NEGLIGENCE OF CONGLOMERATES, GOVERMENTS AND INDIVIDUALS ON THE DISPOSAL AND MANAGEMENT OF HAZARDOUS WASTE

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Abstract

With our blatant disregard for the environment and our callous attitude towards the same we have caused extensive damage. The cost of ensuring that our environment remains in balance or is brought back into balance is extremely high. The generation and management of waste is one of the greatest challenges that we face. Industrial wastes and toxic substances are one of the major "common challenges" the world is facing together currently[3]. The World Bank estimated the universal generation of waste to be approximately 2.01 billion tonnes[4] in 2016. This quantity of waste generated is projected to escalate substantially each year. India produces 277.1 million tonnes of solid waste yearly[5], out of which it is estimated that nearly 7.46 million tonnes of hazardous waste are generated[6]. India, despite generating vast quantities of waste has not yet ratified the Basel BAN amendment[7]. This would ensure that other countries do not use India as their toxic waste dump. In India the competent authority, i.e., CPCB fails to successfully implement the process for safeguarding the environment. Yearly unsubmitted and undocumented records obstruct the accurate analysis of data. This article focuses on hazardous waste and its management in India and internationally. It encompasses the storage, treatment and disposal techniques used for the hazardous waste and the negative impact arising from untreated waste on the ecology and the population. This article also reviews the existing regulatory framework. The article is concluded by giving a few recommendations on improving the current scenario. The goal of this paper is to make the public aware of the issue of waste management and to showcase the wilful disregard of the manufactures towards compliance with the law and the contributory negligence of the answerable authorities towards the integrity of the system laid down by the statutory authorities.

INTRODUCTION

Today's metropolitan cities are overpopulated and are littered with waste. More energy is required in the cities to accommodate the city lifestyle as well as the growing city population. To make room for the continuous influx and movement of people from rural to urban areas the government

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[3] The World Commission on Environment and Development, Our Common Future (1987).

[4] THE WORLD BANK, *Solid Waste Management* available at: https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management (last visited on 11h April 2022).

[5] Taran Deol, *PM calls for week-long garbage-free country, but India is the highest waste-generator,* THE PRINT (New Delhi, 2015).

[6] SWACHH INDIA NDTV *India's deadliest waste pileup:* The Rising Rate Of Hazardous Waste available at: https://swachhindia.ndtv.com/indias-deadlupraiest-waste-pile-up-the-rising-rate-of-hazardous-wastes-7856/ (last visited 11 April 2022).

[7] Basel Action Network, *Basel Ban Amendment and its Implications for India*, August 2020

is compelled to make continuous development in infrastructure and changes in the topographical landscape. The land and its natural resources are being subjected to their limitations whilst the greed of humankind is unyielding. This unrestrained human greed has led to reckless misuse of our planet and its natural resources leading to the generation of large quantities of waste and resulting in widespread pollution. In total there are two main categories of waste viz. Municipal Solid Waste (MSW) and Agricultural Waste (AW). The wide scope of Municipal Solid Waste encompasses seven sub-categories i.e., Residential, Industrial, Commercial, Institutional, Construction and Demolition, Municipal Services and Process. A large number of physical factors also further contribute to the amount of waste produced annually i.e., climate, population, lack of civic sense, etc. Metropolitan India houses over 481 million people and produces over 42.0 million tons of MSW annually[8]. Organic wate which is bio-degradable makes up 30% - 55% of the MSW. Another major contributor to the MSW is inert matter which forms 40% - 55% of the MSW. Only 5% to 15% of the MSW is recyclable. However, these numbers do have a slight variation depending on city to city. For example, cities which are home to a larger number of industries will in turn generate more waste[9]. Post the 1850's the rise of a new era took place in India: The Industrial Revolution. This led to the rise of manufacturing industries and factories. During these early days, the environmental protection guidelines and by-laws were virtually non-existent. This coupled with an ill-equipped waste disposal practice enabled the factories to release toxic fumes and hazardous slurry into the nearby surroundings without any significant repercussions. Poisonous heavy metals such as lead and mercury, if left untreated, damage the surrounding flora and fauna. Even today, conglomerates try to elude guidelines set up by the government and often release untreated chemicals and wastes into the environment to marginalize spending on the laborious and costly process of waste remediation and disposal. Unfortunately, the current waste disposal system is outdated, inefficient, insufficient and cannot cope with the escalating needs of the ever- expanding population[10].

To meet the dietary needs of an ever-increasing population, enormous amounts of resources get invested in the crop and livestock industry (agricultural industry). Trees are cut down and forests

[8] 12th Finance Commission grants, guideline for preparation for detailed project reports and selection of technologies for processing and final disposal of Municipal Solid Waste.

[9] UNEP, *How the Indian State of Gujarat is taking on Plastic Pollution* available at: https://www.unep.org/news-and-stories/story/how-indian-state-gujarat-taking-plasticpollution#:~:text=Gujarat%20has%207%2C751%20units%20that,landfill%20or%20sent%20for%20incineration (last visited 11 April, 2022).

[10] Samar Lahiry, *India's Challenges in Waste Management, Down* to Earth (9th January 2017), available at: https://www.downtoearth.org.in/blog/waste/india-s-challenges-in-waste-management-56753 (last visited 11 April, 2022)

are levelled in order to expand the agricultural lands. Although farming and rearing of livestock has been an ancient process, the modern ways of farming have brought more harm than good to the environment. To enhance crop yields in order to meet the growing demands, harmful chemical fertilizers and pesticides are being extensively utilised. The usage of these toxic chemicals not only harm the ground ecosystem, but their run-off into nearby waterbodies such as rivers, lakes etc., and consequently adversely impact the marine ecosystem as well. Moreover, they also cause ground water contamination. This contaminated water source is used by the villagers for their daily consumption and as well as for cultivation and to sustain their livestock. This continuous process of chemicals getting accumulated from different sources in the diet leads to bioaccumulation at all levels of the food-chain. Bioaccumulation is defined as the total accumulation of a contaminant in an organism from different sources of its food-chain or environment. Mankind, being at top of the food chain, will have maximum quantity of bioaccumulation occurring in our bodies. Furthermore, the agricultural industry produces vast amounts of wastes also termed as agricultural wastes (AW). AW if stored or dumped in a landfill would result in land quantities of land being occupied. Farmers engage in agricultural burning in order to avoid parts of their field being used as waste dumping areas. Agricultural burning is also used when the farmers discard the older crop by burning the residual stem of the plant after harvest so that the new crop can be grown. This process in turn releases large amounts of Carbon Dioxide (CO_2) into the atmosphere. As AW is biodegradable, it's decomposition in a landfill has led to the release of harmful and toxic greenhouse gases such as methane (CH_4) and nitrous oxide (N_2O).

