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HAZARDOUS WASTE SHOULD BE MANAGED PROPERLY FOR DEVELOPMENT OF BETTER WASTE MANAGEMENT STRATEGIES

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ABSTRACT

Hazardous waste products and trash disposal methods are vital to society. Over the last few decades, the production of hazardous waste has increased in tandem with population growth, industrialization, increasing urbanization. The constantly increasing industry sector has resulted in the creation of a massive volume of hazardous waste. As a result, enough care must be taken throughout the collection, processing, transporting, and disposal of hazardous materials in order to reduce environmental dangers, as it cannot be disposed of in the environment since it is. That study looks at hazardous wastes, their many types, and how they are managed. Improved strategies for identifying the most convenient and ecologically friendly hazardous waste medication and disposal techniques are required. This document discusses the numerous hazardous wastes created by industry, as well as the nature of those wastes and several methods that can be used for managing the hazardous waste.

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1. INTRODUCTION

Any undesirable substance whose disposal endangers the surroundings, i.e. it is explosion, combustible, oxidation, toxic and carcinogenic, carcinogenic, abrasive, and/or toxic/ecotoxic, is classified as hazardous waste (Hidaya & Benhachmi, 2019). Management of waste includes the collection, transportation, medication, recycling, and disposal of waste management has been a major environmental problem for several decades. Trash generation has been seen to increase with increased society, industrialization, and urbanization, among other causes. The waste management plan takes into

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both non-hazardous and hazardous waste are taken into account. Hazardous waste poses a significant or possible harm to public health and the environment, whereas non-hazardous waste poses no such risk. The ever-increasing industrial sector has resulted in a large amount of hazardous waste being produced. As a result, because hazardous waste cannot be disposed of in the environment as is, care must be taken during the storage, segregation, transportation, and disposal of hazardous waste to minimize environmental risks. This research examines hazardous wastes, their various kinds, and how to deal with them. The goal of waste management is to reduce the harm that garbage can do to people and the environment. This can be accomplished through biological, physiological, chemical, and thermal processes that convert waste into less hazardous or ecologically friendly compounds, as well as the disposal or dispersion of granular, liquid, or gas products or residues under controlled conditions. (Eduljee, n.d.).

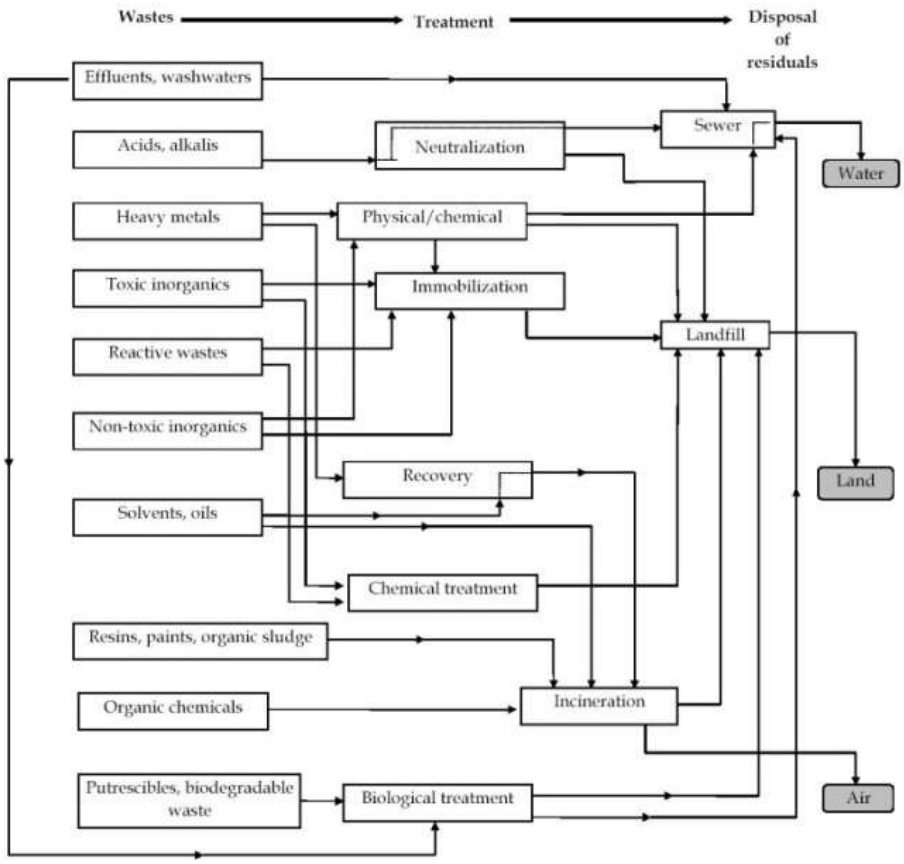

Figure 1. A program for the medication and disposal of hazardous material (Eduljee, n.d.).

