable and correct data of HW which is lying (legacy waste), generated, transported, disposed of and imported is the biggest challenge in the entire chain of HWM in India. Secondly, an assessment of associated risk and scientific HWM is a crucial link in India between Environment Protection, Law and Policies governing HW and Pollution free environment. Real time data on Hazardous waste generated in India and data on HW lying unattended which is called as HW National Inventory can be used to determine the risk levels and same will facilitate the policy makers and authorities to devise urgent measures which are required to be adopted for safe, effective, efficient and scientific management of this modern time waste¹⁹³.

A total of 130 sites in India have been identified as “contaminated” and need immediate action to clear this site. Further, 200 sites are identified as “Near Contamination” where proactive steps need to be taken to avoid further contamination. In the state of Goa, one site i.e. Cuncolim Industrial Estate is designated as “Critically polluted Industrial Estate due to HW where urgent remediation is required¹⁹⁴.”

While an Industrial development will continue to be the dominant catalyst of social-economic development and biggest source of generation of employment as well as enhanced living and prosperity in multiple way, possible ill effects on ecology and environment cannot be eliminated and be simply ignored. No Industry in the World can claim a status of Zero Waste Industry or 100% compliance to environmental norms, which is only a myth. In fact, with the complex Industrial process which is followed today

¹⁹³ Central Pollution Control Board, Parivesh Newsletter-2019, New Delhi, 2019 at P.13-18.

¹⁹⁴ Environmental System- Vol.1, No.1, Newsletter Envis. Centre No..01, C.P.C.B., New Delhi, 2019

it is impossible to have a full compliance of norms of safe and scientific management of Hazardous waste in any country, including that of developed countries even after utilising a state of art approach and setting up of high tech plants.

However, with the strict compliance of the HWM Rules the adverse impact of this waste on ecology, environment and human life can be minimised substantially if not eliminated completely. As technical advancements taking place in the Industrial and R&D sector, there are scientific and technical solutions available to this effect which will definitely minimised the irreversible and irreparable damages of our ecosystem due to HW. However, what is required is a collective effort on part of all stakeholders and stringent regulatory compliance.

Thus there is a requirement of an urgent attention to be given to the ever growing problem of management of HW in India with a considered approach of whole revamp of current strategies and policies being adopted. Minimisation (Reduction), Recycling and Reuse of HW should have priority over the safe and scientific disposal of HW while implementing environmental protection policies and principle of sustainable development in India. Technologies are available in advanced countries wherein the waste can be commercially used (wealth from waste concept), however achieving a total pollution free environment status will be a distant dream at least for now. Setting up of only so called eco-friendly industries will never happen since the role and importance of manufacturing industries override all sectors in this world.

We all are aware today that pollution is a serious problem. Out of all the pollutant, HW pose substantial, potential and immediate threat to living beings and environment and this study has shown that the continuation of indiscriminate dumping of HW in India is a life threatening environmental hazard and as such the effects and extent of the pollution due to HW, in respect of waste which is already generated and lying unattended, waste which is continuously generated on day to day basis and future waste which will be definitely to be generated will be of great concern for entire mankind.

5.1. AN OVERVIEW OF THE STUDY:

This research focuses on four important issues in respect of testing of effectiveness of implementation of the Hazardous Waste Management Rules in India with special reference to the State of Goa, namely the extent of violations of the said Rules by the Industries, the resulting impact on Environment and Ecology, non - performance or failure on part of various authorities in terms of non-implementation of the Rules and lastly analysing the adequacy of these Rules and present Regulatory Framework in arresting the associated problems.

In the introductory chapter the Researcher has provided a brief scheme of the study followed by reasons, need and significance of the study. The focal point of the study is analysing the scenario of HW management in India vis-à-vis the effectiveness and adequacy of the HW Management rules framed time and again and regulatory framework thereof.

The concept of the generation of HW and also its management evolved over the period of time and advancement taken place around the world is enumerated in the Second Chapter. This chapter further highlights the sources of generation of HW, classification, categories of HW and overall the world's scenario and how the world realised this as a global issue leading to BASEL and other important convention thereby further emphasising on government policies, involvement of various stakeholders in shaping of this field is elaborated. The Second Chapter has examined the international legal machinery, which includes the legal systems of HW Waste Management in the United States of America, Europe, Australia, Canada, China and Singapore etc., most of which are pioneered in developing a state of art waste management facilities especially in the field of HWM.

The safe and scientific management of hazardous waste which comprises of a planned strategic sequence right from generation of waste till disposal involved a long, complex and techno-legal and scientific approach with a stringent legal restrictions at every stage. The purpose of effective hazardous waste treatment and disposal is to minimise or reduce the chemical composition or characteristics of waste form and make it permanently de-active or inert so as to ensure that it do not have any further impact on the environment. As technology is getting upgraded, new and innovative methods of disposal of HW are

introduced and being adopted in developed countries whereas developing countries like India is trying to follow the same under technology transfer agreements. Researcher has examined the policies, government strategies and regulations and International conventions governing the legal aspects of the HW in the world with a special reference to the international success stories as well as import of HW illegally via cargo ships.

International experience in respect of HWM indicates that in order to achieve the overall success in safe and scientific disposal of HM it is imperative that a practical and achievable Policy and Strategy is a must which inter alia should incorporate financial sustainability of the infrastructure, affordability, institutional and legal reforms and capacity building and public acceptance. What is required is a broad spectrum of reform in terms of infrastructure, capacity building and cost effectiveness and social acceptance criteria in policy making process. A substantial increase in HW infrastructure including modernization of entire chain of collection, transport, treatment and disposal facilities is required to meet the large anticipated increase in the quantity of hazardous waste produced, regardless of whichever modern hazardous through industrial process.

The researcher has identified four predominant challenges for management of hazardous waste in India: -

1. Lack of disposal options for certain type of HW from processes like chemical activities, pharma, power plants, textiles and tanneries, heavy metals etc. The industrial units are forced to either store the waste at their own premises (captive storage) or resort to open dumping rather than its scientific disposal.
2. Lack of standard acceptable mechanism for disposal of HM. The most popular option used in disposal of HW is incineration facilities and same are not in compliance with international regulations. In fact, there is no laid down standard technology for disposal of HW in the world and every industry is left to its own wisdom.
3. Lack of proper inventory of hazardous waste treatment facilities which provide correct and real time data of number of generator, quantum of waste being generated, quantum of legacy waste, details of transportation, treatment and disposal of HW. Availability of National inventory of waste is prerequisite of any policy decision in effective HWM.

4. Lack of policy in developing a cluster based treatment facilities which could provide a common facility for group of industries in handling the disposal collectively thereby the issues of cost, land etc. could be minimized.

Researcher has further examined the concept of HWM in the Indian context with specific reference to the State of Goa in Chapter III. In India the amount of HW in various Industrial Areas is increasing at the pace of 15% per annum and the rate of the same in the state of Goa is around 10 %, whereas scientific treatment and disposal of HW is at declining trend which is a serious concern.

In the study area comprising of various Industrial Estate's, Industrial corridors, Parks and SEZ's there is a rampant open and indiscriminate dumping of the Hazardous Waste and increasing health hazards and both are closely correlated and the problem is becoming worse day by day.