The Indian Government is trying to bring about awareness to its citizens by implementing new proposals and schemes such as Swachh Bharat Abhiyan[11] and Swachh Bharat Unnat Bharat Abhiyan[12]. These government initiatives are the backbone of change. Under the 2030 climate goals of the Paris agreement[13], signed by the Indian government, India has promised to cut down greenhouse emissions, use cleaner sources of energy and invest in reforestation in order to bring down the levels of carbon dioxide in the atmosphere. Waste being the fourth largest contributor to

[11] SWACHH BHARAT available at SwachhBharat- Swachh Bharat Abhiyan a nation-wide campaign in India (mygov.in) (Last visited 11 April, 2022).
[12] OFFICE OF THE PRINCIPLE SCIENTIFIC ADVISOR TO THE GOVERNMENT OF INDIA, *Swachh Bharat Unnat Bharat* (27th August 2020) available at Launch of Waste to Wealth – The waste to wealth mission - Swachh Bharat Unnat Bharat | Principal Scientific Adviser (psa.gov.in) (last visited 11 April, 2022).
[13] UNITED NATIONS CLIMATE CHANGE, The *Paris Agreement* available at: The Paris Agreement | UNFCCC (last visited 11 April, 2022).

greenhouse emissions[14], which makes it imperative to look at its generation and disposal in a safe and eco-friendly manner.

HAZARDOUS WASTE

Hazardous waste is any waste which has the potential to be harmful by virtue of its physical, chemical, biological, or radiological characteristics which in turn is unsafe to the surrounding environment either on its own or in contact with other wastes. Some compounds when exposed to the natural elements such as air, water, earth or fire form hazardous secondary products. Inevitably these compounds also make a part of hazardous wastes e.g., persistent organic compounds such as Dioxins and Lindane[15].

Characteristics

Waste is hazardous if it exhibits a hazardous characteristic or produces a hazardous product on combination or reaction with other materials or elements of the environment. There are four characteristics that can make waste hazardous[16].

(i)Ignitability – Liquid wastes having a flash point less than 60^{o}C and solid wastes which spontaneously combust and/or meet a certain benchmark for ignition/burning evaluation are characterised as ignitable hazardous wastes. Examples are: Petroleum parts washer solvents, solvent-based paint waste, waste kerosene or petrol or diesel and spent paint booth exhaust filters.

(ii)Corrosivity - Aqueous wastes which are acidic in nature and have a pH less than or equal to 2.0, or wastes which are alkaline in nature having a pH greater than or equal to 12.5, are considered corrosive wastes. Examples are: acid or alkaline cleaning solutions, rust removers, battery acid and caustic hot tank waste.

(iii)Reactivity – Any waste that reacts violently with the air or forms explosive mixtures with water leading to the generation of toxic gases, containing cyanides or sulphides are termed as reactive hazardous waste. Examples are: cyanide plating wastes, waste concentrated bleaches, pressurized aerosol cans and metallic sodium and potassium.

(iv)Toxicity – Those wastes which are capable of death or injury to life of humans, plants or animals are categorised as toxic wastes. A waste is toxic if it fails the Toxicity Characteristic

[14] EUROSTAT, Greenhouse Gas *emissions from Waste,* 23rd January 2020, available at https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20200123-1(last visited 11 April ,2022).

[15] EURITS, *Dedicated, Specialised facilities,* available at Dedicated, specialised facilities | Eurits (last visited 11 April, 2022).

[16] Leelavathy Karthikeyan, et al., *The Management of Hazardous Solid Waste in India: An Overview,* 5 ENVIRONMENTS 103 (2018).

Leaching. Examples are: painting wastes that contain toxic metal-based pigments and/or certain solvents (i.e., Methyl Ethyl Ketone), treated wood waste where the treatment was done with pentachlorophenol, oily wastes, such as used oil filters that exceed the levels for benzene and/or lead.

Classification

The major source of hazardous waste is industrial waste. Hazardous materials are generated by most industrial processes. Hazardous wastes[17] can be classified as[18]:

i. Industrial wastes: This type of waste is generated from industrial activity such as production processes. It will include waste such as process residues/rejects, spent chemicals/solvents, filter residue, sludge etc.
ii. Expired products: This waste consists of products whose expiry date has surpassed and are no longer fit for consumption or usage. It can include products such as expired medicines, food items, pesticides etc.
iii. Discarded products: Comprises of wastes such as batteries, tubes lined with mercury, glass ware etc. Improper disposal (dumping) of such wastes is detrimental to the health of the workers at the disposal facility.
iv. E-Waste[19]: Discarded electrical or electronic products form e-wastes. These products contain toxic metals like Lead (Pb), Cadmium (Cd), chromium (Cr), Beryllium (Be) etc. They become hazardous when improper disposal or recycling techniques are used.
v. Construction and Demolition wastes[20]: This type of waste arises from activities related to construction or demolition of roads, buildings, bridges etc. This type of waste is non-biodegradable in nature and includes materials such as metal, plaster, concrete etc.
vi. Used and waste oil: This includes any petroleum-based or synthetic oil or cooking oil which is used in day-to-day life. Oil is insoluble in water, persistent and toxic to the environment if disposed without following proper protocol.
vii. Used lead acid batteries[21]: Used or depleted vehicle batteries contribute to this class of waste. These batteries contain the heavy metal lead and sulphuric acid which is highly corrosive. Improper disposal of these batteries results in the release of toxic chemicals into the surrounding environment and water bodies.

[17] The Hazardous and Other Waste (Management and Transboundary Movement) Second Amendment Rules, 2021.
[18] S.C.Shastri ENVIRONMENTAL LAW (2021).
[19] E-Waste (Management) Amendment Rules, 2018.
[20] Construction and Demolition Waste Management Rules, 2016.
[21] The Batteries (Management and Handling) Rules, 2001.

viii. Bio-Medical Waste[22]: Wastes that has been generate during the diagnostics, treatment or immunisation of humans or animals in a hospital, medical facility or a research laboratory are termed as bio- medical waste. This category of waste would include syringes, discarded medicines, bandages, blood samples etc[23].

ix. Radio-Active Waste: Wastes which contain radioactive isotopes are considered radio-active wates. These group of waste arises from mining activities, research facilities and nuclear power plants.

