SUSTAINABLE RECOVERY FROM COVID-19: THE STORY OF BIOMEDICAL WASTE

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1. Abstract

The recent outbreak of the COVID-19 Pandemic has resulted in an overall improvement in the environmental situation around the world- from wildlife and aquatic animals returning to their natural habitat to improving air quality in countries where air pollution was a constant threat. Such a drastic improvement wouldn't have been possible had the countries not enforced stringent lockdown to stop the spread of the virus, thereby limiting human involvement, albeit at the cost of trillions of dollars in economic loss.

However, all of these positive changes are only temporary in nature which can be easily observed in China, the epicentre of the pandemic where air pollution levels have already reached pre-pandemic levels and are continuously on the rise. Once the pandemic ends or is controlled, humanity will put all its efforts into restoring and improving its economies around the world and environmental preservation and climate change will take a backseat.

The world economy is going to be in shambles after the pandemic is over or when the lockdown is lifted/controlled and the countries will try to emerge from the financial upheaval. Environmental reforms won't be given as much importance as economies will try to limp towards normalcy which would result in pollution reaching pre-pandemic levels and eventually much more

Thus, this paper aims to analyse the current situation from an environmental standpoint. It aims to look past the short-term gains to plan for the long-term scenario. This paper aims to understand the pollution issue that is on the rise due to COVID-19, that is, Bio-medical waste. Firstly, this paper tries to take into account the various latent damages that have happened to the environment during the pandemic. Secondly, it analyses the

current Bio-medical waste policies and helps in understanding the impact of them, and subsequently gives recommendations for a better sustainable future.

Keywords: Pandemic, Pollution, Bio-medical Waste, Environment, Economy.

2. Introduction

The novel coronavirus virus (COVID-19) pandemic has reduced anthropogenic persecution of the environment because of which many green crusaders and environmental safeguards are celebrating. What these crusaders were unable to accomplish in years, the pandemic achieved in the span of a couple of months.[1]

The pandemic has resulted in improved air quality in once polluted metropolitan cities, diminished greenhouse gas outflows by businesses, saved the ozone layer from further deterioration, and so on. These are just a few out of the many noteworthy changes brought in by the pandemic. At its most elevated point, everyone presently knows the number of our day-by-day practices aren't environment friendly and why nature must be recuperated.

The proportionate is stressed on paper, discussions, online classes, and online talk course of action with sheets of arranged specialists. Regardless, the real forlorn part is finally, all data and recommendations are simply little talks. Little of these learnings have been pushed forward and there has been no noteworthy movement. All in all, the inquiry which remains before us is what will the circumstance of huge changes which we have watched, will they continue as before or will they improve?

3. Literature Review

The recent outbreak of COVID-19 has sent industries and commercial businesses around the world in disarray due to the stringent social distancing guidelines and lockdowns enforced by various governments around the world. This has resulted in the overall improvement in the environmental problems around the globe as seen in Indranil Chakraborty & Prasenjit Maity, *COVID-19 outbreak: Migration, effects on society, global environment and prevention*[2] along with the research of Sulaman Muhammad et

[1] Business as a usual or sustainable model: What is the post-COVID-19 dilemma? (n.d.). Retrieved from https://www.downtoearth.org.in/blog/climate-change/business-as-usual-or-sustainable-model-what-is-post-covid-19-dilemma--71301

[2] 728 Science of The Total Environment 138882 (2020)

al., *COVID-19 pandemic and environmental pollution: A blessing in disguise?*[3]which proves that "Environmental Pollution is reduced up to 30%".The pandemic has resulted in a positive impact on the environment which is shown in the research of Manuel A. Zambrano-Monserrate et al., *Indirect effects of COVID-19 on the environment*.[4]

All these various changes can be easily drawn from the recent events of exotic animals returning closer to big cities where previously no sign of such animals was seen due to constant and increasing human activity[5], Mount Everest being visible from the town of Jalandhar In Punjab, with higher air quality as compared to various parts of the world[6] , with less GHG begin to release in the environment also[7] along with a less carbon impact than what we a country would normally have[8].

These improvements however as seen in the case of China, where once the lockdown ended (although there was a minute increase as the pandemic continues) the air quality quickly climbed back to pre-pandemic levels.[9]

This paper aims to take this collective research forward by providing the community with suggestions and improvement for Indian legislation on how to deal with Bio-medical waste in a post-COVID world, where major economies of the world will primarily be focusing on restarting their economies, with relatively less priority given to the environment and how India can stand out by using this situation as an opportunity to develop a sustainable and environmentally friendly economy.