The lack of accurate and real time data on HW or incomplete national inventory of HW is one of the serious concern wherein even the Supreme Court of India has pulled the Central Government as well as all the State Government's. There is no mechanism available with the MoEF &CL and CPCB to assess and monitor the data of HW generated, transported, disposed or imported. Certain specific sectors of industries which are predominant in India and also play pivotal role in economic growth and employment such as petrochemicals, pharmaceuticals, chemicals, fertilizers, textiles and general engineering are major generator of HW and constitute around 60% of the total hazardous wastes generated in India.

Due to its peculiar chemical composition, non -scientific treatment and disposal of hazardous waste is posing serious threats to human life, the ecology and environment. For instance, hazardous waste that is openly dumped or stored may leach into the groundwater, thereby causing contamination of a ground water table and aquifers and region's water supply which in turn have particular serious consequences production of agriculture and Horticulture and water source. Untreated HW contains serious contaminants like heavy metals and carcinogens which can even affect genes thereby posing coupling threat to future generations like reproductive abnormalities, physical deformities, cancers, chronic

ailments, permanent disorders and even deaths. HW is generated at every moment in India coupled with import of HW as a raw material and for metal recoveries.

The researcher has observed that certain definite reasons and limitations factor like lack of government will, lack of scientific and technical knowledge pertaining to treatment and disposal, ineffective enforcement mechanism, technical incompetence, and inadequate trained and qualified manpower, financial restrictions, protests from Public for setting up of CHWTDF are the reasons for ineffective implementation and enforcement of HWM Rules and India is struggling with the growing challenge of managing and implementing the Hazardous and other Waste (Management, Handling and Trans boundary Movement) Rules, 2016 and the desired aim and objectives of waste minimization and reduction, and disposal maximization appears to be only a mirage and a distant dream.

In Chapter IV researcher has specified and analysed the empirical data collected using statistical tools. In the empirical study, structured and unstructured interviews, RTI applications, meetings and discussions and questionnaires were circulated amongst various stakeholders, enforcement authorities, etc. to collect information. The primary information collected has been examined by converting the responses into useful data and further analysed using statistical tools to test and verify the hypothesis postulated based on findings and subsequently making relevant suggestions. Equally, secondary data available in various forms has been analysed.

5.2. CONCLUSIONS

5.2.1. Testing of Hypothesis

Hypothesis No. 1:

The Hazardous Waste (Management and Handling) Rules framed from 1989 onward are being violated by the Industrial units operating in India thereby posing dangers to the Environment and the public at large.

The cumulative inference drawn from the data analysis, both doctrinal and empirical for last ten years as indicated in Chapter IV elaborates the status of HW generating Industries in India vis-à-vis status of HW management, status of complaints of violation of HW Rules, Quantum of loss assessed in terms of productivity of soil and pollution of water in

the vicinity of dump yards, human and other animal's mortality and other incidental aspects.

The growth of generation of HW in India is coupling and resulting effect of growth of manufacturing sector in India which is growing at the rate of 10 % per annum. So also expansion and diversification of existing industries which is to the tune of 5 % per annum results into generation of more HW. Such hazardous waste due to expansion of the existing units is to the tune of 4 % per annum. However, so is not the case with the rate of disposal of HW. The number of violations of the HW Rules is showing incremental growth every year by 25%. Whereas, the status of rate of disposal of HW is alarming and is only 30 % of HW generated in India is disposed of in terms of the HWM Rules. What happen to 70 % of the total HW and legacy waste is extensively discussed in Chapter IV. Thus the concept of minimization of waste which is one of the objective set out in the Rules is totally defeated.

In short 70 % of the total HW generated in India is not at all disposed of. There is no specific enforcement plan implemented by any of the authorities so as to effectively and consistently detect the violation, compel the timely corrections of all detected violations and deter violations by all regulated entities. These has led to considerable and irreparable loss to ecology and environment besides loss to livestock, agriculture, human life and degradation of environment. The cases reported of deterrent action includes issue of closure directions (only 5%), cancellation of approval (6%), disconnections of water and power supply of industry (14%) in respect of violators are dismal.

In order to test this hypothesis, the Researcher has also analyzed the implementation and enforcement clauses of the HWM Rules and the analysis is indicated here below:

a. Gross violations of the Rule 4 of the Hazardous Waste (Management, Handling and Transboundary Movement) Rules 1989 as amended, by the Industries operating in India.

The Rule 4 of the Hazardous Waste Management Rules 1989 notified by the MOEF provides that the Industries generating HW shall handle, treat and dispose of the waste in a safe and scientific manner. The objective and rationale behind this rules is to ensure that the ever-growing Industrial Hazardous waste is managed in most scientific manner so as

to prevent any kind of ill effect on ecology, environment and life. The same provisions are continued even in the amended Rules of 2000 and 2016. However, the analysis carried out by the researcher indicates that 70% of the Industries who are generation of Hazardous Waste are openly dumping the waste either in open spaces, low lying area or just being dumped anywhere in the open spaces available close to the Industrial areas without any scientific treatment and disposal, thereby posing serious threat to human health, animals, environment and ecology in these areas.

It is to be noted that the industrial operation is a continuous process so also the generation of hazardous waste is a rippling effect of this process. As long as the Industries will run they will continue to generate the hazardous waste. Almost in 80% of notified areas in India there is already untreated and indisposed Hazardous waste to the extent of nearly 5 lakh MT (legacy waste), whereas the Industries operating in said study area are also continuously generating HW of substantial HW.

The trend is that only 30 % of the HW generated per year in India is treated and disposed of and balance HW to the extent of 70% is being dumped in open spaces, low lying area, etc. in gross violations of the Rule 4 of the Hazardous Waste Management Rules 1989. These Industries are even expected to continue their operation further and so also to generate huge quantum of HW in future.

By and large 70% of the total operating Industries operating failed to handle, treat and dispose of the Hazardous waste generated by them in a safe and scientific manner as provided under the Hazardous Waste Management Rules. Further these Industries do not have any place left with them to even store the future generated hazardous waste. Analysis of data by the Researcher clearly indicates that there is a gross violation of the Rule 4 HW Management Rules by the industries operating in India and Goa thereby posing a great threat to the human life, animals, and Ecology and environment and life at large.

b. Gross violations of the Hazardous Waste (Management, Handling and Transboundary Movement) Rules 1989, as amended Rules by the Industries operating in various Industrial Estate, Industrial corridors and SEZ has led to serious threat to human life, animals, and Ecology and Environment.

The Hazardous Waste contains more than 2000 different substances, compounds and chemicals which are toxic in nature and are likely to create serious problems for the environment and human and animal health if not properly handled, treated and disposed of. The highly toxic chemicals found in HW can causes contamination of soil, groundwater table and air pollution. At Present 70% of Industries in India are disposing of the HW in unscientific way by just open dumping leaving HW unattended, which attracts animals, birds, rodents, fleas etc., create unhygienic conditions like odour, release of airborne pathogens toxic elements in Environment.

In the State of Goa there is slight improved version with 40% of Industries in Goa are disposing HW in violations of the Rules. Whereas 60% of Industries are adopting the mechanism of simply storage or open dumping. This also exposes the workers to toxic fumes and unhygienic conditions. The improper storage, handling, transportation, treatment and disposal of hazardous waste result in adverse impact on ecosystems including human and animal life and plants. It has affected soil productivity and even in many cases have polluted the groundwater permanently and make it unfit for drinking, irrigation and for general consumption.

