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ENVIRONMENTAL EXTERNALITIES FROM LANDFILL DISPOSAL AND INCINERATION OF WASTE

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ABSTRACT

In the modern world, the concerns of the environment have been increased and also, the environmental commissions are developing tools for launching new regulations and directives concerning to the environment. Most of the studies are conducted in the field of waste management and restricted to the analysis of cost and benefits of environmental externalities from landfill disposal and incineration of waste. The study aims to review the comprehensive ways of analyzing the important aspects of environmental externalities from landfill disposal and incineration of waste. In a specific manner, it has also provided an overview of environmental externalities that are evaluated in context to different policies of waste management and their integration with the environment. The study explains the concept of externalities, waste management system, receptors, and damages. It has also explained the inputs and outputs of incineration, emissions and impacts and landfill disposal impacts within the environment. The inputs and outputs of incineration are also concentrated to understand the landfill disposals and their impacts. The essential inputs are also identified to provide a necessary review of literature within the study. It has also considered the externalities from incineration and landfill disposals of waste. The research topic is closely associated with the social and economic activities and their impacts. The main externalities are studied according to the need of situation for incineration of waste and landfill disposal in economic and physical terms. The study has also discussed the sensitivity of various parameters to the environmental preferences. The major research limitations relate to the challenges of landfill disposal and incineration of waste within the environmental externalities.

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1. BACKGROUND OF STUDY

The recent developments in the environmental commissions have led to the betterment on decision-making process of new regulations and directives concerned with the environment. This study has mainly concentrated on environmental externalities from landfill disposal and incineration of waste. It is very important to understand the improvement measures in environmental efficiency in context to the economic activities. It has also conducted extensive research in the resource and efficiency indicators in context to the environment. The negative relationship between environmental impacts and economic growth is associated within the framework of the environment. The study addresses the necessity for waste management system and issues of relevance regarding economic costs and environment impacts. It has also estimated that the waste trends are linked with the economic activities in a constant manner and achieve a common goal of achieving cost effective solutions for various environmental problems. The major strategies are related to the recovery of landfill disposal and incineration of waste within the environment and also, gain benefits for environment betterment. The costs and benefits of landfill disposal and waste incineration are also evaluated in specific situations to recycle the environment (Fredriksson, 2000). The increasing rate of waste incineration and landfill levels depend on the environmental impacts in a considerable manner. From the perspective of waste generation, the collected waste is disentangled and managed by incineration, recovery, and composition. The option of incineration is hybrid and excludes the possibility of incineration without energy recovery, and it has to be positive for waste recovery and better environment (Alpay, 2006). The waste needs to be treated by recycling and process of incineration and further, landfill disposals. The present study aims to understand the improvement of environment in context to the environmental externalities from landfills and incineration waste and knowledge of related aspects within the study.

2. STUDY OBJECTIVES

The main objectives of study relate to the understanding of environmental externalities from landfill disposals and incineration of waste. There are different resolutions of waste management and their integration with the environmental impacts. The main aim of the study is to understand the environmental externalities from landfills and incineration waste and their impacts. The objective of various activities of study is as follows:

- To provide an overview of the existing theories of environmental externalities from landfill disposal and incineration of waste and understand the gaps in the available information and knowledge gaps.
- To provide an overview of the different types of externalities rose from landfill disposal of waste and incineration and understand their impacts on receptors from the externalities.
- To present the review of externalities from landfill disposal and incineration of waste within the environment.

3. STUDY DELINEATION

The study mainly considers the environmental externalities from waste disposal to landfills and waste. It does not cover the aspects of another waste disposal such as biological treatment process. The study has served to provide an overview of the literature on externalities in context to the incineration of waste and landfill disposal.

The main focus is on the waste originated from the commercialization, industrialization and households. It implies that study does not consider any specific type of waste or any other classification of waste. Moreover, the study does not imply to hazardous substances. The study also considers the externalities and caused due to landfill disposal and incineration of waste. The study does not consider other externalities caused by collection, waste pre-treatments, etc.

4. CONCEPT OF EXTERNALITIES

The externality can be considered as a cost or benefit that impacts one party who do not choose to incur the particular cost or benefit. For example, the industrialization causes multiple negative impacts on the environment and various other impacts on society whether the individuals may or may not chose to get benefits or costs (Harbaugh, 2002). The external costs exist in the form of environmental pollution and associated costs of the environment. It is a consequence of self-directed actions which lies in the externalization element. Also, there are some external benefits such as safety of the environment. Overall, the costs and benefit summed in the form of different inputs and outputs is the main concept of externality. There are various externalities in the environment due to negative consequences of landfill disposals and incineration of waste and also impacts the environment in a negative manner. The concept of externalities is also well established in the economics context and received a lot of recognition regarding various actions to internalize these activities (Mazzanti, 2008). The external benefits and costs are not like traditional costs and benefits such as operational costs of incineration or income. These types of costs are considered as internal costs, but the externalities are uncontrolled factors affecting the environment due to various reasons.