4. Research Methodology

This Paper follows a doctrinal pattern of research where pre, mid, and posts COVID environmental situations around the world will be analyzed to provide suggestions to

[3] *Supra* note at 4.
[4] *Supra* note.
[5] Federica Braga et al., *COVID-19 lockdown measures reveal the human impact on water transparency in the Venice Lagoon*, 736 SCIENCE OF THE TOTAL ENVIRONMENT 139612 (2020)
[6] American Geophysical Union. (2020, May 11). COVID-19 lockdowns significantly impacting global air quality. ScienceDaily. Retrieved June 10, 2020, from www.sciencedaily.com/releases/2020/05/200511124444.htm
[7] Liane Yuri Kondo Nakada & Rodrigo Custodio Urban, *COVID-19 pandemic: Impacts on the air quality during the partial lockdown in São Paulo state, Brazil*, 730 SCIENCE OF THE TOTAL ENVIRONMENT 139087 (2020)
[8]ve Benedetto Rugani & Dario Caro, *Impact of COVID-19 outbreak measures of lockdown on the Italian Carbon Footprint*, 737 SCIENCE OF THE TOTAL ENVIRONMENT 139806 (2020)
[9] China sees post-lockdown rise in air pollution: Study. (2020, May 18). Retrieved from https://www.reuters.com/article/us-health-coronavirus-china-pollution/china-sees-post-lockdown-rise-in-air-pollution-study-idUSKBN22U09F

improve the already existing legislation and urges the government to come up with stringent parameters which should be followed during the post-COVID-19 period for a sustainable re-development of the Indian economy.

5. Environment During COVID-19

It is evident that there have been gains due to the world-wide lockdown to prevent the spread of the coronavirus; with improving air quality and less polluted water; animals returning to the wildlife to their natural habitats, the Coronavirus has said to have achieved what the "green crusaders" have been trying to achieve for almost a century now. What we do tend to forget is that these gains are short-lived as these were only achievable due to a complete lockdown on human activity while risking trillions of dollars world economy.

There is a lot of data that signifies air quality has drastically improved in various regions during the lockdown. The air quality significantly improved in China due to reduced NO2 levels in January, followed by Europe, North America, and subsequently the whole world in the following months. In some cases, the air quality has improved up to 60% due to little or no human activity during the pandemic. The sad reality is that all these gains are short term as the pollution levels will go back to pre-pandemic levels as soon as the lockdowns are lifted and human activity is resumed. This can be backed by both historical and recent data. When China lifted its lockdown its pollution levels more than increased in April. It was more than what was more than last year's data during the same period. The rapid rise in the pollution levels is dampening the hopes of the environmentalists who had hoped for a "Green recovery". An increase in anthropogenic emissions from economic activity spike is called retaliatory emissions and usually takes place when the economies have come to a standstill and the governments pump in more money only to increase their GDP and get back to normalcy disregarding environmental harm. History has many shreds of evidence for the same- during the 2008 financial crisis even though there was a slight plateau in the emissions curve after the crisis, in 2009 and 2010 the global (CO2) emissions increased by 6%, all of which harmed the local air quality. The air pollution level has been expected to increase during the latter part of the year as the lockdowns are lifted. An independent market survey also showed that 57% of the people would like to have their cars as they fear that using public transport may increase their chances of getting the virus.

6. Going Forward

Each ton of NO_2 which wasn't emitted as a result of the pandemic is the equivalent of removing 62 cars per year from the road. So, one can estimate that even a moderate 10% reduction in NO_2 emissions is equivalent to taking 48,000 cars off the road. But the 40% drop in NO_2 on 2019 levels for January and February in some areas equates to removing a whopping 192,000 cars which is not only hard but also a big feat to achieve. In a survey conducted by CSE, to understand post lockdown mobility, there was a 20% increase in the number of people who would like to use their private vehicles than public transport again making it difficult for the governments to reduce the rising levels of pollution. In terms of waste management, the world will have to deal with it. The COVID 19 pandemic has triggered a zero-waste approach and has prompted a shift towards a circular economy. The zero-waste approach encompasses "the conservation of all resources utilizing responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning, and with no discharges to land, water or air that threaten the environment or human". The post-crisis offers lessons that waste management before the COVID19 pandemic cannot be continued as business as usual but requires structural adjustments.

As the economies start to open up most of the countries will go for "dirty recovery". Here the governments will choose to make the environmental laws less stringent to take give financial stimulus for economic growth. This can be seen in the case of India as well where the Union Finance minister allowed open access auction of the coal mines to cushion the economic shocks of the COVID 19. Such a move will have a detrimental effect on the environment but this will take a backseat as the main focus will be to restart the economy.

The common goal of achieving a reduction 1.5-degree reduction world temperature established in the Paris agreement seems to be farfetched goal pollution keeps increasing and there isn't any stringent action on the same.

7. The Last Global Recession

In the underlying result of the worldwide financial emergency of 2008, overall CO2 surges from an oil-based good start and solid creation lessened by 1.4 percent, just to rise by 5.9 percent in 2010. Moreover, the crisis this time could have a drawn-out effect

on the earth — at a far more noteworthy cost to human prosperity, security, and life — on the off chance that it crashes overall undertakings to address natural change. This ought to be "a crucial year" for those undertakings to address ecological change, as UN Secretary-General António Guterres put it at progressing guidance on the UN's yearly atmosphere highest point, which was reserved to happen in Glasgow in November.

In front of a board of 196 countries plans were laid out to revamp the emission reduction goals as under the Paris Agreement of 2015. However, due to the pandemic, the UN decided not to continue it for the time being.

It was just the most recent sign that the losses of COVID-19 may incorporate worldwide endeavors to address environmental change. Other worldwide gatherings identified with atmosphere — on biodiversity and seas — have additionally been disrupted. While the need to address change hasn't been direr, the inability to gather pioneers to address change makes it harder.