Improper management of hazardous waste poses a serious threat to the health of people, the environment, and ecosystem. Some threats are immediate such as chemical accidents, spills of hazardous waste on or close to transportation routes, air pollution, water pollution and illegal hazardous waste dumping. Even when hazardous waste is managed and disposal of in a careful manner, it may still pose a serious threat. For example, toxic hazardous waste can leak from a poorly constructed or improperly maintained landfill. Such waste contaminations can sometimes irreversibly, impact plants, wildlife and humans and even an Environment disaster.

It is evident from the Research that 60% of the total water bodies such as wells (public as well as private), lakes, perennial springs, river line which are main source of fresh water for centuries in the vicinity of such industrial area are contaminated and are polluted due to the presence of traces of heavy metals released in the ground water due to open dumping of hazardous waste by various industries operating in India. People are advised by the Health Department not to use such wells and perennial water tank due to severe contamination.

There were several cases reported by the Veterinary Dispensary, located in area regarding deaths of cows, buffalos, goats, sheep's etc. due to drinking of this contaminated spring or ground water. Even due to open dumping of HW all over the Industrial areas has reduced the Agriculture and Horticulture production such as Rice, ground nuts, locally grown vegetables, other agriculture and Horticulture produce which is to the extent of 30%. The researcher has found that Agriculture crop production including the horticulture production has substantially dropped in last 10 years considering the fact that ground water is contaminated in the area due to heavy metals present in the HW and also due to accumulation of HW in soil which has caused retardation of growth of agricultural and Horticultural crops.

This research study has also shown from the status of Health Indicators Analysis and Health Impact Assessment of the people residing in the vicinity of Industrial areas data collected through the Health Department that the human life is also being at peril. The result of the violations of the HWM Rules are analysed by the Researcher and it is evident that the number of OPD patient visiting the local Health centre around Industrial area are increased by 30% in last ten years whereas there is also rise in peculiar symptoms or diseases suffered by the residents in the vicinity of the Industrial areas such as chronic illness (rise by 40%), skin diseases and respiratory diseases (rise by 40%). It is also observed that certain other kind of specific diseases on accounts of HW are also increased by 20% during last ten years. The Rule 4 categorically emphasised responsibility upon the generator of HW to manage the HW in a safe, efficient, effective and scientific way at every stage.

Thus it can be concluded that due to gross violations of the Hazardous Waste Management Rules and specifically Rule 4 of the said Rules by the Industries operating in the State of Goa there is an irreparable damage being caused to the human life, animals and Ecology and Environment in the Industrial Estate region of Goa.

c. Failure of the Authorities to effectively enforce the Hazardous Waste Management Rules in the State of Goa.

Important dimensions necessary for efficient management of the HW management problem lies in appropriate cost-effective technological options, appropriate pricing for the polluters, financial management and strong institutional mechanism to enforce the Rules.

To address hazardous waste management issues, Government of Goa through its various agencies such as Department of Environment and Goa State Pollution Control Board is responsible for implementing the Hazardous Waste Management Rules in the state of Goa. The HW Rules is a mechanism or framework taking care of the waste from its source of generation till its safe and scientific disposal. The Department of Environment, Government of Goa through the Goa State Pollution Control Board is primarily responsible to enforce the provisions of the Rules and other line Departments such as Department of Industries, Labour, Factories and Boilers, Goa Industrial Development Corporation and Health Department to cooperate and provide all assistance to ensure all the time that the Health, Hygiene, Environment and Ecology is protected all the time.

Critical evaluation of the functioning of the Department of Environment and Goa State Pollution Control Board indicates that no serious efforts are being made to tackle the problem of Hazardous waste in Industrial Estate's located in Goa. Inspection of the Industrial Estate in Goa is being conducted by GSPCB only in a span of 2 years. Whereas, majority of Industries are not being inspected even once during last 2 years. Nearly 30 % of the Industries operating in Goa have not obtained the mandatory Authorization from the GSPCB as required under the HWM Rules.

Both these authorities are situated at the distance of around 40km to 70km away from the Cuncolim Industrial Estate, thus it takes about 90 minutes for the authorities to reach the area in case of serious complaints. No efforts made by the GSPCB to set up a district or Sub-District office. The GSPCB laboratory is not equipped to test the vital parameter of HW and is mostly used services of external laboratories to test HW samples. Thirdly both these authorities do not have adequate technical and scientific staff strength which is one of the major delay on part of them to address the issues of HW management in Industrial region. Simultaneously the researcher has also analysed the role played by other line Departments and authorities in the matter.

It is a shocking to know that none of the authorities such as Department of Industries, Labour, Factories and Boilers, Goa Industrial Development Corporation and Health Department have visited the Industrial area in last 2 years to ascertain the status of HW dumping in the area. Neither there is any single co-ordination or joint meeting of these authorities held anytime in last 10 years to tackle this serious issue. The authorities even

failed to take action against the defaulting units. The number of criminal cases filed is only 10 during last 10 years. Whereas the order of suspension of unit by GSPCB during last 10 years is only 5 and closure direction issued to only one unit in Goa during the said period.

The Department of Environment's (DOE) failed to discharge relevant regulatory functions effectively. It also affects the Department's ability to demonstrate the appropriateness of its decisions and actions. Missing and unreliable information, stemming from weaknesses in information management systems and poor record keeping, meant that important aspects of the DOE's role could not be reliably audited. Consequently, the DOE is poorly informed about how effectively it is managing hazardous waste. The response to complaints is slow with no logical conclusion. The other areas where non-compliance is seen are growing legacy waste and such sites, no control over import of waste, inadequate state inventory on HW, illegal disposal.

Environmentally sound management of hazardous wastes in the State of Goa would require immediate setting up of Common Hazardous Waste Management Treatment and Disposal Facility (CHWTDF) for industrial clusters all over the Industrial estate. However, neither these Departments has provided any technical support to the small scale industries nor any efforts being made to set up a CHWTDF. The Labour Department is not fully aware of the responsibility laid down upon it under Rule 5 of the HW Rules, 2016 and has not taken any action towards safety of workers. The Regulatory authorities do not interact on a regular basis.

The Central government has suggested setting up common facilities for Industries in Goa. However, no such facilities are set up in the state. Thus it is crystal clear that these Authorities merely acted blind spectators and miserably failed to implement the HW Management Rules in Goa.

Thus it can be concluded that the various Authorities of Government of Goa has failed to discharge its duties to impose the provision of the Hazardous Waste Management Rules 2008 in Goa.

d. The Rules framed are inadequate to control and prevent the degradation of environment, etc. caused due to improper management of the Hazardous Waste by

the Industries operating in India and also in the State of Goa.

The Hazardous Management Rules only enforce responsibility upon the industry to handle and manage the Hazardous waste in safe and environment sound manner. This being the only specific executive Rules on the subject matter are not at all exhaustive in nature.

It is pertinent to note that these Rules should be read in conjunction with the Environment Protection Act 1986, Air Act 1981 and Water Act 1974. However, per the Hazardous Waste Management Rules in isolation are not sufficient and effective.

The Data analysis conducted by the researcher clearly indicates that only 60% of the Industries are aware about the Rules. The rules do not provide for punishment for the violations of the provisions and offences thereof. There is no regulatory framework provided in the Rules except that of the State Pollution Control Board whose responsibility is only to grant or rejection of the Authorization to the applicant Industry. Nearly 85% of the participants representing various enforcement agencies say that these Rules are inadequate to tackle the problems and issues arising out of the improper HW management.