The novel corona virus disease 2019 outbreak set out new challenges for the government to dispose of hazardous waste. Due to its highly contagious nature, the virus spread rapidly and thus the use of protective equipment such as PPE suits, masks, gloves etc., were mandated by the government to stop the further spread of this epidemic. This has led to increase in single use plastics and bio- medical waste. Further pressurising an already overwhelmed waste disposal system[24].

Radioactive and nuclear wastes are also classified as hazardous wastes. India being energy deficient must look towards using nuclear power plants to generate cleaner energy. This will lead to an increase in nuclear and radio-active waste. However, not all types of nuclear wastes are difficult to manage in comparison to industrial toxic wastes produced. The safe management of nuclear waste is of utmost priority for the nuclear energy program of any country. Nuclear wastes can be classified into different categories depending on the half-life of the radioisotope and its activity. There are three broad categories of nuclear wastes. Low level wastes, Intermediate level wastes and high-level wastes. The disposal methodologies for the three will be discussed in the upcoming section of disposal[25].

E-waste or Electronic waste is one of the rapidly growing forms of waste in India. Presently, the IT sector is booming in India causing this generation to indulge in various forms of electronic

[22] Bio-Medical Waste Management (Second Amendment) Rules, 2019.
[23] WORLD HEALTH ORGANISATION, *Health-Care Waste* available at: https://www.who.int/news-room/fact-sheets/detail/health-care-waste (last visited 11 April, 2022).
[24] MD. Sazzadul Haque, et al., *Coronavirus Disease 2019 (COVID- 19) Induced Waste Scenario: A Short Overview,* 9 J.ENV.CHEM.ENG. 104660 (2021).
[25] GOVERNMENT OF INDIA, DEPARTMENT OF ATOMIC ENERGY, *Radioactive Waste Management: Indian Scenario* available at http://www.barc.gov.in/pubaware/nw.html (last visited 11 April, 2022).

devices/gadgets. The culture of replacing phones and gadgets every few months when a new device/gadget is introduced into the market is leading to a tremendous generation of e-waste[26].

In India, Gujarat[27] is the largest upcoming industrial hub. Thus, it is the major contributor to the total hazardous waste produced in India. Within the nation, hazardous waste reports are filed annually with the State Pollution Control Board (SPCB) and the Pollution Control Committee (PCC) and submitted to the Central Pollution Control Board (CPCB). Although there are acts, notifications, guidelines and regulations set up by the Central Government[28], the processes are not being followed. Statistical data collected by the CPCB show gaps in the data sent by the 31 SPCBs/ PCCs annually. The percentage of reports submitted by each state can be seen in Figure 1 (a). This data shows that only a percentage of SPCBs/ PCCs annually file their reports. Show Cause Notices are given only to states which have filed less than 50%, which in turn still leads to a large gap with inconsistent values. Figure 1 (b), shows the percentage of total waste generated by each state when compared with the authorised value. Upon extrapolating the information submitted by SPCBs/ PCCs, using the percentage of reports submitted by them, we can arrive at a completely different value for the total waste generated by each state. This derived data set shows that some states may exceed the boundaries laid down by the government. The plot for the same can be seen in Figure 2.

In Figure 2, one can see that for states/UTs such as Nagaland, Sikkim etc., have submitted 100% of their report and have the waste generated at the authorized limit even after extrapolation. However, for states/UTs such as Delhi, Mizoram, Uttar Pradesh etc., have exceeded the authorized limit after extrapolation. This leads to some states/ UTs exporting their waste to other states.

[26] Dr. S. Chatterjee *Electronic Waste in India,* DEPT. OF INFO.TECH.;
MINISTRY OF ELECTRONICS AND INFORMATION TECHNOLOGY, *Green Electronics for a Sustainable future* available at: https://greene.gov.in/ (last visited 11 April, 2022).
[27] Anand Adhikari, *Supersize Gujarat,* BUSINESS TODAY, 23rd January 2011;
Karunjit Singh, *Gujarat displaces Maharashtra to become largest manufacturing hub in country,* THE INDIAN EXPRESS, 1st December 2021, New Delhi; *Supra* 9
[28] Central Pollution Control Board, National Inventory on Generation and Management of Hazardous and Other Wastes (2020-21).