8. Current Situation of Deals with the Potential of Environmental Impact

The European Union has come under pressure to hold significant atmosphere activities, with Poland requiring a carbon trading program to be postponed and the Czech Republic urging that the EU's milestone atmosphere bill be abandoned, while airline organizations have squeezed controllers to delay emission cutting policies. China has just declared such delay, stretching out cutoff times for organizations to satisfy ecological guidelines and delaying an auction for the option to manufacture a few colossal solar homesteads.

In the United States, after an influential oil anteroom filed a petition against the Trump administration to loosen up implementation, the Environmental Protection Agency said it would not punish organizations that neglect to agree to federal monitoring or reporting requirements if they prove that the non-implementation is a direct cause of Coronavirus on their business. Furthermore, as of late, it declared a rollback on car emission rules that were a focal point of U.S. endeavors to decrease ozone-depleting substance discharges.

Governments have a human right promise to shield their residents/citizens from ecological harm— and this also incorporates a commitment to address environmental change and ecological harm. They may have authentic inspirations and legitimate

motivations to quickly extricate up the prerequisite of some biological rules as they scramble to contain the pandemic and salvage their economies. In any case, these measures could do extreme damage, on the off chance that they are utilized to push the more extensive antienvironment plans by pioneers of the same like President Donald Trump.

The genuine impact of the COVID crisis on the environment could depend in the long run upon choices made concerning how governments need their economies to look when they recover—and, explicitly, the amount they will proceed with their dependence on oil-based commodities.

Many see the undertakings to contain the financial result of the pandemic as an opportunity to animate the transition to cleaner essentialness decisions, for instance, sun and wind energies. Decisions could consolidate ensuring that financial boost programs organize interests in cleaner essentialness, or molding help to associations, especially in carbon-positive regions, on extreme cuts in emanations. Moreover, cash related industry bailouts could anticipate that banks should place less in oil-based commodity and more in natural change help and quality undertakings.

In Europe, the opportunities for green improvement are generally all the more encouraging. Considering one European pioneer's call to forsake climate quantifies, an EU delegate was supreme: "While our prompt spotlight is on fighting COVID-19, our work on conveying the European Green Deal proceeds. The atmosphere emergency is as yet a reality and requires our proceeded with consideration and endeavors."

As of late, numerous models have exhibited our powerlessness to move in the direction of a superior future.

South Australian government's alleviation to oil and gas travellers by conceding expenses and work program responsibilities of investigation licenses for at any rate a half year;

Inconclusive delay of the green force barters by Brazilian vitality controller, that was initially planned for 2020; Farmers association’s push to defer the introduction of 'Homestead to Fork' methodology, planned for making horticulture less contaminating—with the support of the European People's Party (EPP) alliance of the European Parliament. German Farmers Association's push for facilitating ecological

measures of the 'Compost Ordinance' that limit the utilization of manure to diminish contamination

These models strengthen my point about how we are not learning. It is reasonable that organizations can't wilt this emergency alone, and government support is an unquestionable requirement if not going under is to be maintained at a strategic distance from.

Be that as it may, the principle issue is the interest for enormous extra appropriations that are liberated from any condition(s) by these partnerships.[10]

9. Waste Generation During COVID-19.

Another latent harm to the environment during the pandemic is the excessive amounts of waste generation. This can be seen from the increase in medical waste due to the novel coronavirus. The first instances were in China where the average medical waste increased six-folds during the lockdown to contain the virus. Various cities were struggling to maintain the facilities dealing with such waste. This wasn't an isolated anomaly but was instead as the start of a global realignment of demands for medical waste management. The USA is another example of the same where it created 2.5 million tons of waste in one month which was half of its medical waste produce last year. The most common form of dealing with medical waste is incineration and autoclaving. Even though some countries use autoclaving to promote sustainable disposal of such waste, it is an expensive process and many countries stick to incineration. Incineration of medical waste in the open releases a lot of harmful and hazardous gases which should be avoided at all costs. But the truth remains, that many countries with less stringent rules will continue to adopt incineration as it is easier and cheaper for the countries. and There is a need for policies to be in place to deal with this menace. Policies are critical for both enforcing sanitation standards and also dealing with infrastructure for waste management. The market will have to adjust with this such an influx of medical waste management and medical companies and governments need to be ready for the same. The repercussions of this glut will have a profound impact on sustainable medical waste management for years to come

[10] *Id* at 3.

Apart from medical waste, there has been an increase in waste generation in general. Volumes of unrecyclable waste have risen. Local waste management has been a consistent problem during the pandemic as the municipalities have stopped recycling programs due to the fear of propagation of the virus in recycling centers and ultimately to its workers. Furthermore, food retailers have switched back to plastic bags and cutlery at food checkout points to curb the spread of the virus through the recyclable options spiking the rates of plastic consumption during the pandemic. Numerous purchasers have expanded their utilization of takeaway food in single-use plastic. Most of the export-oriented output, which couldn't be exported due to the pandemic got rotten. The export material was perishable and in huge quantities were left to decay due to which the methane levels are expected to rise sharply.