These participants also opined that these rules do not provide any standard and specific technology for management of the HW. Only one industrial unit is directed to close its operation during last 10 years in Goa for violation of HWM Rules, whereas in only 5 cases the order of suspension of operators is issued by GSPCB during last 10 years. No direction is issued by the State Government under section 5 of the EPA during last ten years.

Considering these facts, the researcher concludes that the present Hazardous Waste Management Rules 2008 are inadequate to control and prevent the degradation of environment caused due to improper management of the Hazardous Waste by the Industries operating in Industrial Estates of Goa.

To summarise, priority in India is given towards setting up of more and more industries with greater focussed on industry output. Whereas, the waste management concept in Industries is always looked as a burden. Very less resources i.e. to the tune of 3 % of the Annual Budget in terms of trained and dedicated manpower and financial allotment is done towards management of HW. Enforcement of Rules are often treated as harassment to the

Industrial growth and often been raised at the Industries Association as detrimental to ease of doing business in India. There is no technology for total elimination of hazardous waste generation, however certain measure can reduce the quantum of generation of waste and use of alternate mode like wind energy, solar energy in Industrial processes can ease the pressure on natural resources thereby also reduces the quantum of HW, which will result in less emission of hazardous waste thereby moving towards green economy.

Remediation of critically polluted Industrial estates and cleaning and disposal of legacy waste has to be the most priority area's in the approach towards safe and scientific management of HW. Industries responsible for causing repeated pollution should be blacklisted and ordered to close the operation permanently. Where it is not possible to track the polluters remediation of such sites to be carried out through Waste Exchange Banks/Collection Centres. A setting up waste to energy and common facilities for disposal of HW (through TSDF or CHWTDF) is a need of time before we encountered major environmental disasters in India. However, the number of TSDF or CHWTDF and their disposal capacities are very low to the extent of only 10 % of the annual waste generated. Whereas, in the State of Goa there is no single TSDF or CHWTDF being set up. The result indicates that the hypothesis No. 1 is proved.

Hypothesis No. 2:

“The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016” suffer from certain basic shortcoming and as a result, they have become ineffective in protecting the environment generally and health of the people in particular.

For effective planning and devising a suitable strategy towards it, one of the prerequisite is to have a reliable data of exact estimation of HW generation, the sources and characteristic of HW and risk assessment data on HW disposal and also forecast of future generation of HW.

There is no specific HWM Policy or a well-defined proper and systematic waste management system in place in India or Goa and no such provisions made in the Rules to this effect. Selection of proper technology has been an issue throughout since 1989 when the rules were first notified and this aspect is not given any effect in the new Rules notified in 2016. Majority of Judicial officers in India (95%) which include judge of High Courts,

Judicial Members and Expert Members of the National Green Tribunal, and enforcement officers of State Pollution Control Boards feels the Rules are merely administrative in nature which has only a force of Government Notification and requires four major category of amendments, viz. i. Strengthening of compliance mechanism, ii. Remedial actions; iii. Suspension of operations; and iv. Penal actions. However, all the four aspects are lacking in the Rules of 2016.

Nearly all judicial member and Expert Members of NGT (96%) feels that insisting upon the Bank Guarantee from the Industry as a pre requisite towards compliance of HW Rules 2016 should be duly incorporated in HW Rules thereby making it mandatory for the applicant industry to submit the same to the SPCB/PCC. The Rule 12 (1) categorically imposed prohibition on prohibits imports HWs in India for the purpose of storage or disposal. However, Rule 12 (2) is an exception that HW can be imported in India as a raw material for industries involved in metal recovery, co-processing and reuse. Thus, the Rules of 2016 moreover allows import of HWs in India in the guise of raw materials by various Industries. The empirical analysis indicates that the import of HW in India is growing every year at the rate of 15 % whereas in the state of Goa the import of HW is growing at the rate of 6% up to 2015 and thereafter has shown a declining trend from 2016 till 2019 at the rate of -5%.

Moreover, Rule 15 which considered such trans boundary movement of HW an illegal the Rules of 2016 failed to achieve the objective laid down where minimisation (Reduce) of generation of HW at the source level plays the pivotal role. On an average the total quantum of waste imported under this provision of Rules is 1.2 MT per annum whereas after recovery of metal around 1MT of HW is added annually to around 7.2 MTA already generated HW. This cycle further continues every year leading to new category of generation of HW by way of import. This is the biggest loophole of these Rules. Majority of Members of the NGT, official of SPCB's & CPCB, customs Department and State Government feels (90%) that there shall be a complete moratorium of at least 5 years through the amendment to the Rules of 2016 thereby imposing a complete ban on import of HW in India.

Inadequacy and effectiveness of the Rules of 2016 are further analysed using empirical data and nearly 90% of the members of the NGT, Judges of High Courts, CPCB, SPCB

feels that there is a need of amendment to the HW Rules of 2016 wherein they have suggested inclusion of standard operating practice and Standardised protocol in the Rules.

The enforcement authorities of the State Government such as SPCB's, Labour Department, Industries department's and Environment Department has also pointed out that these Rules have inherent defects and provisions shall be made for third party Audit (85%) and extended producers Liability (EPL) Provision in the Rules (95%). None of the state is yet to introduce a deposit refund scheme system.

Issues associated with effective management of HW in India are further examined which inter alia include mechanism of collection and storage, handling and transportation, treatment and disposal of HW is examined in detailed. Even in the 21st Century most of the stakeholders are unaware of the specific provision on HWM in India. Out of the total stakeholders of 3000 who were interviewed, contacted 40% are unaware about the Rules and majority of them (80%) are mistaken HW with either solid waste or plastic waste. There are 25 common hazardous waste treatment facilities (CHWTF) operating in 12 state of India. Nearly all (100%) of the officials of MoEF & EL, CPCB, SPCB's and NGT are of the opinion that every state shall set up the CHWTF and the mandatory provisions shall be made to that effect in the Rules. The major reasons which are hindering set up of such common facilities include protest from public around vicinity of site (70%) and lack of funds (20%). Thus public awareness and sensitisation are the keys in management of HW in India. On disposal front majority of stakeholders (95%) feel that the management of HW involved scientific and technical aspects and experience from the developed nations in terms of treatment and disposal and innovations in the fields would be of great advantages in case if the same is adopted in India.

Thus the hazardous waste and other substance (Management and Transboundary) Rule 2016 failed to achieve it desired result of minimization (Reduction) of HW in India and also failed to set up an effective enforcement mechanism in place without provisions for any specification Hazardous Waste Management Plan/ Strategy in place with a top down approach. As such based upon the detailed study and analysis of data both doctrinal and empirical, it is concluded that the hypothesis No. 2 is also proved.

5.3 SUGGESTIONS

Manufacturing sector of India is a thrust area identified by the Government of India as well as most of the State/UT Government's. This sector is a focal point of most of programme and policies launched by various Government's. The Government of India has introduced various mission mode flagships programme such as "Digital India", "Ease of Doing Business", "Make in India", "Pradhan Mantri Kaushal Vikas Yojana" and "Skill India" coupled with impetus to Foreign Direct investment, which are predominantly focussed on economic development of India through manufacturing sector.

Naturally, these policies are aimed towards increase in production capacities of the industrial units by expansion of their present capacities and setting up of new industries in India and same will ultimately lead to generation of huge quantum of HW in India. Moreover, Government of Goa has also notified the Goa Investment Policy 2014 with main objective to provide employment to 5000 people per year through development of Industrial sector with a target of investment of Rs.25000 crores in next five years. No doubt that the economic scenario of India is mostly depending on the manufacturing sector and various strong initiatives of the Government both at Central and State level will enable and increase the number of Industries in India at a rapid space.