Conversely, wastes can be restrained or consolidated to reduce or limit waste mass dispersion and receptor exposure to the hazard. Aside from deterioration, annihilation, and disposing methods, the

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term "medication" also refers to waste recycling and recovery activities, which aim to remove these items from the disposal chain and so avoid their entry further into environment. (Eduljee, n.d.).

Furthermore, in order to be safe, recycling or recovery methods may produce hazardous byproducts that must be diverted to different medications or disposal options. Because hazardous wastes have such a diverse range of physiochemical properties, medication technologies must be carefully matched to each waste type, taking into account the nature of the wastes, the level of hazard reduction required (i.e. the nature of the residue streams), as well as economic and other factors. Natural systems, physiological and chemical processes, biological processes, and thermal processes are the four basic groups of hazardous waste medication systems. Figure 1 (Eduljee, n.d.).

These medications' possible health risks range from small, short-term discomforts like headaches and nausea to serious health problems like cancer and birth defects, as well as significant mishaps that result in instant harm or death. As a result, it's critical to put in place effective waste management strategies. As a result, hazardous waste management is required, including environmentally friendly and cost-effective disposal, and advice is provided based on waste types and states. (Amadi et al., 2017).

Hazardous waste is defined as any waste that, when improperly handled, transported, or disposed of, might considerably raise the risk of mortality or permanent or disabling reversible illness, or that poses a current or potential threat to human health or the environment (Ibrahim et al., 2018). Solid waste is classified as hazardous by the United States Environmental Protection Agency (USEPA) if it falls into one of the four (4) categories stated in the Federal rules (CFR) (F, K, P, and U) (Worldloop, ill.)

I. The F list classifies hazardous waste produced by routine engineering and industrial procedures, such as wasted solvent residues, wood preservative chemicals, and so on.

II. The K list is a waste classification system that classifies hazardous wastes from a variety of enterprises and industries according to their origin. Companies that generate iron and steel, pesticide manufacturing, and wood preservation produce this type of trash.

III. The waste of formulations of clear and marketable grade composition of some remaining chemicals that must be discarded is included in the P and U lists. Hazardous waste materials can also be categorised according to their level of danger. Hazardous waste is divided into three categories, according to a study: high-risk waste, intermediate-risk waste, and low-risk waste.

Materials with a high concentration of hazardous, transportable bio-accumulative components, such as chlorinated solvents and cyanide waste PCBs, are classified as high-risk waste (polychrome biphenyl).

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Metal hydroxide sludges are seen in V. Transitional risk wastes.

VI. Low-risk wastes: Waste that contains both low-hazard and putrescible waste in substantial quantities.

Hazardous waste is found not just in industries and medical facilities, but also in homes.

2. METHODOLOGY RESEARCH

The writing approach employed is a literature review, which will be filled by numerous journals and papers that have been studied and are linked to the issue, namely the role of hazardous waste in developing better waste management strategies. Articles and journals originating from online social media, as well as a review of articles and journals from international and national offices with issues that are relevant to what will be covered, were used as sources for this writing. Following that, it will be included in the results and discussions that describe the influence of the impact and advantages to the factors of hazardous waste management that should be appropriately handled in order to design better waste management strategies.

And for the last part conclusions and suggestions for hazardous waste should be managed properly for development of better waste management strategies. Not only that, the methodology of this research also includes statements from the results of research on hazardous waste in several countries. Finally, conclusions and recommendations for hazardous waste management should be appropriately managed in order to establish better waste management plans. Not only that, but the methodology of this study includes remarks based on the findings of hazardous waste research in numerous countries.

Hazardous waste management principles and practices

Water pollution results from the disposal of solid waste remnants. Municipal incineration with advanced energy recovery systems was popular at the turn of the century in big European and American towns, but eventually became extinct owing to exorbitant running expenses. In recent years, incineration has been used for hazardous solid waste management (Gupta N). has declined in popularity as a result of the danger connected with rising air pollution control measures. Waste created by numerous industrial and home activities can pose serious health risks as well as have a detrimental influence regarding the environment. The following are examples: technique depicts a typical waste management strategy in a developed civilization. Figure 2 depicts the many stages required in hazardous waste handling.