The ISWA had already predicted such problems and in their guidelines had clearly stated that in no condition should the recycling facilities be closed or come to a halt. It said that the functionality of recycling should be emphasized more in this situation to facilitate better waste management. If households and businesses stop segregating their waste the public authorities will be burdened with 30 to 50% more material essentially leading to a risk of system failure. Moreover, if any Authority calls a halt to all recycling collection during the crisis, the message to citizens will be that it is not important, and restoring the current rates of diversion will be difficult if not impossible". Had the countries followed the same the waste disposal wouldn't have been such a problem

The stockpiling of gloves, gowns, masks, and other protective gear has resulted in an unnatural waste emergency due to an unusual amount of waste production by the increase in the number of disposals of personal protective equipment from both households and health facilities. This has led to serious consequences for developing countries that do not have a standard waste management system and policy. The world was already dealing with challenges in the wats management sector before the pandemic with over 2 billion people lacking access to waste collection and 3 billion people who lack access to waste disposal.

The pandemic has caused a serious rat infestation in Canada due to less food waste on the road. This has led the rats to intrude households and medical facilities in search of food[11]. This needs to be dealt with carefully as these pests are the carriers for a lot of

[11] SWR Staf. (2020). Garbage shortage driving rats indoors. Retrieved from https://buf.ly/2M7h8lY

various other diseases. The situation in Canada helps us understand that there lies a challenge in not only dealing with Bio-medical waste but also household and domestic waste.

The panic buying of hand sanitizers, toilet paper, gloves, and so on has led to an increase of 20% sales in one supermarket alone[12]. In just 15 countries in Africa alone, the total face masks per day are reported as 58,68,33,053 based on an 80% acceptance rate and an avg of 2 mask per capita. However, hardly a fraction of them gets recycled in Africa[13].

In Hong Kong, it has been reported that the facemasks have been piled up at nature trails and beaches due to a lack of proper disposal mechanisms in waterways[14]. This has also hurt marine life and its habitat and if not dealt with can have serious consequences. In Barcelona, medical waste such as overall, face masks, and gloves increased by 350%—generating about 1,200 tonnes of medical waste compared to the usual waste of~275 tonnes.

The lockdown period has led to an increase in plastic use; something that has policy implications. Increasing the use of plastics during the lockdown and stay-at-home measures serve as a conduit for contamination between pathogens of animal and human origin—which increases the spread of diseases. The COVID 19 lockdown and temporary closure of borders have put the recycling market at a standstill. Due to low oil price and demand, the competitiveness of recycled plastics has declined, hence affecting the price of virgin plastics.[15] The recycling system in developing countries has also been affected by the closure of borders as most of such countries depend on foreign technologies for their recycling and sometimes outsource such waste. This has led to countries incinerating their waste rather than effectively dealing with it due to the sheer volume of the waste.

[12] Reconomy. (2020). Food waste: An opportunity for change. Retrieved from https://buf.ly/2SpCFtD
[13] Nzediegwu, C., & Chang, S. X. (2020). Improper solid waste management increases potential for COVID19 spread in developing countries. Resources, Conservation and Recycling, 161, 104947. https://doi. org/10.1016/j.resconrec.2020.104947
[14] Farah, M. A. Y., Chow. (2020). Discarded coronavirus masks clutter Hong Kong's beaches, trails. Retrieved from https://buf.ly/2wduBnW
[15] Silpa, K. (2020). Waste workers are protecting our communities during COVID-19. Retrieved from https:// buf.ly/2ZPSxKi

The problem in dealing with such waste lies in the fact that there is no accurate data on the amount of waste that is produced nor are there, proper projections about the same. Alack of identification of hot spots i.e., the places that produce the highest amount of waste is also a major problem as the governments can't decide where to effectively locate their waste management facilities and cut costs and prevent the spread of diseases.

10. Environmental Policies, Suggestions & Recommendations – Bio-Medical Waste

According to the Biomedical waste Management Rules of 1998, biomedical waste refers to the waste generated during the diagnosis, treatment, or immunization of human beings or animals or in research activities relating to the production or testing of biological and health camps and also includes the categories mentioned in Biomedical Waste Management & Handling Rules (BMWMHR) 1998.

It should be noted that 75-90% of the waste belongs to the non- hazardous medical waste category and is comparable to domestic waste and only 10-25% of the waste carries the risk to the general population and the health care workers associated with handling testing and disposal of the waste.[16]

We have seen a tremendous increase in the generation of medical waste during the pandemic times and if not managed properly the waste can pose a very big threat not only in the short term by presenting with physical, chemical, and microbiological risk to the general population but also in the long term as it would impact in achieving the sustainable long- term goals as set by various countries. The disposal of the waste can harm both the environment and the population at large but it has been seen that if the waste is managed properly the risk can be reduced by a significant level.[17]

It has been seen that a good medical waste management system is based on the core principle of 3Rs- reduce, reuse, and recycle with the added principle of prevention. The best practice to deal with medical waste is by preventing the generation of waste as

16 Li CS, Jenq FT, Infect Control Hosp Epidemiol. 1993 Mar; 14(3):145-50.
17 United Nations Industrial Development Organization, Environmentally Sound Management of Medical Wastes in India, May 2011

much as possible by being responsible rather than disposing of it. The problem should be tackled at the source rather than using the end pipe approach. [18]

The second edition of the WHO handbook dealing with waste management "The Blue Book" consists of various new methods to deal with waste management, environmental pollution control methods, and so on. It also deals with the health care waste management during emerging pandemics, climate changes, and drug resisting bacteria something useful and relevant in the current scenario of the world[19]

Dealing with hazardous waste is a pertinent issue as its mishandling can lead to the following issues especially during the current pandemic such as an increase in the risk of infections among the medical personnel, development of drug-resistant bacteria, lead to spread of nosocomial infections like HIV, Hepatitis B, and Hepatitis C, etc. amongst the patients and medical staff and so on. Improper waste management gives people to recycle the disposables and repackage the unused of the expired drugs. This is especially a problem in the country right now as many rag pickers and poor people would recycle the masks by washing them at cheaper prices during the shortage of such masks.