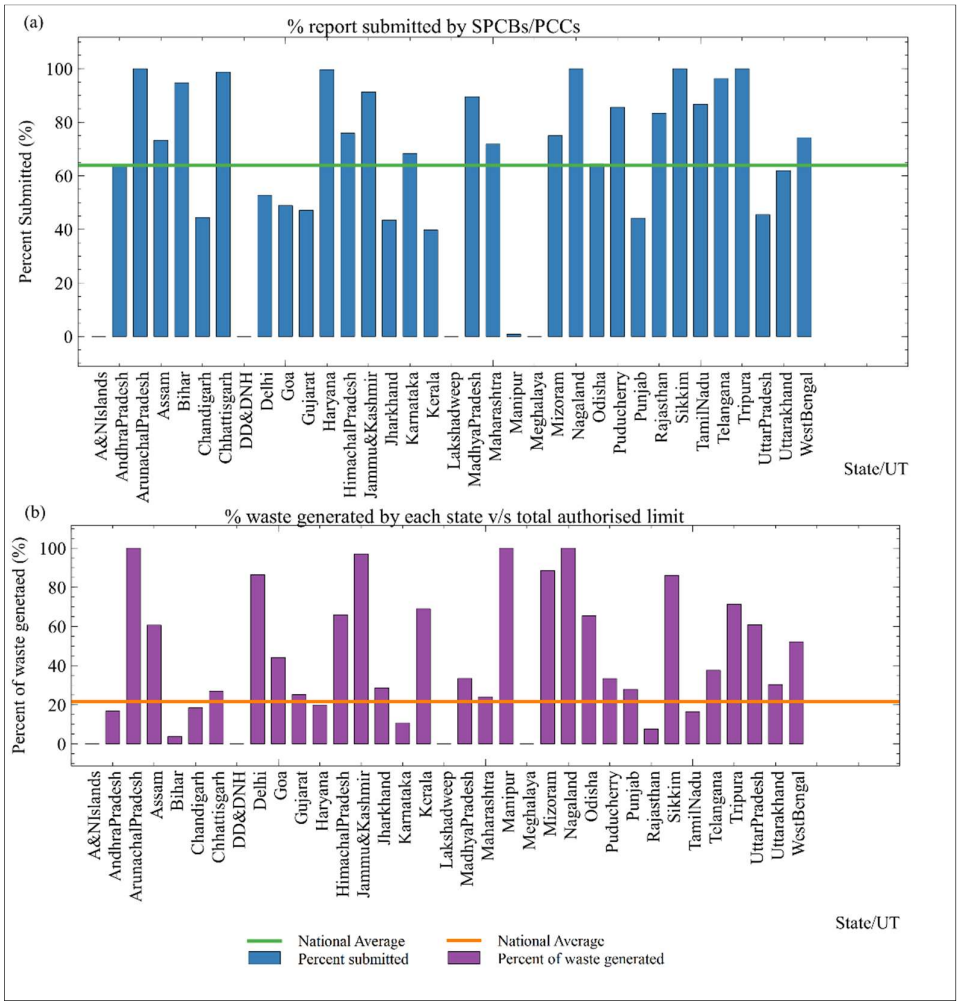

Figure 1 (a): Shows the percentage of reports submitted by each state/UT, with the national average represented by the green line. (b) Depicts the percentage of waste generated by each state compared to the authorised limit for that state/UT, the maximum being 100%. The national average for the percentage of waste generated is represented by the orange line.

'There are data gaps w.r.t. generation, import and management of other waste. The said gaps have been communicated to SPCBs/PCCs; however, clarifications/updated inventory has not been provided by Andhra Pradesh, Goa, Haryana, Karnataka, Kerala, Madhya Pradesh, Puducherry, Rajasthan, Uttar Pradesh and West Bengal[29]. '

[29] *Supra* 28

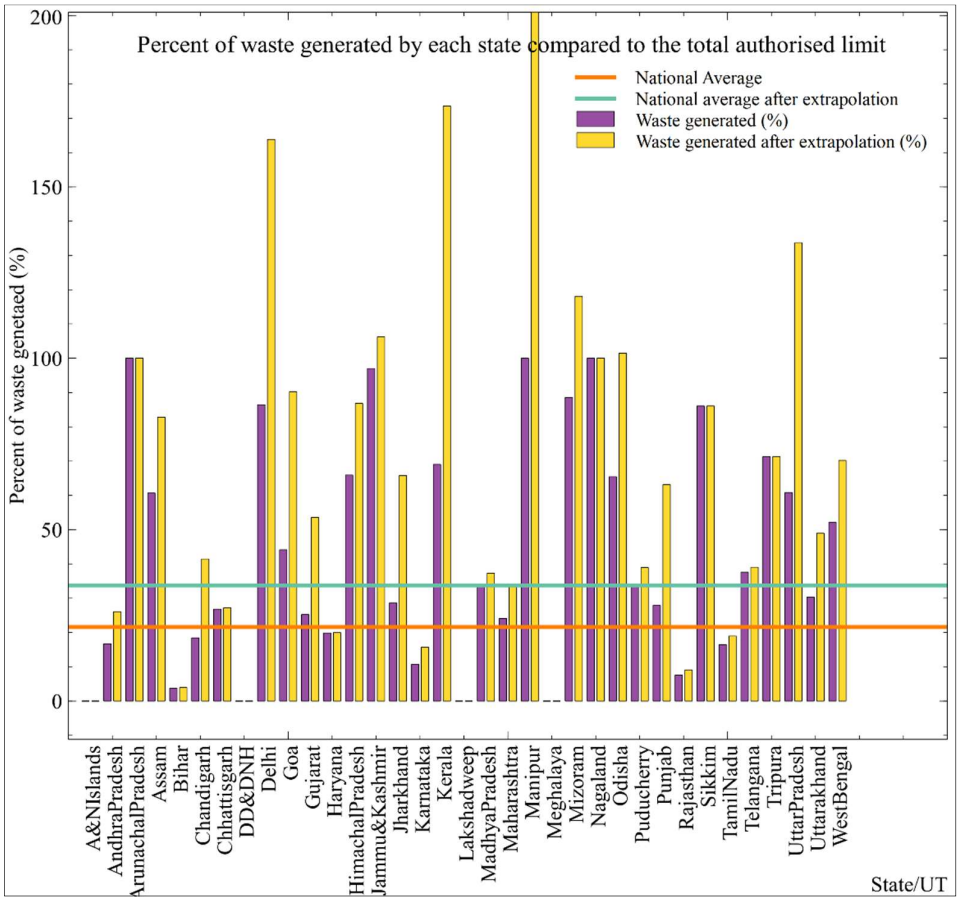

Figure 2 represents the % of waste generated by each state/UT compared to the authorised limit. The bar graph in purple represents the percentage of waste generated by each state according to the partial reports and numbers submitted by that particular state/UT. Extrapolating for 100% complete reports submitted by the state/UT, the percentage of waste generated with respect to the authorised value for each state can be visualised by the yellow bars.

DISPOSAL OF WASTE

The process of disposal of waste should be carried out in a manner in which the risks to the environment and the common public are as minimal as possible from the output of the final material produced by this process. It should involve the decontamination of the hazardous waste which results in the destruction or neutralisation of the detrimental contaminants. This step needs to be carried out before or during the recycling process. An additional important aspect of treatment of hazardous wastes is to recycle and recover those materials which can be reused, at the same time reducing the emissions vented through this process. The disposal facility must take into consideration the composition of the waste, along with all the potential risk factors and take

precautionary measures to safely dispose of this waste in a secured and controlled manner[30]. Hazardous waste management is an important and mandatory method of waste disposal. This method is lengthy, expensive and may take up most of a nation's budget. Many third world countries may not be able to afford implementing the appropriate procedure to manage the hazardous waste[31]. However, it is imperative that a nation implements proper protocols for the disposal process of waste.

A circular economy is a methodology adopted by many countries wherein recycling of material is being given the topmost priority. The process is being changed from a take-make-dispose model to take-make-reuse/recycle model. Originally, raw natural resources are taken from the environment, moulded into useful commodities, and then disposed of once their self-life has expired. However, in the new model, instead of abandoning the product entirely, it is sent for recycling and materials which can be reused or given a new purpose are extracted. This way only a part of the product gets disposed of, while the remaining product gets reused leading to lesser wastage of natural resources and a more sustainable manufacturing and disposal process. Hazardous waste needs to be decontaminated, their hazardous components removed, to protect the environment, public and the people working at the waste facility. The circular economy will not work without the decontamination process due to the fact that the hazardous components would either be dispersed in the environment or be present in the recycled product and in turn increasing its toxicity. The financial budget for India, set out for the current fiscal year, 2022-23 encompasses the crucial role played by embracing the model of a circular economy[32].