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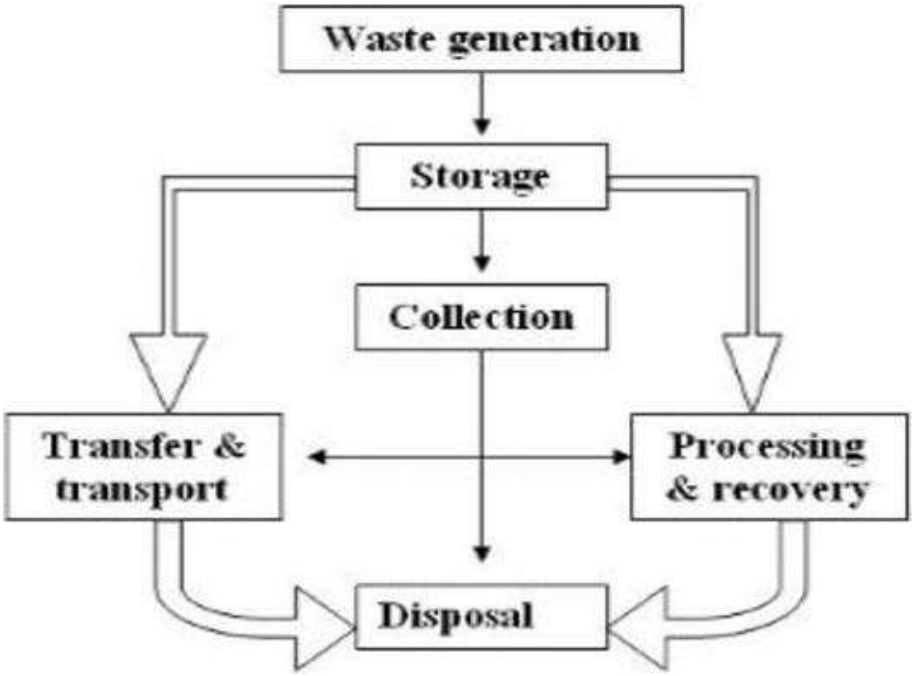

Figure 2 The procedures for disposing of hazardous trash.

Toxic waste disposal Individuals who handle hazardous materials are recommended to take steps to safeguard their health. Exposure to hazardous waste causes skin rashes, asthma in long-term exposure, eye irritation, and chest tightness.

Hazardous waste transportation

Hazardous waste created frequently need transportation to a specific medication, preservation, or disposal facility at a authorized facility (TSDF). As a result the possible hazards in terms of public safety and environmental protection, governmental authorities pay extra attention to transportation in order to avoid the odd unintentional leak (Jerry, 2015) .

The last stage of a hazardous waste management system is hazardous materials disposal. Among the many garbage disposal options are secure landfill, deep borehole, and substrate disposal.

Safe landfill some hazardous pollutants were disposed of in this manner conventional landfills, resulting of unacceptable levels of dangerous compounds infiltrating the earth. This pollutants ultimately make their way into hydrologic systems that occur naturally to avoid exposure to chemicals from infiltrating of soil, landfills must have a barrier in place to capture hazardous compounds that may linger in discarded garbage. Hazardous wastes are now stabilized, solidified, and disposed of in landfills,

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depending on the kind of the waste . A landfill site when hazardous garbage is disposed of by burying it in the ground (Nathanson, 2020). Figure 3 depicts an example of a suggested design. Before disposal, the trash is placed in sealed barrels. The hazardous-waste disposal is made up of multiple impermeable liners as well as leachate.

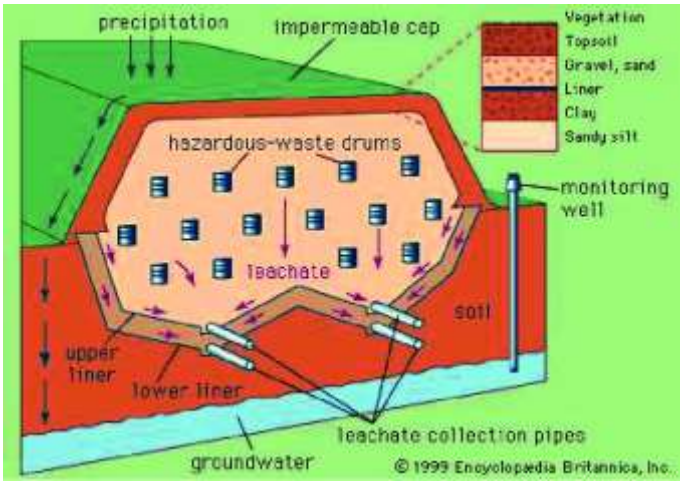

Figure 3: Landfill technique security systems

A network of pipes installed above each liner makes up the double leachate collection system. The upper layer prevents leachate from entering the fill, while the bottom layer serves as a safety net. The leachate is collected and taken to a medication processing facility. A finished landfill is covered with an impermeable top or cover to decrease the quantity of leachate in the fill and the potential for environmental impact.