The core principles of health care waste management were discussed in the Geneva meeting of the WHO in 2007. It was stressed that investment in the right resources for health care waste management can significantly reduce the threat posed by it. It was also said that it is the moral and legal obligation of all the parties financing and supporting the health care activities to ensure that the people are safe and hence should also bear the cost of proper management of the waste. It was held that the manufacturer of such equipment and products has to ensure that his product is sustainable and environment-friendly. It was reinforced that a part of the budget should be invested in the creation of efficient healthcare systems which also includes novel inventions to reduce the bulk and toxicity of the waste.[20]

18 Chartier Y, Emmanuel J, Pieper U, Prüss A, Rushbrook P, Stringer R, editors. 2nd. Geneva, Switzerland: WHO Press; 2014. Safe Management of Wastes from Health-Care Activities; pp. 1–146
19 Ibid.
20 WHO, Review of Health Impacts from Microbiological Hazards in Health-Care Wastes Geneva: World Health Organization; 2004.

11. History of Medical Waste Management in India

Until the late 80s, medical waste wasn't considered a different type of waste which was to be handled scientifically and hence didn't receive much attention. It caught the attention of the government when the policymakers noticed stockpiles of untreated medical waste which lead to the spread of infections and diseases the government also had to deal with the external pressure from various NGOs and the public at large. The government succumbed to the pressure and legislations to handle this problem were brought in. Most of the effort from the government was concentrated toward building and expanding a network of health care delivery systems both in the public and private sectors. Numerous medical colleges and big hospitals were started in the country due to the liberalization in the 90s and revolutionized the health care delivery system in the country which propelled India into a health tourism destination.

The western model of usage of plastic and disposable items, kits, and syringes were adopted by India without realizing the facts that the country doesn't have the technical or the technological means to deal with the waste generated after the use of such items of the minimize and assess the impact it has on the environment. During the same time, there was an outbreak of the HIV/ AIDS and hepatitis B viruses[21] , and the information about its potential spread from contaminated needles spread slowly phasing out the glass syringes which were reused before the outbreak of the virus[22]. Improper disposal of the reusable needle created a market for the used syringes which were repackaged and sold in the open market. This was a big threat to the medical industry as there was a small portion of the sold syringes that were contaminated and it couldn't be separated from the sterile ones putting the front-line workers at risk. This situation can be analogized with the current scenario during the pandemic. There have been several cases where the used PPE and other equipment that was improperly disposed of were being repackaged by people and being sold in the market taking advantage of the scarcity of the PPE for medical professionals, increasing the risk of the spread of the diseases.

[21] INCLEN Program Evaluation Network (IPEN) study group, New Delhi, India. Indian J Med Res. 2014 Jan; 139(1):141-53.
[22] Seetharam S, Indian J Med Ethics. 2009 Jul-Sep; 6(3):120-1.

12. Legislative Framework & Timeline of Waste Management Regulations in India

The EPA or the Environmental Protection Act deals with all the matters relating to the environment or with any of the matters discovered in the Stockholm declaration of 1972. Various PILs put pressure on the government to provide a law that governed health care waste management. The MoEF had issued various drafts of the biomedical waste rule and the ultimate rules were promulgated on July 20^{th,} 1998. It was followed by 3 subsequent amendments to the rules. The first amendment dealt changed the rules dealing with the waste management facilities as given in Schedule VI of the said rules. The first amendment was notified on 6th March 2000. The second amendment dealt with some major changes such as the defining role of Municipal bodies in a given area, nominating Pollution control board/ nominees as prescribed authorities, and addition of forms seeking authorization to operate a facility and for filing an appeal passed by the said prescribed authorities. This was notified on June 2^{nd,} 2000. The third amendment of 17th September 2003 notified that the prescribed authority for enforcement of these rules for the defense healthcare establishments shall be the Director-General, Armed Forces Medical Services.

The whole nation went under the umbrella of the principles as 31st December 2002 was the cut-off time for the last period of usage of the guidelines covering all the medical services foundations, urban areas, towns, and towns broadly. At first, the states were given the alternative to pick the recommended position however since the work incorporated a great deal of specialized work, for example, observing the air emanations from the incinerators, checking the poisonousness of the effluents delivered in the water, and so on, it was felt that the contamination control board would be the suitable endorsed authority and the progressions for the equivalent were acquired by a revision to the principles.

In 2003 rules for normal biomedical waste therapy office (CBWTF)and the development of the biomedical waste incinerator were distributed by the Central Pollution Board.

In 2016 the amended rules for the Bio-Medical Waste were notified. This is the current set of rules which govern the disposal of the health care waste generated by various facilities.