Equally and simultaneously there will be an expansion of existing manufacturing capacities of the existing operating units. This will further increase the generation of HW in India which is to the tune of 15% every year at National level and around 10 % growth in the State of Goa. However as suggested, immediate proper attention is required during storage, segregation, transportation and disposal of hazardous waste, in a planned and sound manner. This is required with utmost priority so as to achieve the desired result of safe and scientific disposal of Hazardous waste in India as well as Goa.

Based upon the detailed study and analysis of data both doctrinal and empirical, following are the suggestions made by the researcher for effective and efficient management of Hazardous waste and Rules thereof:

1. Framing of Waste Specific Comprehensive National policy on Hazardous Waste Management in India:

Presently there is no National policy on HWM in India. HWM needs a multidisciplinary approach and subject is equally growing continuously at even international level. Any waste management policy has to be locally adaptable and sustainable in India considering its large and diverse geographical regions and demographic pattern. For its effective implementation the Policy shall have an incentive driven approach with active Industry-Public participation as a key taking into account the unique and specific challenges of India as a Developing Country in the Industry sector. The policy shall further promote use of clean technology and allocate necessary resources, funds, manpower and expert pool.

2. Publication of National Inventory of HWM in India:

The MOEF & CL shall publish with the provisions for real time data on HW generated, transported, treated, disposed and imported in India within a period of 6 months. Such real time data will enable the respective SPCB's/PCC's to assess the risk and Government to take various policy decisions connected with safe, efficient, effective and scientific management of HW in India.

3. Priority for disposal of legacy waste:

The accumulated HW which is lying unattended shall be disposed of in a definite time period of 6 months. So also confiscated consignments of illegal imported HW should be treated and disposal of in a safe and scientific manner. Contaminated dump sites to be remediated urgently.

4. Review of current Rules:

a. The Hazardous and Other Wastes (Management & Trans boundary Movement) Rules, 2016 has outlay guidelines to ensure prevention, minimization, recycling and safe disposal of hazardous waste do require major amendments. Most of the provisions of these Rules are generic in nature. The Central Government through

Ministry of Environment, Forests and Climate Change may consider for amendment to the Rules of 2016 to include with respect to every stages of HWM chain i.e. Handling, transportation, treatment and disposal of HW by the generator, inspection and enforcement mechanism with overall co-ordination and monitoring through electronic and GPS tracking by State Pollution Control Boards at State levels and Central Pollution Control Boards at National level. This will enable the Central Government to have a uniform and integrated approach for management of HW in India.

b. These new Rules do not have any provisions for treatment or disposal of the existing HW which may be called as a legacy waste i.e. already generated waste which is in lakhs of tones lying abandoned in various Industrial Estates/corridors or open space in India. First and foremost, priority should be given for treatment and disposal of this legacy waste in a safe and scientific manner. Moreover, CPCB should give specific directions to all the State and UT Government to treat and disposed of this legacy HW in the first instant with a definite time period of around 2 years and to seek a time bound action plan and compliance report thereof. Necessary provisions to that effect be made in the Rules itself.

c. These rules also require amendment to make it mandatory for the applicant Industry to submit a Bank Guarantee while submitting application for Authorizations to the SPCB which in turn will ensure that in the event if the applicant found to be non-complying with the Rules and or directions of the enforcing authorities, the Bank guarantee shall be forfeited. Such stringent provision like deterrent financial of loss of will act like a pre assurance to ensure precautionary and corrective actions within the negotiated timeframe.

d. Third party monitoring by utilizing the services of panel of experts outside the regulatory mechanism has shown great results in the developed countries like USA. The Rules shall provide a specific third Monitoring Mechanism or surprise Check for inspection and verification of disposal mechanism and its efficiency as the subject of HM management is highly scientific and technical in nature.

e. Extended Producer Responsibility shall be made mandatory in the Rules: Based upon the polluters pay principal, the responsibility of the producer of the HW for the end-of-life of the HW generated by it, improve the entire life cycle of HWM and also impact caused on Environment and Life due to indiscriminate dumping of HW. The role of each stakeholder in the cycle of HWM should be clearly emphasized in the rules itself so as allow any scope for further interpretation.

5. Speedy disposal of all cases pending related to HWM in India.

Unlike the Solid Waste, the toxic effect of the HW on ecology and environment is immediate and not silent. As such the action required to mitigate the ecological balance due to HW should be also immediate to curtail the associated problems. In order to speedily disposed of around 900 PIL WP pending before the various High Courts and Supreme Court regarding violations of HWMR in India shall be transferred to the respective circuit benches of the NGT so speedily disposed of these cases and effective monitoring thereof.

6. HWM is to be Thrust area in terms of Waste Management Strategies of the Government of India:

While Municipal solid waste and plastic waste management has gained considerable attention due to it being one of “Swachh Bharat Abhiyan’s” primary objectives, component for management and treatment of hazardous waste through Community and Industry participation should also be incorporated in this mission. Regular coordination between MOEF & CL, CPCB, SPCB’s, and PCC’s shall take place to review the progress in WM.

7. Adoption of Energy from waste Concept: -

There has been a technological advancement for safe storage, handling, transportation, treatment and disposal of HW. Energy-from-waste is a crucial element of waste management because it can possibly reduce the volume of waste and help in the converting the waste into renewable energy. Thus Waste to Energy Plant shall be given an independent identity as Industry thereby inviting investment

in this sector on public private partnership or annuity basis or under any economic model for a viability of such units in India. Approvals for such energy plants should be granted on a fast track basis.

8. Setting up of dedicated complaint Management cell within SPCB's:

The Hazardous Wastes Rules do not have a mechanism such as imposing fines or penalties that could be laid upon on non-complying industries. Power through requisite amendment in the Environment Protection Act, 1986 should be made to empower SPCBs and CPCB to impose penalties and fines under the polluters pay and precautionary principle. So also there are no dedicated complaint redress mechanism within SPCBs to respond and address the specific complaints of violations of HW Rules of dedicated complaint redressed mechanism with a quick response inspection team shall be constituted in all SPCB/PCC to deal with specific complaint of violation of HW Rules in the respective State /UT.

9. Strengthening of regulatory mechanism:

Regulatory Authorities like the National Green Tribunal and SPCB's/PCC's are facing various administrative challenges and financial restrictions like shortage of trained and qualified staff, shortage of funds, administrative and infrastructure issues, delay in getting approvals from Ministries, etc. are directly associated with effective control and enforcement of the HWM Rules in India. Government of India through MoEF & CL shall devise a "general enforcement sequence" for all SPCBs to maintain uniformity in its enforcement and taking all environmental cases of violations of HWR to its logical conclusions.

In furtherance of this all posts which are lying vacant in National Green Tribunal, MoEF & CL (HW Division), CPCB and SPCB/PCC should be filled immediately. A special division should be set up in all SPCBs/PCCs to monitor the HWM in the respective State. All dormant circuit bench of NGT including a Western Zone Bench, Pune which caters the Goa State shall be made operational with immediate effect so that all pending cases of Environmental damages including violations of HW Rules in the state of Goa are disposed of in a time bound manner. One nodal officer be appointed in each SPCB/PCC to exclusively oversee the compliance of

rules.