3. RESULTS AND DISCUSSION

3.1 Hazardous Waste's Nature and Aspects

Hazardous waste characteristics have properties that could be seen and then known depending on the hazardous level of the waste itself. A hazardous waste is one that has been identified. and toxic material if it has certain properties, including: ignitability, corrosivity, reactivity, and toxicity (Gaurav Singh, 2022).

3.1.1 Ignitability

Waste with these characteristics ignites because it can burn due to contact with air, fire, air or other materials, both in temperature and pressure, at this flash point it will ignite if it comes into contact with

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fire. Hazardous Waste that is not in the form of a liquid will easily ignite through friction or absorption of water vapor if it is at a temperature of 25 degrees Celsius or 760 mmHg. The following is the symbol for hazardous combustible waste and EPA has designated D001 as the waste code for ignitability hazardous waste.

Figure 2. Symbol of Ignitability

3.1.2 Corrosivity

This waste is dangerous because of its corrosion properties, waste with these properties can damage or destroy anything that comes into direct contact. This waste can be said to be corrosive if it has a pH equal to or less than 2 for acidic wastes and equal to or greater than 12.5 for alkaline wastes. The corrosive nature of solid waste is carried out by mixing the waste with water and If the pH of the waste is less than or equal to 2, it is acidic, and if the pH is more than or equal to 12.5, it is alkaline. ones. Waste that causes irritation characterized by redness or swelling and swelling or edema. This trait can be identified by testing on mice using the applicable method. The following is the symbol for hazardous corrosivity waste and EPA designated D002 as the waste code for corrosive hazardous wastes.

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Figure 3. Symbol of Corrosivity

3.1.3 Reactivity

This waste is dangerous because under normal conditions it is unstable and can cause changes without detonation. This waste visually shows the presence of, among others, gas bubbles, smoke, and discoloration. This waste when mixed with water has the potential to cause an explosion, producing gas, steam or smoke. This waste is also cyanide and sulfide waste which at pH conditions between 2 (two) and 12.5 (twelve point five) can produce gas, steam , or toxic fumes. The following is the symbol for hazardous reactivity waste and EPA designated D003 as the waste code for corrosive hazardous wastes.

Figure 4. Symbol of Reactivity

3.1.4 Toxicity

Toxic Hazardous Waste is Waste that has toxic characteristics based on the determination of toxic characteristics through TCLP, LD50 Toxicological Test, and sub-chronic tests.

a. Determination of Toxic Characteristics via TCLP

   Waste is identified as hazardous waste category 1 if the pollutant substance content in the trash exceeds TCLP-A, as indicated in Attachment III, which is an important element of this Government Regulation. If the concentration of pollutant compounds in the trash is equal to or less than TCLP-A and larger than TCLP-B, the waste is classified as hazardous waste category 2. in Appendix III which is an integral part of this Government Regulation.

b. LD50 Toxicology Test

   Waste is If it has a value equal to or less than, it is classified as category 1 hazardous waste. the 7 (seven) day oral LD50 Toxicology Test with a value less than or equal to 50 mg/kg (fifty milligrams

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per kilogram) of body weight in mice. If a trash is classified as hazardous waste category 2, it is classified as such. has a value greater than the 7 (seven) day oral LD50 Toxicology Test with a value less than or equal to 50 mg/kg (fifty milligrams per kilogram) of body weight in mice and smaller or the same as from the 7 (seven) day oral LD50 Toxicology Test with a value less than or equal to 5000 mg/kg (five thousand milligrams per kilogram) of body weight in mice. The LD50 Toxicological Test value was generated from the toxicological test, namely the determination of the acute nature of the waste through a biological test to measure the dose-response relationship between the waste and the death of the test animal. The LD50 Toxicological Test value was obtained from probit analysis of test animals.

c. Sub-chronic

Waste is identified as hazardous waste category 2 if the sub-chronic toxicology test on mice for 90 (ninety) days shows sub-chronic toxicity, based on observations on growth, accumulation or bioconcentration, study of response behavior between individual test animals, and/or or histopathology.

Toxic Waste is hazardous when consumed or absorbed due to its toxicity. Toxic waste is a source of concern because it can leach from waste and pollute the environment. The following is the symbol for hazardous toxicity waste and EPA designated D043 as the waste code for corrosive hazardous wastes.

Figure 5. Symbol of Toxicity

3.2 The Effects of Hazardous Waste on the Environment and Human Health

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Inadequate or inappropriate hazardous waste disposal that does not fulfill the regulations can have a detrimental impact on the environment and human health. This trash is classified as usually released so that it contaminates groundwater, soil, and atmosphere (James M. Beard, 2021).

3.2.1 Impact on The Environment

We often encounter hazardous waste in our daily life, such as in products that we often use. Products that contain hazardous and toxic substances that we encounter and use, such as detergents we usually use to wash clothes, air fresheners, clothes bleaches, floor cleaners, batteries and other electronic devices. Without realizing it, we often dispose of B3 waste in any place which of course will have a negative impact on the environment. Advances in technology have made life easier for humans. But on the other hand, technological advances and daily activities produce hazardous waste itself.