India has set up protocols and facilities in place to dispose of waste efficiently. These facilities include Treatment, Storage and Disposal facilities (TSDFs), which comprise of incinerators and secured landfills (SLF) where factories send their waste for disposal. Moreover, some industries have their own disposal facilities within the boundaries of their establishment. These disposal facilities are known as captive TSDFs. India currently houses 45 common TSDFs and 136 captive TSDFs[33]. Out of the 45 common TSDFs, 18 are integrated TSDFs i.e., they have an incinerator as well as a SLF, 16 SLF and 11 standalone incinerators. The 136 captive TSDFs include 6 integrated captivate facilities, 45 captive secured landfills and 85 captive incinerators[34]. High temperature

[30] *Supra* 15.
[31] Environment Protection Agency, Best Practices for Solid Waste Management: A Guide for Decision – Makers in developing countries (2020).
[32] Ministry of Finance, Speech of Nirmala Sitharaman, Budget 2022-2023, (1st Feb. 2022).
[33] *Supra* 28.
[34] Central Pollution Control Board, Guidance document for conducting Environmental Audit of common/ captive treatment, storage and disposal facilities (TSDFs) 1(2021).

incineration is being used to manage hazardous waste and reduce the amount of waste being sent to landfills. During this process, the precipitation of heavy metals occurs within the flue gas cleaning system or within the slag. Physical or chemical treatment is used to absorb the volatile materials and chemical conversion of halogens and sulphur is done[35].

Waste generated from household such as paint drums, needles, syringes, CFL bulbs, tube lights etc., are termed as domestic hazardous waste. These domestic hazardous wastes must be treated by the facilities listed under the Hazardous Waste Management rules. Deposition centres have only been established only by the states of Madhya Pradesh and Tamil Nadu. Despite that, no authorized capacity has been set by the SPCBs. Most of the States/UTs are yet to ensure the management of Domestic hazardous waste. Further, there are data gaps between quantity of waste received by collection centres and quantity management. The said gaps have been communicated to SPCBs/PCCs; however, clarifications/updated inventory have been received only from Mizoram and Tamil Nadu[36].

Bio-hazardous waste can be lethal as well as infectious in nature. When an individual without any precautionary measures comes into contact with it, the individual may develop severe repercussions[37]. In India within a span of a year i.e., from August 2020 to June 2021 an amount of 47,200 tons of waste associated with Covid 19 was produced. This is in addition to the 600 tons per day of Bio-medical waste that was generated before the pandemic[38].

As mentioned in the previous section, nuclear waste needs to be disposed of in an efficient manner. Different waste disposal techniques are being employed to tackle radioactive wastes. The use of the technique depends on the characteristics of the waste, i.e., both physical as well as chemical properties. Surface disposal and near surface disposal facilities are being used to tackle low-level wastes and intermediate level wastes. For high level radioactive waste, vitrification followed by underground burial is the preferred method of disposal within the nuclear community[39].

The main components of electronic waste presently are metal and plastic. When segregated, both these components can be recycled individually and reused. In India e-waste is reused in the non-

[35] EURITS, *Why High Temperature Incineration is Vital* available at: Why High Temperature Incineration is vital | Eurits (last visited 11 April, 2022).
[36] *Supra* 28.
[37] Abhimanyu Chakravorty, *Fighting from the bottom, India's Sanitation Workers are also Frontline Workers battling Covid,* THE INDIAN EXPRESS, 27th May 2020, New Delhi.
[38] Anusha Krishnan *COVID –19 and the Changing Nature of Waste,* MONGABAY available at: https://india.mongabay.com/2022/01/covid-19-and-the-changing-nature-of-waste/ (last visited 12April, 2022).
[39] *Supra* 28

formal sector. This illegal sector does not take the correct course of implementation to recycle the said waste. General awareness needs to be raised to the public about the importance of recycling and the potential misuse of electronic devices[40].

REDUCE RECYCLE AND REUSE

These three words constitute the meaning of sustainability. This practice must be implemented in daily households as well as on the national and international level. We as a society must limit our use of raw materials which are finite in nature. Reduce also pertains to reduction in the amount of waste created. To do so, we must buy only what we need, giving more emphasis on those items that can be reused or recycled. Reuse is using an item more than once. Reusing is not only cost effective, but it also lessens the burden on our natural resources and gives an incentive for an individual to innovate. Recycle is when a material can be re processed and effectively reutilized in a productive manner. Drop off centres should be created in every corner of the country to maximize the amount of recycling that can take place. Day-to-day items such as electronic products, to paper and many forms of plastic, glass, etc. can be recycled. Societies can also have their own organic composter. Recycling is a method in which lesser resources are utilised compared to newly manufacturing the product. This procedure is not only eco-friendly but also provides new job opportunities. Recycling reduces the overall waste produced and can ease the burden on our overfilled landfills. Construction material such as bricks, cement, steel, wood etc, are non-reactive in nature. Hence, a higher priority should be given to reuse or recycle them as most of these materials are highly durable. Proper segregation must take place for the maximum utilisation of these products. The quality of the product should remain uncompromised after reusing or recycling. Processing and storage of items such as plastics, broken glass, scrap metal should be handled on site[41].

TREATMENT STORAGE AND MOVEMENT OF HAZARDOUS WASTE

Treatment, Storage and Transport go collectively. The stage of storage may take place before and after the course of treatment. Before the storage of the waste takes place, it is mandatory to undergo thermal, biological, chemical and physical treatment. In certain cases, provisional on-site waste disposal storage facilities are constructed, which include open waste piles, ponds or lagoons. Precautionary measures should be set up in order to protect the dispersion of the waste through

[40] *Supra* 26; MAHARASHTRA POLLUTION CONTROL BOARD, *Waste Management* available at: Electronic Waste | Maharashtra Pollution Control Board (mpcb.gov.in) (last visited 11 April, 2022).

[41] Greater Hyderabad Municipal Corporation, Environmental Impact Assessment Report, (2006).

wind and from the leachate generated[42]. Before the final stage of treatment, hazardous waste is stored in containers. These containers need to be compatible with the compound which comprises the waste. According to Rule 8 of the Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016 hazardous waste can be stored up to a period of 90 days. Nonetheless, this period can be extended up to a period of 180 days by the discretion of the SPCB. Despite this mandate set out by the government, the hazardous waste stored at the end of the fiscal year exceeds the quantity of waste stored at the commencement of the same fiscal year, the figures showing 2.1 million MT and 1.53 million MT, respectively[43].