10. Implementation of Success stories:

The HWM aspects did not differentiate between developed, developing and under developed countries and all were placed in equal footings in terms of its science, technology and legal aspects. It's encouraging to know that there are various success stories in management of HW in the European Union, Canada and Singapore, where certain types of HW can be used as an alternate fuel. The Government of India may devise a suitable policy in this regards to adopt these success stories in India.

11. Infrastructure development for public health and protection of the environment:

All the State/UT Government shall mandatorily earmark an Industrial plot of sufficient area in every Industrial Estate /Zone /Corridor/SEZ for setting up of common facilities for HW disposal (CHWTDF). Necessary infrastructure should be provided by concerned State/UT Governments and the facility could be given a legal status like a society wherein every generator of HW in the area should be asked to join as a member who will dispose of its HW in this facility only. This will reduce burden on individual unit to dispose of its HW at unit level due to space constraints and also save cost on setting up of individual facility. This can be run with active participation of local bodies and NGOs with the revenue cluster model.

12. Specific Ban or Moratorium to be imposed on import of Hazardous waste in India:

Considering the fact that industries operating in India have already generated HW and out of which substantial quantum of HW is lying unattended and in addition a huge amount of waste is generated every second due to manufacturing process, such import of HWs expands the definition of HW and add to it non waste items. Thus the most pragmatic and practical approach would be to impose a moratorium or ban for certain period like say five years for import of HW in India preventing India for being used as a 'Dumping Destination' in garb of 'Recycling Destination'.

13. Development of HWM Plan at Regional Level:

Implementation of Compulsory Hazardous waste management plan with top down approach shall be laid down by Government of India to make all the authorities and generator accountable. All the Industries who have not obtained mandatory Authorization shall be directed to obtain the same within 3 months' period by conducting industry interaction Program at Regional level.

14. Setting up of common Hazardous waste treatment facility in every District of India:

Industries being the major employer in India are set up in every District of India leading to the generation of hazardous waste. Steps should be taken to set up a common Hazardous waste treatment facility in each District of India with strict monitoring of these facilities by implementation of Hazardous waste management plan and individual facilities / self-disposal method should be discouraged since it will harm systematic operational approach could naturally lack. And that would lead to air, water, soil and underground water pollution. Therefore, quality attention, management and monitoring are possible only in common treatment facility.

15. Awareness sensitization and Training on handling and disposal of HW should be provided to all the line staff of Industries so as to ensure minimum impact of HW on Worker's Health and safety Personal protective care, interaction programme training and support to these staff assure efficient interventions and safety of manpower associated with the disposal mechanism.

16. Industrial Estate wise disaster management plan to manage incidents of accidents should be made compulsory by all the State/UT Governments to ensure displacement and closure of HW site in the event of any casualty.

17. Setting up of R & D Facility in the field of HWM:

At present there is no specially designated Research Facilities in the field of HWM. Promoting R & D in this field will give additional benefits with research in the field

of state of art technologies, expertise and innovations. CPCB shall create an expert pool in the field of remediation, restoration and scientific management of HW.

- 18.** Moving away from mind set of “Waste “to “Resource” with Designation of a single body at the Central and State Level taking ownership of Management of Waste in India.

There is no clear identification of a single authority/body for monitoring and enforcement of waste Rules at the Central and State Level, which lead to gap in accountability and on many occasions lead to situation of overlapping of role and diffusion of responsibilities. This has led to ineffective compliance and shirking of statutory role. However, such bureaucratic tussles and inefficiency leads to only degradation of Environment on account of human failure. It is proposed that single body at the Central level say CPCB and SPCB at State level who shall exclusively monitor and enforce the provisions of Waste Rules in India and reduce the threats posed to Ecology and Environment. These body shall be equipped with technical and scientific clear mandate, adequate funding and technical and scientific manpower.

- 19.** Creation of public awareness and capacity building program in the field of HWM:
The HW is the deadliest waste amongst all category of waste and hardly any specific awareness program is being run by either Central government or state government therefore it is essential to devise a Public awareness campaign and it should be operated by Government at regional level on potential health hazards and threat to the ecology and environment on account of specific nature and toxicity associated with this category of waste. In addition to this capacity building program for official of cell enforcement authorities as well as Industries shall be carried out by CPCP in terms of scientific, technical and legal aspects of HW.

- 20.** Inventorisation and Updating of inventory of HW generated, transported, treated and disposed of on real time basis at all levels viz. National, State/UT and regional level:

No reliable or credible records available with any of the agencies or statutory authorities of State/UT regarding the quantum of HW generated and its disposal. The real time software solution shall be developed at the level of CPCB with provisions for continuous updating of HW related data which will give correct version of HWM in India for policy decisions.

21. Preferred Policy approach of prevention of generation of HW to be adopted:

A complete reduction of HW generation of HW or Zero waste concept is never possible, but the approach towards promotion of environmental friendly Industries will be a paradigm shift in near future. Promotion of the sector specific Industries which generates minimum HW with Extended producer's responsibility/liability imposing mandatory responsibility on the generator of waste to either adopt modernization, innovation, state of art facilities or innovative technologies in the production line to achieve a minimal generation of HW or to utilize the HW generated for the co-processing or in house power generation facilities or effective recycling technologies. Government of India should promote collaborations between various stakeholders including domestic and foreign to set up large scale common hazardous waste treatment and disposal facilities on revenue generation or PPP model.

22. Prevention of illegal traffic of HW and international Alignment:

In order to address the large scale issues of illegal trade of HW including cross border trade and International trade of HW, it is imperative to establish the networks and cooperation between all the regulators and stakeholders. At country level, between MOEF & CL, CPCB, customs and police is very essential. At the State level cooperation between SPCB, Police, Industries, etc. is must and at international level there has to be cooperation between Interpol, World Customs Organization and International Network of Environmental compliance. The matters connected with scientific disposal of HW should in line with approved international best practices (BASEL Convention EN 50625-series, PACE Guidelines).

23. Industry – Public – Government Cooperation:

In India even after seventy year of Independence there is no specific zoning guidelines for sitting of Industries taking into account the natural resources and

habitation. Government of both Central and State Level shall frame such guidelines highlighting locations of setting of industries based upon habitation, ecologically sensitive areas and other restricted Zones. Central Government shall formulate a comprehensive guideline for sitting of HW generating Industries in India with the provisions for enforcement & Monitoring of the HWM in the country. Special earmarked zone for sitting of Industries will reduce pressure on water sources, ecologically sensitive areas and habitation from the plausible hazard of HW.

24. While making a Goa State specific suggestion for implementation of HWM in the State is concerned the Goa Waste Management Corporation which is the statutory waste management corporation constituted by the State Government in 2019 shall be made fully operational with dedicated manpower and powers with assigned mandate for HWM in the State of Goa. The State of Goa has initiated action in 2016 to set up a common hazardous waste treatment & disposal facility at Pissurlem, North Goa, however besides obtaining an Environment clearance for the proposed work no further progress is made thereafter. The State of Goa shall take an immediate step to expedite setting up of the said facility which will cater at least 80% of the total HW generated in the State of Goa.

25. Implementation of the Framework of Extended Producers Responsibility:

At present there is no framework of EPR in respect of the HWM in India. In order to ensure environmentally sound management of HW in India, the Central Government shall introduce a framework of EPR so as to ensure that the HW generating Industries in India shall channelize the HW generated for its reuse, recycle and disposal and obtain an authorization in prescribed form from the concerned SPCB and also file an EPR-annual returns to that effect. Necessary amendments shall be introduced to this effect by MoEF and CL in the existing Rules of 2016. The said EPR can be implemented either individually by the generating Industry or collectively through group of Industries or through authorized recyclers depending on EPR Plan approved by State Pollution Control Board or Pollution Control Committee, as the case may be.