We all often don't care about waste because we don't know the dangers of hazardous waste, even though this small amount of hazardous waste is very dangerous for the environment. Lack of understanding about the dangers of hazardous waste and assessing the small amount so that it is easy to dump it into the ground without going through a medication process. Furthermore, the health of animals and humans on land will be disrupted. Land where hazardous waste is disposed of without medication will not only result in decreased crop productivity on site or crop failure, but some of the plants on the land may die. Of course, land contaminated with hazardous waste will reduce the quality of the land. Land contaminated with B3 waste will be damaged due to quality changes and plant cultivation is difficult because it has been contaminated with hazardous waste. For this reason, do not let the land be contaminated with hazardous waste because the impact is very bad for the land. While on the land where all living things live, especially humans. Polluted soil is very dangerous, starting from plants that cannot grow, various diseases for all living things on land, including humans because the soil structure is damaged, soil air is polluted and air is the source of life for all living things, including humans. Contaminated soil can also damage plants or plants cannot grow, while plants are a source of life for humans. Everything will be destructive if the hazardous waste has damaged the soil, not only the plants die but the environment will die (Jatinder Kaur Katnoria, 2020).

3.2.2 Impact on Human Health

In human health, hazardous waste that contaminates the environment will also have a negative influence on human health Humans exist in their surroundings. If the environment in which they live is

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polluted then it can also pollute human health. A clean environment is currently difficult to obtain due to several factors, such as there are still many people who are still not aware of the dangers of waste, especially hazardous waste. People still don't know about waste, such as the types of waste they know, only waste that they usually encounter, such as household waste, even though there are many other forms of garbage, such as hazardous waste, require particular management in order to be managed.

The impact of hazardous waste on human health can affect many aspects, especially the population if they consume water that has been contaminated with hazardous waste. Water is a very vital natural resource and is needed to determine the sustainability of the life of all living things on this earth. In all kinds of human activities, water is a basic need to carry out various activities, such as household needs, for example for drinking, cooking, bathing, washing, industrial purposes, trade purposes, agricultural and livestock needs, shipping purposes and so on. Therefore, water is very functional and plays a role in the life of living things on this earth. But if the water is contaminated with hazardous waste, it can threaten human survival. Populations can be negatively affected if hazardous waste has also contaminated the soil and air. Exposure to hazardous trash can result in a variety of health issues, including dyspepsia, respiratory illnesses, mental retardation, skin irritation, and so on (M A Hasan, 2020).