13. International Conventions, Agreements, and Regulatory Principles

The Basel Convention- India ratified the Basel convention of the Control of Transboundary Movements of Hazardous Wastes and their Disposal on 24th June 1992. It was signed by 170 members and deals with protecting the environment from hazardous waste, specifically by the disposal of the wastes from health care in hospitals and health centers, and clinics[23]

The Stockholm Convention on POPs- POPs are the toxins that accumulate in the fatty tissue of the living organisms and cause damage over the long term. The major source of POPs in the waste burnt in the medical incinerators and other combustion processes. The guidelines and the provisions to tackle them were released in 2006. It deals with the best environmental practices BEP such as source reduction, recycling, resource recovery, and so on[24]

The Minamata convention's main objective is to protect human health from the adverse effects of mercury on human health. It was signed on October 10, 2014, in Japan by more than 90 nations signed and was the first new global convention on environment and health. This treaty includes the phasing out of certain types of equipment such as mercury-containing thermometers and blood pressure devices.[25]

14. Principles that deal with Biomedical Waste.

- The *Polluter pays* principle says that the people producing waste are both legally and financially obligated to deal with its safe disposal.
- The *precautionary principle* is one of the key principles in governing health and safety laws/regulations

[23] Technical Guidelines on Environmentally Sound Management of Wastes Consisting of Elemental Mercury and Wastes Containing or Contaminated with Mercury 31 October 2011. Geneva: Basel Convention and United Nations Environment Programme; 2011. Secretariat of the Basel Convention

[24] Revised Draft Guidelines on Best Available Techniques and Provisional Guidance on Best Environmental Practices of the Stockholm Convention on Persistent Organic Pollutants. Geneva: Secretariat of the Stockholm Convention; 2006. Secretariat of the Stockholm Convention

[25] David Lennett, Richard Gutierrez. *In: Minamata Convention on Mercury. Geneva: United Nations Environment Programme*; 2014. Countries: List of signatories

- The *Duty of care* principle puts upon the person the obligation to take utmost care while dealing and managing hazardous waste or its related equipment. It's both an ethical and legal obligation
- The *proximity principle* says that the treatment and disposal of hazardous waste should take place in a location closest to its source.

15. Current Laws Governing Bio-Medical Waste Management in India.

Many studies show that despite India being among the first countries to initiate Biomedical Waste disposal waste rules, there is still an urgent need to take action and strengthen the existing the system capacity, increase funding and commitment to disposal of waste especially during the current situation in the country during the pandemic and the growing numbers.

The BMW rules of 2016 are the latest laws dealing with biomedical waste in India.

The 1998 rules on Biomedical waste rules were modified in 2000, 2003, and 2011. The 2011 draft remained only a draft due to a lack of consensus on categorization and standards.[26] The rules were finally amended in 2016 and have increased the coverage, simplified the categorization and authorization, and improvised the segregation and disposal of waste. In addition to the strict guidelines that have been laid to ensure pilferage of recyclable items, no secondary handling, or in the advent of spillage by animals. The increase in air pollution due to the incineration of medical waste has been checked by issuing new standards for incineration and improving its operations.[27]

Information from the Government of India site demonstrates the absolute BMW produced in the nation is 484 TPD (tons every day) from 1, 68,869 HCFs. Shockingly, just 447 TPD is dealt with, and 37 TPD is left untreated. There are 198 CBMWTF in-activities and 28 under development. The quantity of HCFs utilizing CBMWTFs is 1, 31,837, and around 21,870 HCFs have their treatment offices on-site.[28]

[26] The Gazette of India Biomedical Wastes (Management and Handling) Rules. India: Ministry of Environment and Forests, Government of India; Notification Dated; 20th July 1998.
[27] Bio-Medical Waste Management Rules. 2016 Published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-Section (i), Government of India Ministry of Environment, Forest and Climate Change. Notification; New Delhi, the 28th March 2016.
[28] *Ibid.*

16. Rules Laid Down in the New Amendment

The obligations of a medical services office occupier have been reexamined not many which ought to be noted incorporate the utilization of chlorinated packs, gloves, blood sacks, and so on ought to be decreased, and progressively eliminated and this ought to be done within a two-year time frame from the notice of these standards. Also, it was required to set up a standardized identification framework for BMW containing that will be conveyed to the premises for treatment and removal. Thirdly, it was required to update or alter the current incinerators to accomplish the new guidelines inside 2 years.[29]

The obligations of the operator were expanded as well. It was set out that there ought to be bar-coding and a global positioning system ought to be set up for taking care of biomedical waste and the entirety of this ought to be done inside 1 year of the notice of the guidelines. All records for the activity of burnings/hydroplaning and autoclaving ought to be kept up for at any rate 5 years.

No medical care office should establish on-site biomedical waste therapy and disposal if the provision of CBMWTF is available inside 75 km of the health care facility. On the off chance that no CBMWTF is accessible, the occupier can set up an essential Biomedical waste therapy office, for example, an incinerator, autoclave, shredder, and so on in the wake of taking earlier approval from the recommended authority. After affirming the treatment of plastics and dishes via autoclaving or microwaving followed by mutilation/destroying, these recyclables ought to be given to approved recyclers.[30]

The new rules set down new criteria for the approval of various Biomedical waste treatment near health care facilities. CBMWTF is a famous idea in created nations because by working it at its maximum capacity, the expense of treatment/kg BMW gets fundamentally diminished. Further, this makes control and checking of different garbage removal plants less dull & less tedious.[31]

[29] *Ibid.*
[30] *Ibid.*
[31] Priya Datta, Gursimran Kaur Mohi, Jagdish Chander, Biomedical waste management in India: Critical appraisal, J Lab Physicians , 2018 Jan-Mar https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5784295/#:~:text=Biomedical%20waste%20(BMW)%20is%20any, biological%20or%20in%20health%20camps.