26. Establishment of circuit Benches of the NGT in India.

At present the Principal Bench of the NGT located at New Delhi is in operation and all 4 Benches, viz. Western Bench, Southern Bench, Eastern Bench and Central Bench are dormant on account of vacancies of Judicial Members and Expert Members of the NGT are fallen vacant. The matters before these four benches are decided via video conference mode. It is imperative that all these Benches are made operational by the MOEF & CL and so also more Benches and circuit benches are set up in the States having maximum number of complaints of violations of various Environmental legislations and Rules including the HWM Rules in the State's like Gujarat, Karnataka, Andhra Pradesh, Uttar Pradesh including a circuit benches in the State like Gujarat, Madhya Pradesh, Rajasthan, Kerala and Goa.

27. E Governance initiatives in HWM.

In order to have an effective and efficient control over every stage of the HWM, it is imperative that the E Governance mechanism is made in the Rules itself making it compulsory for registration of every step involved in the HWM thereby making centralized command and control center in every SPCB/PCC for monitoring entire process.

28. Creation of "State Level Environment Protection Force" is a need of hour to protect should be the environment from the environmental degradation and pollution. These forces must be provided with powers to file cases of violations of various environmental legislations before the concerned bench of the NGT and such violations shall be treated as a criminal offence with provisions for deterrent effects like severe punishment, fines, closure directions and forfeit of security deposits, etc.

29. The Industrial units which are generating high quantum of Hazardous Waste with less Employment potential and Revenue shall not be promoted and such category of units shall not be permitted or shall be categorized under the non-thrust area.

30. The Central Government shall immediately prepare a Standard Operating Procedure for containment and disposal of legacy Hazardous waste which is lying

unattended in various hotspots of India. Such waste need to be contained so as to prevent any further impact on ecology and environment and thereafter shall be disposed of in a sound and scientific manner within a prescribed time limit.

The Hazardous Waste Management is not the issue connected with only individual Industries but its impact is seen on entire mankind and the Environment as a whole. Even the Industries operating in one part of the world could have a remote impact on air, water, and ecology of another part. Protection of Environment is collective and continuous efforts. The global climate change is the evidence of this phenomenon. That is the magnitude of the hazardous waste and its impact on humanity and all kind of life on this earth. We have to accept the fact that total reduction of hazardous waste or zero waste Industry concept will never be achieved. What is required is required is to devise a binding framework for effective management of hazardous waste which include a definite role and responsibility upon all the stakeholders, enforcement authorities and the Tribunals/Courts with a stringent technical, scientific and legal control over every cycle or phase of the Hazardous Waste Management.

ANNEXURES

ANNEXURE I

IMPLEMENTATION OF THE HAZARDOUS WASTE MANAGEMENT (HWM) RULES WITH SPECIFIC REFERENCE TO GOA STATE AND CUNCOLIM INDUSTRIAL ESTATE(CIE), CUNCOLIM-GOA.

Questionnaire for the Authorities ie. Officials of MOEF & CL, CPCB, Department of Environment, GSPCB, Goa Industrial Development Corporation, District Magistrate, Health Officer, Police Inspector, Labour Inspector, etc who are involved in enforcement of the HWM Rules in their respective Jurisdiction.

(This questionnaire is designed to facilitate the assessment of the current situation of implementation of Hazardous Waste Rules in India.)
(Information is Optional)

Name of Officer & Designation:

Date:

Organization:

Kindly Tick mark the relevant option:

1. Are you aware of the specific Rules available for the management of Hazardous Waste generated by the Industries in India?
1. Yes 2. No 3. Don't know.

2. Are you aware of the serious Environmental Pollution in region of Industrial Estates in India due to haphazard dumping of Hazardous Waste by Industries?
1. Yes 2. No 3. Don't know

3. Are you aware that some notified Industrial areas in India are declared as a Critically Polluted Industrial Estate by Central Government due to serious

problems due to non-disposal of Hazardous Waste in a safe and scientific manner?

1. Yes 2. No 3. Don't know

4. Do you know that some Industrial Units in India/State of Goa are importing hazardous waste from abroad?

1. Yes 2. No 3. Don't know

5. Whether your Department is taking adequate steps to ensure that the disposal of HW generated in India/Your Jurisdiction in a safe and scientific manner?

1	Yes
2	No
3	Efforts are not Adequate
4	Don't know

6. Whether all the concerned Industrial Units have obtained all the requisite permissions from your Department which are essential as per the existing HWM Rules/Guidelines, etc.?

1	Yes
2	No
3	Some have not obtained
4	Don't know

7. Do you have any special cell or any dedicated staff to look after HWM in India/Goa/CIE?

1. Yes 2. No 3. Don't know

8. Whether your Department is conducting awareness programmes in India/Goa/CIE area in respect of disposal of HW generated in a safe and scientific manner?

1. Yes 2. No 3. Don't know

9. Whether the Central Government or State Government is having an Integrated Management Plan exclusively for HWM in your jurisdiction?

1. Yes 2. No 3. Don't know

10. Whether any stop gap or interim remedial or mitigation measures are being adopted by the State Government or your Department to control or prevent the immediate accident or hazard if occurred due to HW?

1. Yes 2. No 3. Don't know

11. Is there a co-ordination between your Department and other authorities / Department in dealing with this issue?

1. Yes 2. No 3. Don't know

12. How often routine inspection is carried out by your Department/Organisation to verify the position of disposal of HW in your jurisdiction?

1	Every Month
2	Every Six Month
3	Surprise Inspection carried out
4	No specific inspection is carried out.

13. What is an action taken by your Department in respect of any complaints or noncompliance which leads to pollution due to HW?

1	Inspection, Show cause Notice including closure of Industries
2	Directions issued to comply
3	Personal Hearing conducted
4	No Specific Action Taken

14. Whether your Department is having adequate manpower and technical resources to check and control the menace of HW in your jurisdiction?

1. Yes 2. No 3. Don't know

15. Whether discreet inspection is carried out by the officials of your Department/Organisation during inspection so as to verify the compliance of the HW Rules?

1. Yes 2. No 3. Don't know

16. What is the main reason for inefficient enforcement of HWM Rules in India in respect of safe and scientific treatment and disposal of HW generated in your unit?

1	No problem faced
2	Inadequate infrastructure /manpower/ Resources/ funds/space, etc
3	Lethargic attitude and lack of willingness by Industries/Authorities
4	Don't know

17. Whether there should be a complete ban on new industrial Units or their expansion in India so as to ensure that no new HW is generated?

1	Yes
2	No
3	Yes for temporary period till existing waste is disposed of.
4	Don't know

18. Whether import of HW shall be banned in India?

1. Yes 2. No 3. Don't know

19. What is the best solution according to you for combating the serious problem of HW in the region?

1	Setting up of Common disposal System by State
2	Closure of All Industries in CIE

3	Continuous monitoring by the Authorities.
4	No solution exists.

20. Any other issue or comments which you would like to highlight in the matter of Management of Hazardous Waste?

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THANK YOU FOR YOUR COOPERATION!

ANNEXURE II

IMPLEMENTATION OF THE HAZARDOUS WASTE MANAGEMENT (HWM) RULES WITH SPECIFIC REFERENCE TO GOA STATE AND CUNCOLIM INDUSTRIAL ESTATE(CIE), CUNCOLIM-GOA.