3.3 The Importance of Waste Management on Hazardous Waste

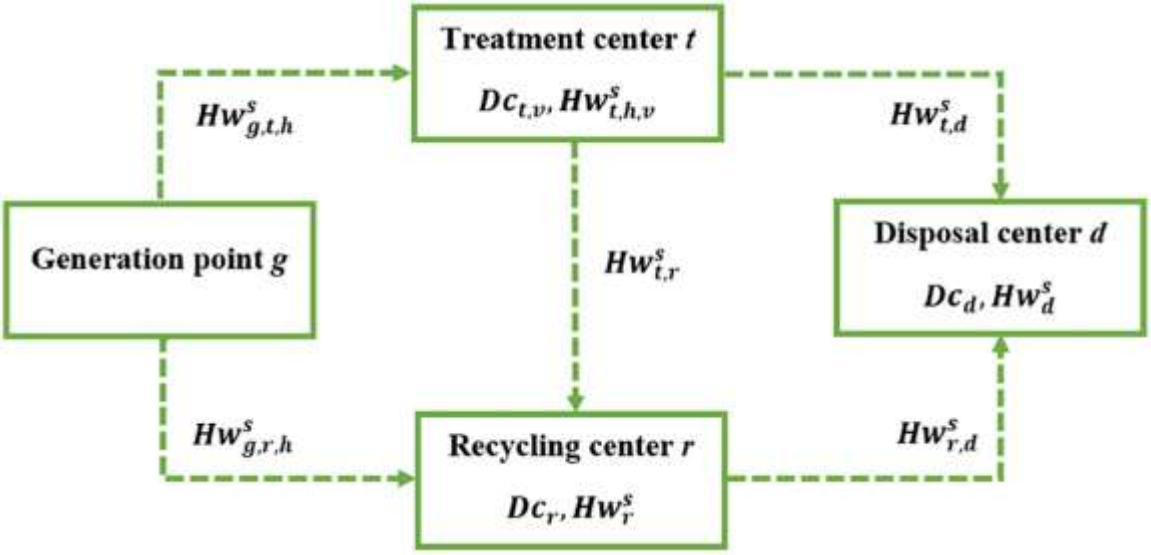

Figure 6. The Problem System on Waste Management

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When it comes to management of waste, the first thing to consider is how the problem will be identified and resolved. As represented in the graphic above, the topology of a hazardous waste management system's network is shown. Hazardous waste is collected at its source and sent to the proper recycling and medication facilities based on its content and characteristics. Hazardous waste cannot be processed in incineration plants because of its explosive nature. The waste leftovers will be immediately processed from the recycling facility in the following step, with the ultimate objective of being disposed of at the disposal center afterwards. The strategic facility site judgments made in the first phase of the hazardous waste network design issue are stable, since they do not alter as a result of a variety of situations.

3.4 The Plan Methods in Hazardous Waste

In the hazardous waste plan methods there are physical, radioactive, chemical, and biodegradability characteristics, as well as the degree of risk, are all characteristics of wastes that aid in determining the optimum disposal method. Criticality in terms of interaction with various media (water, water, or soil), as well as the potential harm if exposed to ecosystem, to human life and the environment, as well as its assessment The scope of the service area for which the disposal facility will function, i.e. collecting garbage from local industry and transporting it to the facility, is determined by gathering detailed topographical, geology, meteorological, and hydrogeology parameters of disposed areas. The disposal's appropriateness site is determined based on economic, social, and environmental issues, as well as the influence on nearby water sources, communities, and other factors. All of the disposal site's emergency evacuation plans and equipment are designed to ensure that adequate monitoring systems are available. On the workmanship and also the selection of medication technology is determined by the qualities of the trash When a plant has a short landfill site and produces waste, incineration is employed as a medication strategy. Little waste. Not only that, the different procedure is used when the landfill area is larger and a large volume of residue is produced. Thus, It would be a cost-cutting measure for current technology that would have been installed at the disposal site otherwise. A disposal facility's design capacity will not change over time. However, the garbage that must be disposed of will

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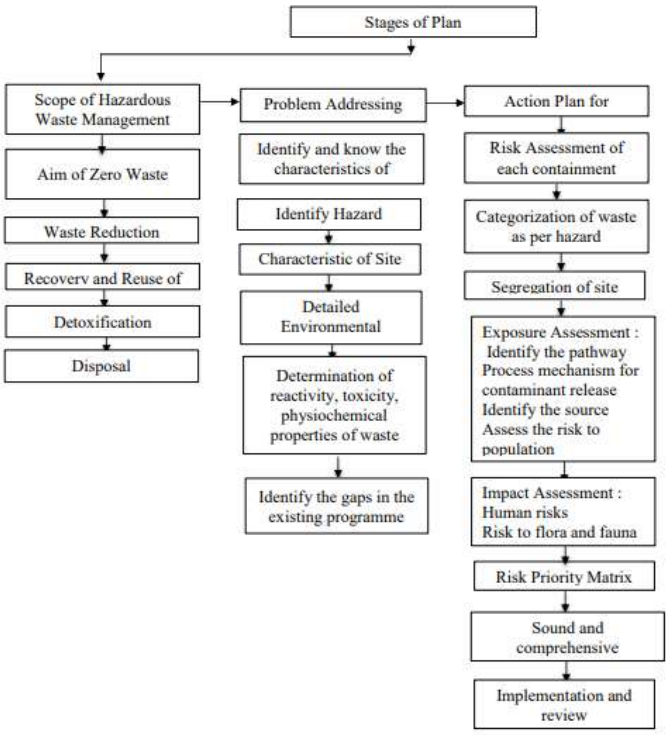

Figure 7. The Plan Design on Methods Hazardous Waste

They will continue to come and even climb in the future as a result of rising industrialization. Garbage will be routed to landfill locations for disposal under rigorous laws, restricting available space. The resources will be expended at some point, and facilities will have to adopt another technique, or the facility owners will be compelled to relocate. In order to be used, the depleted facility must be replaced; this must be considered at the design phase. Before moving forward with initiatives, the negative cost implications associated with technology should be properly considered, such as. There may come a point when a specific technique, like as making it an unappealing alternative. Moving on, discuss the various models that have been developed for a proper waste medication and disposal system plan that takes into account the waste's characteristic features and amount, yearly waste handling capacity, transportation distance, regional population statistics, the risk connected with the disposal technique, as well as the functional location of waste-generating industries Then there's the fact that not all models can accommodate all of the details. Such as being appropriate for various sorts of rubbish. Although garbage from the same industrial category may be generated, their properties may differ and, as a result, they cannot be managed in the same way. If incompatible wastes are allowed to come into touch with one another, a threat such as a fire or the release of harmful gases can develop. It is possible that an explosion or heat generation will occur. It is also challenging to establish an efficient

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management system that conforms with all legal rules and compliances, as well as transportation and operational maintenance expenses. The majority of storage is found in bedrock.. A hazardous waste disposal facility or repository is depicted in Figure 5. The type of host rock, as well as some potential downsides, are significant considerations. For more hazardous substances, this strategy is extensively employed.