17. Challenges for Implementation

There are various challenges to the implementation of the new Biomedical waste rules of 2016. All the above-mentioned rules though modern and can help in improving the waste management in India it unreasonable to expect that the said rules can be applied in the Indian context as well. The said rules are nearly impossible to implement due to the lack of funds to replace the current options with better and sustainable options.to phase out chlorinated plastic bags, gloves, etc. and to establish a bar code system will take a higher period for doing the same, and 2 years is enough time.

As of now, in India, there are 198 CBMWTF that are active and 28 are under development. There is an incredible requirement for the quick improvement of a lot more CBMWTF to satisfy the requirement for treatment and removal of all BMW produced in India. Incinerators emanate poisonous air toxins, and incinerator debris is conceivably perilous. It’s been a long time since the execution of these rules and there isn't a lot of progress since the notices were delivered.

The facilities weren't adequate to deal with the then needs of the country and it is not enough to deal with the growing needs of waste disposal during the pandemic. The waste generation by various health care facilities has increased manifold and so has the generation of ancillary waste.

18. Current Situation

With access to only 198 Common Bio-Medical Waste Treatment Facilities (CBMWTFs) and 225 captive incinerators, India's needs for waste management have increased manifold during the pandemic. As of 2017, only 78% of the waste was treated and the remained was treated by either captive facilities or through deep burials. Seven states lack the required facilities to deal with the changing times. On the other hands, non-hazardous waste like masks and gloves, like dry recyclable waste must also be handled with utmost care as improper handling leads to a black market of such items, and if not that it ends up in landfills which don't decompose as it takes eons for it to decompose. A recent study indicated that the virus stays on cardboard for about 24 hours and on plastic for 72 hours. This puts all the sanitation workers and the ragpickers at an elevated risk as there is no systematic segregation of the waste in the country. Proper disposal of Personal Protective Equipment (PPE), including protective suits,

gloves, masks, and other waste from hospitals, medical facilities, or clinics through appropriate CBMWTFs. The central board of pollution also issued guidelines to deal with the same, yet there is a need for immediate capacity building and guidance to manage municipal solid waste, especially household hazardous waste. There is a critical need for appropriate monitoring, review, and verification mechanisms to curb the risks. There is also an increase in the risk of air pollution and toxins being released in the air as most of the medical waste is dealt with incineration. Incidentally, when developed nations are moving to supplant incineration with non-incineration innovations for treatment and removal of clinical waste & medical waste, incineration is being promoted in developing nations. developing nations for the most part appear to be less mindful of air contamination emerging from the burning of clinical waste & medical waste. Then again, new age incineration innovation has possibly improved establishing an atmosphere where there is the minimal impetus for developing nations to truly think about other options.[32] This is the same case with India as well. Most of the BMW treatment facilities include incineration and very few opt for other sustainable methods such as autoclaving due to the lack of funds for advanced technologies.

The waste management sector has been on a rough ride in the past 2-3 months. For the last 10-15 years, a lot of work has been done in the circular economy of the country. The union government recently introduced a policy to strengthen the collection, segregation, and recycling of plastic waste. Ever since the lockdown has started in the country, municipalities are collecting wastes at different frequencies. There is no secondary segregation and resource recovery due to the fear of getting an infection by the SARS-CoV-2 virus. Waste that is being collected is disposed of in the landfills and no proper treatment for the same is done. When a few recycling plants started due to government recommendation, only 30% of the circular economy can be activated as many workers migrated to their native places and the procurement of the waste for recycling became a herculean task. Due to the recycling units not getting sufficient waste to run the plants, the operational costs of the plants have gone up making it less feasible to recycle and manage the waste properly hurting the circular economy of India.

[32] UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION, Environmentally Sound Management of Medical Wastes in India, May 2011

This is in contrast to India's scenario a few months ago, as it was one of the top countries to collect and segregate PET plastic was and also recycle 60% of the same.[33]

The last problem that the economies had to face was the sudden dip in crude oil prices as this made virgin plastic cheaper than second-hand plastic making it difficult for the recycling plants to run the plants at high operational costs and low profits.[34]

19. Recommendations

There is a need to increase the funding towards the waste segregation department of the country to deal with the pandemic. The 2016 rules dealing with biomedical waste were ahead of its time but there was a lack of implementation and a lack of funds which led to the failure of the system established.

Their provisions mentioned in the 2016 rules are a great way of ensuring the implementation of proper management of medical waste. The time frame for the same needs to be increased and a reasonable amount of time should be allowed for the same. The bar-coding system will help track and identify the bags during the inspection and disposal of the bags during quality control and quality assurance. The color-coding system is another great way of ensuring an efficient way of management of waste. The blue and the red bags will be sent to the recyclers and will keep the recycling realm under the control of various government agencies. This promotes recycling and also helps in reducing the use of resources thereby decreasing pollution levels.