As treatment, storage, or disposal facility (TSDF) might not be at the same place where the waste is generated, transportation services are required to move the said waste. Special attention is given to the transportation of hazardous wastes because of the potential threat to the environment and public safety. Proper transportation awareness is required about:

Transportation Require	**Description**
iner	uld be mechanically reliable without any structural d
ling of Container	uld be correctly labelled to describe the type of wa ossible hazard and the remedial measures to be use ental spills.
portation Vehicle	d be capable of carrying the waste without spillage environment.
ctor / Transporter Selectio	d have the relevant skills and be technically compete
fest /license	mandatory to have all the valid transportation ments.
gency procedures	be educated about the measures to be taken in ents.
and fines	must be paid for not having proper documentation an ied for not following the laws.

INTERNATIONAL DISPOSAL

Industrialised nations although developed, continue facing drawbacks in the sector of waste management. The Basel Convention, which is an international agreement has been ratified by 53

[42] BRITANNICA, *Hazardous –Waste Management* *available* at: https://www.britannica.com/technology/hazardous-waste-management (last visited 11 April, 2022).
[43] *Supra* 28.

signatories under the United Nations Environment Program (UNEP)[44]. This convention governs the movement of hazardous waste, solid waste and municipal incinerator ash across international boundaries.

US-Mexico Border Waste Program

International agreements for the protection of the environment are not just signed at the United Nation but are also signed by neighbouring countries. An example of one such agreement is the US-Mexico Border Waste Program[45]. Under this program, there are five major goals, one of which is to promote material management, waste management and clean sites. Through this collaboration, both countries strive to make the border area cleaner whilst implementing sustainable solutions.

European Union

Managing hazardous wastes safely and in accordance with the guidelines is an important aspect to achieve sustainable development. European Union for Responsible Treatment of Special Waste (EURITS)[46] is an association of companies that manage hazardous waste across the European Union. Their main goal is to safely treat hazardous waste while simultaneously recovering maximum quantity of the material that can be reused or recycled.

ADVERSE EFFECTS OF UNTREATED HAZARDOUS WASTE

Untreated hazardous waste has dire consequences to the human society, the animal kingdom as well as Mother Nature[47]. We humans, being an intellectual and a technologically evolved species, must implement changes for the betterment for all future generations. There are various factors which would determine the after-effects of the exposure of hazardous wastes to all species. They are: type of chemical, number of times, a person/ species is exposed to it, duration of the exposure, amount of toxicity of the chemical.

Depending on the above-mentioned factors, the consequences from the hazardous wastes can vary in humans and in the environment.

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[44] BASEL CONVENTION, *Parties to the Basel Convention on the control of Transboundary movements of Hazardous waste and their Disposal* available at: http://www.basel.int/Countries/StatusofRatifications/PartiesSignatories/tabid/4499/Default.aspx (last visited 11 April, 2022).

[45] US EPA, UNITED STATES- MEXICO ENVIRONMENTAL PROGRAM, EPA-906-B-21-001.

[46] EURITS, *About Eurits* available at: https://www.eurits.org/about-eurits/ (last visited 11 April, 2022).

[47] US EPA, *Health and Ecological Hazards caused by Hazardous Substances* available at: https://www.epa.gov/emergency-response/health-and-ecological-hazards-caused-hazardous-substances (last visited 11 April, 2022).

RAMIFICATION TOWARDS HUMANKIND

The effects of the exposure of these chemicals on humankind range from a mild rash to something as critical as cancer. The way in which these health effects manifest themselves depends on the mode of exposure, the way the chemicals enter the body and the chemical composition. Immediate exposure to chemicals can lead to the onset of acute health effects range from skin diseases[48] to organ failure or central nervous system disorder. However, prolonged exposure to even insignificant amounts of the chemicals may lead to bioaccumulation and later lead to chronic illnesses such as cancer, reproductive abnormalities etc. These damaging effects even have the potential to cause illnesses in the succeeding generations as well as in the form of birth defects or genetic disorders. Moreover, during the process of waste disposal, sanitization workers may get burnt upon encountering injurious chemicals or in the process of incineration may get physically burnt too[49]. In developing countries, such as India there are Safai Karamchari's[50] assigned to collect and segregate the waste. In this process, the workers may also encounter and may potentially be critically affected by used syringes and medical hazardous waste[51].

RAMIFICATION TOWARDS THE ECOLOGICAL COMMUNITY

Hazardous run offs into nearby rivers, streams, lakes, and estuaries can disrupt and cause an imbalance throughout the food chain[52]. The plunge in numbers of any species may limit the ability of an ecosystem to survive. Similar to the ill effects in humans, the chemicals can cause severe reproductive consequences in the animal kingdom as well. In the water bodies, the excess chemicals can lead to a fall in oxygen levels in the water leading to asphyxiation of the plant as well as marine life present in the water. The usage of nitrates and phosphates in chemical fertilisers may lead to eutrophication of the water body. The harmful and unchecked algae blooms which occur in the water bodies due to these fertilisers, they in turn absorb most of the oxygen and nutrients present in the water and cause further deleterious effects to the marine ecosystem[53]. This phenomenon is known as eutrophication.

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[48] Prayag Arora- Desai, *NGT askes ED to investigate polluting industries at Tarapur MIDC,* HINDUSTAN TIMES, 19th February 2022, Mumbai available at: https://www.hindustantimes.com/cities/mumbai-news/ngt-asks-ed-to-investigate-polluting-industries-at-tarapur-midc-101645294505270.html (last visited 11 April, 2022); Also see: *Akhil Bhartiya Mangela Samaj* v. *Maharashtra Pollution Control Board* 2020 SCC On Line NGT 1384.

[49] *Supra* 20.

[50] The National Commission for Safai Karamcharis Act, 1993, s. 2(e).

[51] Sunil Kumar, et al., *Challenges and Opportunities Associated with Waste Management in India,* 4, R.SOC.OPEN SCI., 160764 (2017).

[52] *Adil Ansari* v. *C.L. Gupta Exports Pvt. Ltd.* 2020 SCC on line NGT 1672.

[53] *Vijay Kumar* v. *Malana Silver Nitrate Recycling* 2019 SCC on Line NGT 2754.

LEGAL FRAMEWORK AND CONSEQUNCES ON DISOBEYING THE GUIDELINES

Waste disposal guidelines and regulations have been implemented globally to prevent or to reprimand the polluters for disobeying them[54]. A chain of command should be established, and the responsible institution or public entity should be held accountable at each stage of command and should be penalized.