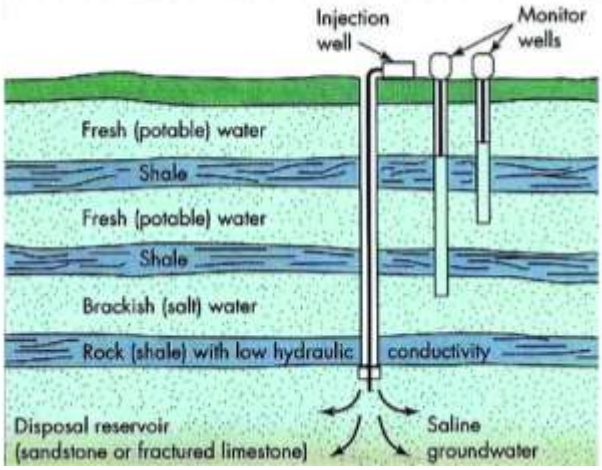

Figure 4. Deep well disposal technique

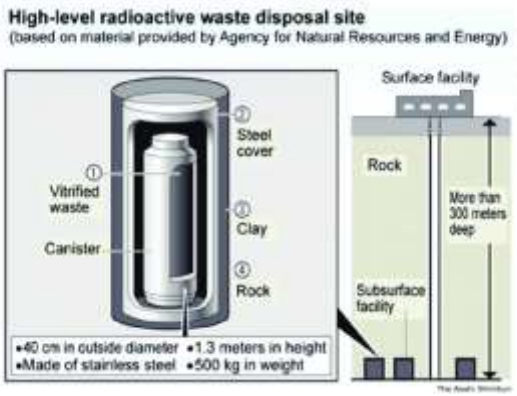

Figure 5. Method of disposal in bedrock

For example, copper or stainless steel can be found buried deep within solid rock formations. (Joshi & Ahmed, 2016).

Hazardous waste is divided into three categories: reusable, incinerable, and biodegradable. In comparison to other classes, The disposable Hazardous Materials classification has the most entries (inorganic in nature and should be disposed of in a landfill) (Sharma & Jain, 2019).

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The selection and deployment of appropriate methods, phases, and systems in order to meet stated goals and objectives is defined as integrated sustainable waste. This method ensures that all components operate together, making planning and execution more efficient. It is made up of four basic ideas and three independent variables.

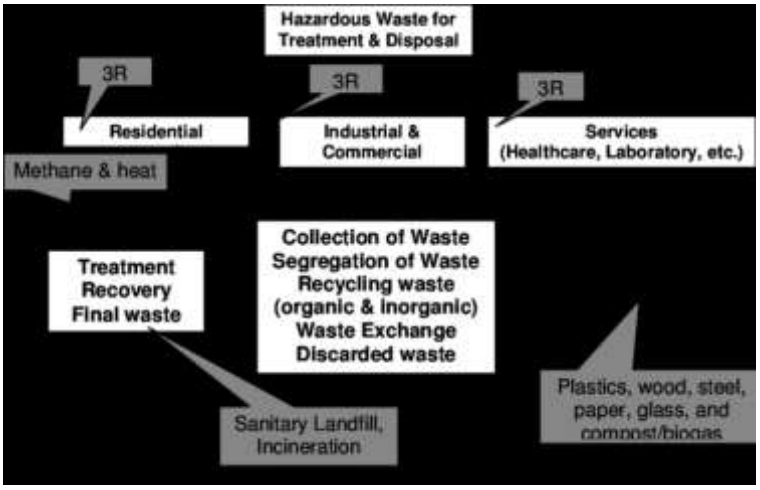

Figure 6. Waste management that is both integrated and sustainable.

For the local conditions, waste management is technically, environmentally, socially, economically, fiscally, institutionally, and politically possible. It has the ability to last for an extended period of time without depleting the resources on which it relies. ISWM consists of several components, including collected, distributed, and disposed of or processed waste. Long-term sanity, environmental preservation, and resource management require sustainable hazardous waste management. The key factors are decreasing the development of hazardous wastes.

4. CONCLUSION

Hereby we may conclude that The waste disposal program's main goal is to change the way hazardous waste is handled when it is being stored, delivered, and disposed of in an environmentally sound manner. A need to address possible hazards to human health and the environment motivates the focus on hazardous waste management. Toxic waste management requires more than just dropping it on the ground. As part of the manufacturing process, industries are being urged to produce less hazardous waste. Because it is impossible to totally prevent hazardous waste, the only option is to reduce, recycle, and treat it. As a result, actions should be done to maximize use of modern technologies

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while minimizing environmental impact. The importance of waste minimization, recycling, and medication cannot be overstated.