There is a need to increase the Biomedical waste treatment facilities to prevent waste from ending up in landfills and also for efficient management of waste. There needs to be a shift from the obsolete method of incineration to much sustainable and efficient methods such as autoclaving and so on. This needs to be done as incineration poses serious threats to human health due to the release of dioxins from burning medical waste. The burning of medical devices made up of PVC is one of the largest contributors to dioxin.[35] The ash from these incinerators also needs to be checked as they can pose

[33] Ashish Jain, COVID-19*: India's Circular economy faces a rough ride.*, DownToEarth, 12th May 2020.https://www.downtoearth.org.in/blog/waste/covid-19-india-s-circular-economy-faces-a-rough-ride-71069
[34] Ibid.
[35] Vilavert L, Nadal M, Schuhmacher M, Domingo JL, Arch Environ Contam Toxicol.*Two Decades of Environmental Surveillance in the Vicinity of a Waste Incinerator:* Human Health Risks Associated with Metals and PCDD/Fs. *2015 Aug; 69(2):241-53.*

a serious threat too. Some countries have already started to shift from incineration to other forms of dealing with waste. The Philippines have banned the use of incinerators while Denmark went a step ahead and banned the construction of incinerators altogether.

India also needs to implement better ways of encapsulation of sharps. Sharps are hazardous substances that can spread easily and can also sometimes eat through the material encapsulated it. We need to make sure that such technologies are implemented especially in today's scenario to prevent the spread of the virus through scalpels, injections, and every equipment used for the treatment of the patient.

There needs to be better segregation in the Indian household during the pandemic as there isn't a lot of staff available for the secondary segregation and also because it puts the staff at the risk of getting the infections

More emphasis needs to be laid upon the use of multi-use products such as reusable masks and so on to reduce the waste generated by single-use PPEs. The best way to reduce waste is by reducing the waste at the source and this can be done by using products that are resistant and can be used multiple times.

There needs to be an imposition of obligations on the manufactures of such products which can be drawn from the polluter pays principle. This is essential to prevent the manufacture of products contributing to the excess waste in the landfill.

20. Alternative Options to Deal with Waste

Plasma pyrolysis- this technology uses plasma torches to plasma energy. the ionized gas in the plasma state can conduct electricity but due to high resistance, it turns into heat energy. This is especially useful for infectious waste, sharps, etc. This system has many advantages such as low emission rates, residue waste inactive and sterile and there is 80-90% reduction in mass making it easy to dispose of. This is the type of technology needed by India due to the increasing number of cases leading to an increase in medical waste.[36]

[36] Nema SK, Ganeshprasad KS. *Plasma pyrolysis for medical waste*. Curr Sci. 2002; 83:271–8

Some systems use ozone for decontamination of the medical waste as it is a strong oxidizing agent destroying all the microbes and convert them into molecular oxygen[37]

Some technologies have promising futures such as the bio-convertor which uses biological degradation to help facilitate the process. Though further research needs to be done for the mass manufacture of such a product, it is a technology that can be implemented for better management of waste, especially during the current pandemic.[38]

According to a survey conducted by the WHO on various methods used by various countries to deal with medical waste said that only the republic of Korea and Japan are the countries using the best available technology for Biomedical waste logistics and treatment. Most of the countries had fairly satisfactorily results and these were because little no financial support was given to use better ways of management of waste. Funding such projects are not only important for efficient management during the pandemic but also for a sustainable future[39]

21. Conclusion

The fight to ensure that human freedoms & human rights and climate duties are not COVID-19 collateral will continue in the US, the EU, and elsewhere as governments face the errand of restarting their economies in the numerous months to come. The outcome will portray our capacity and will to relieve what finds a way to be an overall fiasco unquestionably more conspicuous even than the viral pandemic.

A functioning administration over the political scene will go far in ensuring that due thought is given to changing future money related improvement to the duties of COP21 and the Sustainable Development Goals.

World Leaders and Pioneers must comprehend that propelling a green and practical economy is as critical as guaranteeing lives during COVID-19 or shielding people's money related to security by saving and supporting our current economies. There is a

[37] Emmanuel J. Washington, DC: *Health Care Without Harm*; 2001. Non-Incineration Medical Waste Treatment Technologies.
[38] Roohi, Bano K, Kuddus M, Zaheer MR, Zia Q, Khan MF, et al. *Microbial enzymatic degradation of biodegradable plastics.* Curr Pharm Biotechnol. 2017; 18:429–40
[39] United Nations Industrial Development Organization, Environmentally Sound Management of Medical Wastes in India, May 2011

need to push a money related improvement model that is earth adaptable and progressing, both in general and all around.

To briefly conclude from all the above events happening around the world it is highly unlikely that an environmental law calling for environmental and climate protection will be passed in any governing bodies around the world as the governments will be focused on recovering their economics. On the contrary, a decrease in environmental protection, and particular climate protection is likely to be the result of this pandemic and environmental issues are likely to shift from focus.

However, we should at the very least focus on making sure that we as a race don’t try to harm the planet more than we have and the latest problem in achieving that objective of ours is the problem of bio-medical waste. Which we can minimize with the help of the suggestions and recommendations which we have provided in this paper.