The legal framework set out by the Indian Government and its legislature

The National Green Tribunal (NGT)[55] is empowered to work within the established safety valves of the principles of natural justice and appeal to the supreme court. Initially only the High Court and Supreme Court were allowed to take Suo-motu action. In order to address issues relating to the environmental damage NGT can exercise Suo-Motu powers. Certain urgent matters require imminent and effective responses and in the interest of natural justice, the NGT cannot remain a silent bystander. When the registry of NGT receives a communication or letter, it may cause to initiate Suo-motu action by inviting attention of the NGT in the form of office reports. Notice is to be given to the sender of communication or author of news item. The party likely to be affected should be given an opportunity to present their side before suffering adverse consequences.

India is a quasi-federal state governed by its constitution. The constitution of India is supreme and maintains checks and balances between the legislative, judiciary and executive. It differentiates the powers and the responsibilities of the Indian government towards its citizens and the duties of the citizens towards the welfare of state. Fundamental duties are established within the ambit of the Indian constitution in Part IVA[56]. It acknowledges the moral duties of the Indian citizens towards their country. Article 21 of the Constitution defines protection of life and personal liberty. As ruled by the Supreme Court of India, a substance is deemed to be hazardous to life if that particular substance can cause any imbalance to the surrounding environment[57]. Article 51 A(g) of the Indian constitution mentions that it is the duty of every citizen to protect the environment. It is the duty of every citizen to protect and preserve the natural environment (natural environment includes forest, rivers, lakes, and wildlife). The responsibility of the state towards the environment is mentioned in Article 48A of Part IV[58] which states that the state shall not only endeavour to protect the environment, but it should also improve the environment while safeguarding the forests and

[54] *M.C Mehta* v. *Union of India*, (1987) 1 SCC 395.
[55] *Municipal Corporation of Gr. Mumbai* v. *Ankita Sinha* 2021 SCC online SC 1298.

[56] Constitution of India, 1950, Part 1V-A
[57] *M.C. Mehta* v. *Kamal Nath*, (1997) 1 SCC 388; M.C. *Mehta* v. *Kamal Nath*, (2000) 6 SCC 213*; M.C. Mehta* v. *Kamal Nath*, (2002) 3 SCC 653.
[58] *Supra 56* Part IV

wildlife of our country[59]. Article 32[60] of the constitution, in the case of a public interest litigation (PIL)[61]

Extended Producer Responsibility[62] is a policy to promote the total life cycle of a product. It extends the responsibilities of the manufacturer of the product to various parts of the entire life cycle of the product, and especially the recovery, recycling and final disposal of the product. Under this policy, the producers are obligated to provide incentives to the collection service, the processing facilities and the recycling plants to meet the environmental goals set out by the government.

The only thing constant is change. The Hazardous Waste Management Rules came into effect in 1989[63]. Subsequently this act has been amendment frequently. The current amendment, called, Hazardous and Other Wastes (Management and Transboundary Movement) Second Amendment Rules, 2021 came into effect in November 2021. According to this amendment "other waste" is defined[64] as '*wastes specified in Part B and Part D of SCHEDULE III for the purpose of import and export and include such indigenously produced wastes as may be notified from time to time'.* Under chapter VI, Rule 23 sub-rule 1&2 of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016, for negligent behaviour caused due to improper handling and management towards the environment or third party, the occupier, importer or exporter or operator are held responsible and punitive damages are imposed. Furthermore, the owner of the disposal facility, shall be held liable and pay damages in cases of any infringements of the current rules[65]. The Ministry of Environment, Forest and Climate Change (MOEFCC) and the PCC i.e., the SPCBs and the CPCB together form the core panel for the enforcement of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules. To fulfil the constitutional obligation as mentioned under Article 48-A[66], and to adhere to the responsibilities listed in the Stockholm Declaration of 1972[67], the Environment (Protection) Act, 1986 (EPA) was passed. The

[59] *Supra* 56
[60] *Supra 56* Part III
[61] *Supra 56;* (2004) 6 SCC 402; (1996) 3 SCC 212.
[62]OECD, *Extended Producer Responsibility* available at: https://www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm (last visited 11 April, 2022).
[63] The Hazardous Wastes (Management and Handling) Rules, 1989.
[64] Gaz. Not. No. CG-DL-E-16112021-231156, *The Gazette of India: Extraordinary,* MOEFCC, (12th November 2021).
[65] Hazardous Waste Management Rules, 2016, R 23.
[66] *Supra 56.*
[67] United Nations Conference on the Human Environment, A/CONF.48/14/Rev.1, (June 1972).

EPA incorporates rigid laws pertaining to the pollutants discharged by the various industries falling within its purview.

Whilst transgressions under environmental acts are non-cognizable, acts under Prevention of Money Laundering Act (PMLA), are cognizable offences i.e., the perpetrator can be arrested, and the police do not need an arrest warrant. In February 2013, the PMLA act was amended to recognise environmental offences under it. Although only over the last few years the enforcement directorate (ED) has started taking stringent actions against the offenders[68].

'In its final judgement, the NGT revised the total amount of environmental compensation payable by 100 identified polluting units to ₹262 crore, up from ₹160 recommended by the expert committee in June 2020[69].'

'The MIDC was also rapped for failing in its statutory duties and ordered to pay an amount of ₹2 crore as environmental compensation[70].'

Section 3[71] of the money laundering act states that "Whosoever directly or indirectly attempts to indulge or knowingly assists or knowingly is a party or is actually involved in any process or activity connected with the [proceeds of crime including its concealment, possession, acquisition or use and projecting or claiming] it as untainted property shall be guilty of offence of money-laundering." Untainted property is defined as a property which is non- polluted or untouched by any kind of waste, including hazardous and toxic waste by either manufactures or nearby industrial plants.

The legal framework internationally and international ties with India

To protect human health and environment from the effects of persistent organic pollutants (POPs) such as Dioxins, Lindane etc., a global treaty called the Stockholm Convention[72] was brought into effect on May 17, 2004.

Internationally the Basel Convention[73] lays down the regulatory guidelines for the transboundary movement of hazardous waste and its procedure for disposal. Article 4 sub-section 2 and 3 under this Convention lays down by-laws to judge, assess and restrain countries from deviating from the established laws set by the convention.

[68] *Supra 48*
[69] *Supra 48*
[70] *Supra 48*
[71] Prevention of Money-Laundering Act, 2002, Section 3.
[72] *Supra 67.*
[73] *Supra* 41.