Questionnaire for the Industrial Units located in India /Goa/ Cuncolim Industrial Estate (CIE) which are generating Hazardous Waste.

(This questionnaire is designed to facilitate the assessment of the current situation of implementation of Hazardous Waste Rules in India.)
(Information is Optional)

Name of Officer:

Date:

Organization:

Kindly Tick mark the relevant option:

1. Whether your Industrial Unit is generating Hazardous Waste (HW)?
1. Yes 2. No 3. Don't know

2. Are you aware of the Hazardous Waste Rules notified by the Central Government for safe and scientific treatment and disposal of HW generated in your unit?
1. Yes 2. No 3. Don't know

3. Are you well versed with all the relevant provisions of the HW Rules pertaining to the safe and scientific treatment and disposal of HW generated in your unit?
1. Yes 2. No 3. Don't know

4. Whether you unit possesses trained staff and manpower for the safe and scientific treatment and disposal of HW generated in your unit?

1. Yes 2. No 3. Don't know

5. What is a mode of safe and scientific treatment and disposal of HW generated in your unit?

1	Scientific Treatment as per Rules
2	Temporarily Stored.
3	Given to other Industry for disposal
4	Dumped in open spaces.

6. Whether your unit strictly follows the treatment and disposal mechanism as specified in the Rules and guidelines issued by the authorities from time to time?

1. Yes 2. No 3. Don't know

7. Whether your Unit has obtained the Authorization required from the State Pollution Control Board/Committee (SPCB/PCC) for handling the HW?

1. Yes 2. No 3. Don't know

8. How often the official of SPCB/PCC visits your unit for inspection?

1	Every Month
2	Every Six Month
3	Surprise Inspection carried out
4	No inspection is carried out.

9. Whether discreet inspection is carried out by the officials of SPCB/PCC or any other Authority of your unit ?

1. Yes 2. No 3. Don't know

10. What is the main problem you faced for the safe and scientific treatment and disposal of HW generated in your unit?

1	No problem faced
2	No space available
3	Non availability of funds/ technology/ resources etc
4	No space available including funds, technology, resources ,etc

11. Are you aware of the fact that unsafe disposal of HW in the notified Industrial areas poses threat to Environment and Ecology in surrounding region?

1. Yes 2. No 3. Don't know

12. Are you aware of the fact that the water bodies and ground water in the region is polluted and declared as unsafe for drinking?

1. Yes 2. No 3. Don't know

13. Is there outcry by Public, NGO's and complaints/petitions filed etc. due to serious environmental degradation in the are due to haphazard dumping of HW in your area?

1. Yes 2. No 3. Don't know

14. Do you expect to generate more HW in future due to reasons such as expansion of unit etc. ?

1. Yes 2. No 3. Don't know

15. Whether Technical support is provided by the Government authorities to your unit for the safe and scientific treatment and disposal of HW generated in your unit?

1. Yes 2. No 3. Don't know

16. Any accident/damage/casualty etc. occurred in your factory premises due to handling of HW recently?

1. Yes 2. No 3. Don't know

17. Do you have accident spillage Plan/ Countermeasure Plan/ Disaster Management Plan in place in case of any casualty occurred due to handling of HW in your factory premise?

1. Yes 2. No 3. Don't know 4. Under preparation

18. Whether there should be a complete ban on setting up of new industrial Units or their expansion in your area so as to ensure that no new HW is generated in area?

1. Yes
2. No
3. Yes for temporary period till existing waste is disposed of.
4. Don't know

19. Are you aware of the fact that the Cuncolim Industrial Estate in Goa is declared as a Critically Polluted Industrial Estate by Central Government due to serious problems due to non-disposal of Hazardous Waste?

1. Yes 2. No 3. Don't know

20. What is the best solution according to you for combating the serious problem of HW in the region?

1	Setting Up of Common disposal system by State
2	Closure of All Industries in CIE
3	Continuous monitoring by the Authorities.
4	No solution exists.

THANK YOU FOR YOUR COOPERATION!

ANNEXURE III

IMPLEMENTATION OF THE HAZARDOUS WASTE MANAGEMENT (HWM) RULES WITH SPECIFIC REFERENCE TO GOA STATE AND CUNCOLIM INDUSTRIAL ESTATE(CIE), CUNCOLIM-GOA.

Questionnaire for the General Public residing in the vicinity of notified Industrial area in India/Goa/ CIE and Employees working in the various Industrial Units located in CIE.

(This questionnaire is designed to facilitate the assessment of the current situation and impact of HW in Cuncolim Industrial Estate Area)

(Information is Optional)

Name of participant:

Date:

Kindly Tick mark the relevant option:

1. Are you aware that the Hazardous Waste is being generated by various Industries operating in the various Industrial area in your region?

1. Yes 2. No 3. Don't know

2. Do you know that the HW generated in Industries is harmful to human beings, plants, Animals and the Environment?

1. Yes 2. No 3. Don't know

3. Do you know that specific Rules are available to ensure that the HW generated is treated and disposed of in a specific, safe and scientific manner?
1. Yes 2. No 3. Don't know
4. Is there any problem of environmental pollution in your area due to the Industries operating?
1. Yes 2. No 3. Don't know
5. Do you know that the Industrial Hazardous waste is dumped or stored in open spaces by various Industries operating in the various Industrial area in your region)?
1. Yes 2. No 3. Don't know
6. Do you know that the storing or dumping of Industrial Hazardous waste in open spaces by various Industries operating in the various Industrial area in your region is not permitted under the Law/Rules?
1. Yes 2. No 3. Don't know
7. Are you aware that the some of the Industrial estates are declared as one of Critically Polluted Industrial Estate in India by the Central Government?
1. Yes 2. No 3. Don't know
8. Are you aware that the Authorities like State Pollution Control Board/PCC/Labour Department, etc visits the various Industrial area in your

region to inspect and check the situation of Environmental pollution caused due to HW?

1. Yes 2. No 3. Don't know

9. Do you know about the authorities whom to approach or to file complaint in case of incident regarding dumping or storing of HW in open area?

1. Yes 2. No 3. Don't know

10. Whether there should be a complete ban on setting up of new industrial Units or their expansion in in Industrial area so as to ensure that no new HW is generated?

1. Yes 2. No 3. Don't know

THANK YOU FOR YOUR COOPERATION!

ANNEXURE IV

Feedback Survey Form to assess awareness of HW generated from Industries located in various Industrial areas in India (From general Public in the locality and employees of industries)

SR. NO.	QUESTION ABOUT HW	YES	NO	CAN'T SAY
1	Do you think HWM is a problem or issue in Industries.			
2	Do open dumping of HW causes diseases to human being.			
3	Whether Industries store and treat the HW generated.			
4	Are you aware of about health related risk caused by improper management of HW			
5	Does water and Air Pollution is caused due to indiscriminate dumping of HW			
6	Are you aware of the concept of 3r(Reduce, Recycle and Reuse) in waste management.			
7	Do you think there is a specific legislation for the disposal of HW			
8	Are you aware of the Regulator of HWM in India			
9	Do you know about specific rules governing HWM in India			
10	Have you come across any issues pertaining to HW in India			

THANK YOU FOR YOUR COOPERATION!

ANNEXURE V

LIST OF PUBLICATIONS

(I). PUBLICATIONS IN JOURNALS

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