5. REFERENCES

(n.d.). Retrieved from Illegal Flows. Retrieved January 5, 2022, from https://worldloop.org/e-waste/illegal-flows/

A.Vallero, D. (2019). Chapter 31 - Hazardous Wastes. *Waste (Second Edition)*, 585-630. doi:https://doi.org/10.1016/B978-0-12-815060-3.00031-1

Gaurav Singh, P. Y. (2022). Hazardous Waste Characteristics and Standard Managemet Approaches. 145-164.

James M. Beard, R. A. (2021, june). Hazardous Waste. 363-380. doi:10.1201/9780429316548-16

Jatinder Kaur Katnoria, P. S. (2020, January). Impact of Hazardous Waste on Soil Health: Sources of Hazardous Waste. *Innovative Watse Management Technologies for Suistanable Development*, 18-35. doi:10.4018/978-1-7998-0031-6-ch002

JeyaSundarAmjadAlidiGuoZengqiangZhang, P. G. (2020). 6 - Waste medication approaches for environmental sustainability. (A. R. Pankaj Chowdhary, Ed.) *Microorganisms for Sustainable Environment and Health*, 119-135. doi:https://doi.org/10.1016/B978-0-12-819001-2.00006-1

M A Hasan, J. M. (2020). Environment friendly ceramics from hazardous industrial wastes.

management, A. s. (2020, February 28). *Journal of Cleaner Production, 277*. doi:https://doi.org/10.1016/j.jclepro.2020.123566

P.Brito, A. P. (2021, May). Thermo-environmental evaluation of a modified Waelz process for hazardous waste medication. *Process Safety and Environmental Protection, 149*, 442-450. doi:https://doi.org/10.1016/j.psep.2020.11.021

S. V. Santosh Vani*, S. B. (2017). Hazardous Waste - Impact on health and Environment for sustainable development in India. *World Scientific News, 70*, 158-172. Retrieved January 6, 2022

Saurabh Shukla, R. G. (2020). Hazardous Waste - Types and Sources. 24-52.

Gupta N, Yadav KK, Kumar V. A review on current status of municipal solid waste management in India. J Environ Sci (China). 2015 Nov 1;37:206-17. doi: 10.1016/j.jes.2015.01.034. Epub 2015 Jul 30. PMID: 26574106.

A.N.Jerry, Encyclopedia Britannica, Hazardous Waste management,2015

Nathanson, J. A. (2020, October 30). hazardous-waste management. Encyclopedia Britannica. https://www.britannica.com/technology/hazardous-waste-management

Amadi, C. C., Okeke, O. C., Amadi, D. C., & State, I. (2017). Hazardous Waste Management: a Review of Principles and Methods. *International Journal of Advanced Academic Research | Sciences, Technology & Engineering*, *3*(8), 12.

p-ISSN 0853-7720; e-ISSN 2541-4275, Volume 7, Nomor 2, halaman 193 – 209, Juli 2022
DOI : http://dx.doi.org/10.25105/pdk.v7i2.12815

Eduljee, G. (n.d.). *M SC PL O E – C EO PL O E –*.

Hidaya, R., & Benhachmi, M. K. (2019). A multi-objective model for the industrial hazardous waste location-routing problem. *Lecture Notes in Networks and Systems*, *66*, 69–77. https://doi.org/10.1007/978-3-030-11914-0_7

Ibrahim, E., Gushit, J., Salami, S., & Dalen, M. (2018). Accumulation of Polychlorinated Biphenyls (PCBS) in Soil and Water from Electrical Transformers Installation Sites in Selected Locations in Jos Metropolis, Plateau State, Nigeria. *Journal of Environmental & Analytical Toxicology*, *08*(02), 8–13. https://doi.org/10.4172/2161-0525.1000561

Joshi, R., & Ahmed, S. (2016). Status and challenges of municipal solid waste management in India: A review. *Cogent Environmental Science*, *2*(1), 1–18. https://doi.org/10.1080/23311843.2016.1139434

Misra, V., & Pandey, S. D. (2005). Hazardous waste, impact on health and environment for development of better waste management strategies in future in India. *Environment International*, *31*(3), 417–431. https://doi.org/10.1016/j.envint.2004.08.005

Sharma, K. D., & Jain, S. (2019). Overview of Municipal Solid Waste Generation, Composition, and Management in India. *Journal of Environmental Engineering*, *145*(3), 04018143. https://doi.org/10.1061/(asce)ee.1943-7870.0001490