The Basel Ban Amendment[74] is an accord undertaken by Basel Convention Parties to forbid the member states that have ratified the ban amendment from exporting hazardous wastes as defined by the Convention to other countries – primarily emergent nations or countries with economies in transition.

By taking into account a country's potential economic, social and technological capacity, the amount of hazardous waste generated should be minimal. Furthermore, the country must ensure that the waste is disposed of in an environmentally conscientious manner in which there are adequate disposal facilities equipped with eco-friendly disposal protocols present in the country. The people involved in the management of waste should make an effort to avoid pollution as a consequence of the waste and if during the process a by-product pollutant enters the environment, precautionary measures should be implemented to reduce its impact on the environment. Additionally, the transboundary movement of wastes must be as low as possible and carried out in an environmentally cautious and efficient manner protecting not only the environment against adverse effects but also the human health[75]. During the induction of the party to the Basel Convention, the party determines if their particular country's legislation allows them to import waste and process it in an environmentally sound manner. If the Basel Convention has reasons to believe that if a particular country cannot manage its waste in an eco-friendly manner, then the Basel Convention will prevent the import of the hazardous and other waste. According to Annex V A[76], the Basel Convention notifies the countries about the negative effects of the transboundary proposed movement of hazardous waste and other waste on human health and the environment. To accomplish the prevention of illegal trafficking of wastes, the Secretariat conducts activities with other parties which in turn assists in improving the management of such waste, whilst also preventing unauthorised trafficking of the aforementioned waste under Article 9 of the Basel convention. The parties are heavily fined if they resort to illegal trafficking of hazardous waste. The imposed penalties are decided by the legislation of the country which is the recipient of the said waste. Moreover, the exported waste is sent back to the country of origin where fines are levied.

CONCLUSION

The waste disposal systems and procedures are ever evolving as more efficient and effective methodology is being developed each day. Developed and emerging nations are striving to find an

[74] *Supra* 6.
[75] *Supra* 44.
[76] *Supra* 41.

environmentally beneficial process. Internationally and in India the government must lay down even more stringent laws with lesser formalities. The Government must allocate some funds towards knowledge-oriented programs in order to educate the general public on the hazards, management and disposal of wastes. The public authorities must encourage the citizens to devise waste disposal strategies for their communities. Research programs should also be funded to motivate the youth of the republic. The SPCB and PCCs should provide complete reports as compared to the partial reports currently provided by them. In case of partial data submission stricter action must be taken by the Central Pollution Control Board against the defaulting authorities. Improved and state of the art waste disposal facilities should be brought about. Captive waste disposal should be given preference to limit the movement of waste.

As the amount of waste generated is directly proportional to the population of the country, the government must introduce proper family planning initiatives for a planned parenthood. Sustainability and recycling should be the main goal of. To that effect that the concept of circular economy should be implemented at all levels and in all countries throughout the globe. Segregation and recycling of waste must be made compulsory for household waste. Initiatives and tax exemptions should be provided by the government to incentivise the public. The import and export of wates should be carried out efficiently and with improved safety measures to prevent undue harm to the environment and humans. The rules set down by the Basel convention must be adhered to prevent the same. Although the process of waste disposal is time consuming and expensive, it is a mandatory process and one worth investing in as, it not only impacts the current generation but also the future ones to come. The current generation is already facing the negative impacts of the previous generations and the changes must be implemented from today as, in a few decades the ramifications will be irreversible.

RECOMMENDATIONS

India's population, standard of living and its exponential industrial growth make it a herculean task to manage, segregate and dispose of waste in a secure, regulated and eco-friendly manner. Authorities must ensure that the landfills are used to their maximum capacity before commissioning new landfills. Several recommendations have been provided by the CPCB, although the SPCBs/PCCs do not comply with those orders, thus failing to submit their finalized annual reports on schedule. Furthermore, action for non-compliance is rarely taken by the CPCB in case of non-submission of the annual reports. Moreover, it is the duty of the SPCBs/PCCs to make sure that the waste stored at the factories/industries/ occupier's premises is in compliance with the guidelines set out in terms of the amount of storage of hazardous waste and must also be prepared

to make disposal arrangements for the same. A detailed inventory of the hazardous waste generation from different parties along with the disposal methodology employed should be maintained by the SPCBs/PCCs. A study must be conducted with the exhaustive data collected by the SPCBs/PCCs and submitted to the CPCB to further implement efficient operating protocols[77]. In the condition that the government may feel overburdened by the massive influx of duties, they must hire third party experts to remediate the situation.

Governments should set up initiatives to educate and encourage the general public on the perils of hazardous waste by including it in the school curriculum and organising awareness campaigns. The Government should levy heavy taxes on manufacturing hubs who produce large amounts of waste and leave them untreated. However, tax breaks/benefits should be given to companies who follow the waste management protocols[78]. The Government should allocate a certain amount of financial as well as human resources into this current issue. The competent authority should also make this subject matter their topmost concern and prioritize this concern as when neglect leads to an imbalance in the ecosystem which in turn not only affects human lives but also the surrounding flora and fauna.

Radio-active waste should be managed and disposed in such a way that no radioactive material should come in contact with human, plant or animal life now or in the future[79]. Deep Geological repositories should be developed for long term storage of high-level radioactive waste[80].

More stringent review/committee reports should be filed and subsequently the punishments levied by courts/authorities should be equivalent to the unlawful misconduct of the parties held accountable[81]. Surprise inspections and investigations should take place intermittently to ensure the legitimate disposal of waste[82].

In India, Safai Karamchari's are still presently used by the government to perform menial task which often have detrimental effects on their health. At the least, the government should provide

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[77] *Supra* 30.
[78] *Supra* 47.
[79] Hosam El-Din M. Saleh, MANAGEMENT OF HAZARDOUS WASTE, Chapter 3.4, (2016).
[80] NEA, *Geological Disposal of Radioactive Waste* available at: https://www.oecd-nea.org/jcms/pl_13324/geological-disposal-of-radioactive-waste?details=true(last visited 11 April, 2022). Also see: W. Alexander, Linda McKinley, DEEP GEOLOGICAL DISPOSAL OF RADIOACTIVE WASTE (2007).
[81] *M.C. Mehta (II)* v. *Union of India (1988) 1 SCC 471.*
[82] Times News Network, *Rs.3 Cr. Penalty on Varanasi plant for polluting Ganga,* THE TIMES OF INDIA (Lucknow, 2020).

them with basic protection kits. However, the government should equip them with modern machinery to limit their exposure to toxic waste.