5. WASTE MANAGEMENT SYSTEM

The waste management system is closely linked to the landfill disposal and incineration of waste within the environment. The waste can be classified in many ways such as fractions of materials considered as waste or stream waste such as paper, glass or organic wastes. The main characteristics of waste are recyclable, combustible and hazardous. The major sources of waste are industrial, commercial, agricultural and household, etc. The study focuses on solid waste that generates from the household, commerce, and industry. The waste has various environmental impacts related to the landfill disposals and incineration of waste and has most of the proportion for waste. The waste generation has been increased in recent years and based in current trends; the generation of waste is increasing in last decade. The proportion of waste is directly transported to landfill and despite the efforts of incineration, minimization of waste and recycling levels, the waste levels are generated increasingly. It is important to handle the waste from the source generation itself. It also involves various stages such as prevention of waste at source, collection, recycling, sorting and treatment (Copeland, 2004). It also focuses on environmental externalities linked to the landfill disposal and incineration of waste. These stages have considerable influence on environmental impacts. The prevention of waste reduces the amount of generated waste and recovery at source decrease the waste amount and enters the waste management system (Price, 2001). The collection of waste will result in externalities related to environmental impacts. All impacts of the environment are associated with the landfilling and incineration by reuse, recovery, and recycling of waste streams which affects the composition and quantity of waste.

The landfill disposal and incineration of waste on environmental impacts are completely influenced by the composition of waste. The particular quantity of waste is composed by different streams of waste and fractions that have considerable environmental impacts depending on the inherent characteristics of hazards. For instance, the recycling of waste materials with maximum contents of metals and organic contaminants decreases the pollutants concentration in the waste stream and reduces the emissions from landfills and incineration (Brock, 2004). There are a different percentage of different types of waste, and it varies according to location, season and other variations. The significant improvement in the environment can be made with the proper waste management system.

6. RECEPTORS AND DAMAGES

The pathway of impact is important to quantify the exposure of receptors and identified emissions. The receptors are considered as organisms in the environment such as flora, fauna, buildings and humans that are affected adversely by emissions from the incinerations of landfill disposal and waste. It is important to identify receptors and their detrimental consequences to the human health with the effect of direct emissions and also, some indirect effects. The main is that the population for the impacts dominates the preventive strategies for environmental impacts (Mazzanti, 2008). The damages results in various effects for receptors. Some of the common damages are health effects related mortality and morbidity, damage to infrastructure, climate changes, and negative effects of ecosystem and other negative effects to environment. There are various categories of damages which correspond to the environment. The acute effects occur in short-term exposure to the pollutants such as some days, weeks. And chronic effects occur due to long term exposure of pollutant and lead to severe damages to environment. Repeated exposures can also lead to the chronic effects (Harbaugh, 2002). Although the pollutants may not result in toxicity tests but it is considered that sublethal effects may exists. For investigating the damages of long-term pollutants exposure, the entire reproductive cycle have to be studied in context to inputs, outputs and their impacts.

7. INPUTS AND OUTPUTS OF THE INCINERATION

In this study, incineration refers to the aerobic thermal treatment of waste without energy recovery and it also includes the disposal of residual by-products which usually results from incineration. There is a specific sequence of unit processes which differs according to the inputs and outputs. The main inputs are waste and additional resources in operations of incineration. The additional resources can be renewable and non-renewable resources such as fossil fuels, land, water and other auxiliary materials (Vollebergh, 2005). Mainly, auxiliary materials are used in the cleaning of flue gas and include calcium carbonate for removal of hydrogen chloride and fluoride, sodium hydroxide. The nitrous oxides can be removed by injecting carbon in the stream of flue gas. The additional substances are different types of flocculating agents which are used for cleaning of waste water produced while conducting the cleaning process of flue gas. The usage of water quantity is quite low and drinking water is not used during the process. The impacts on environment occur at local level and it also depends on the water availability. Fossil fuels are normally used to start and shut down the incineration process. The electricity produced from fossil fuels originates from recovered energy and consumed additionally during the operations and cleaning process of flue gas (Cagatay, 2006). The land amount required for the incineration process is independent and process technology will be small as compared to the

capacity. The main outputs include emissions to air, recovered energy, water, soil during the combustion process. The emission to air also consists of flue gas which is generated during the incineration process. All these emissions are controlled with the utilization of specific treatment process and remove the gases before the emission of air and flue gas. The process of cleaning the flue gas produces various residues which are very hazardous and should be treated properly before disposal. The process of incineration also generates the residual solid waste which requires disposal or proper utilization such as material of road construction. There are several contaminants in residual solid waste which leads to emissions to water and soil. For example, the recovered heat energy can be used for heat housing (Seppala, 2001). The optimization of energy and recovery the need distinct system if heating which can be used according to required climate otherwise it will be wasted completely. The combined heat and power plants also produces electricity which are very efficient in context to displaced pollution. It can also be considered that energy cannot be recovered from all types of incinerators but many of them are capable of recovering the energy in a well manner.

8. IMPACTS

8.1. Impacts of Waste

There are various impacts of waste which are related to emissions of contaminants in waste water, flue gas and residual solid waste and also, from the operations of energy recovery. The emissions to air contaminants are mostly found in the flue gas and include dioxins, heavy metals, nitrogen oxides, acid gases and other types of volatile compounds. These types of contaminants are emitted in environment with the help of smokestack. The concentration of contaminants is reduced up to certain extent after emission but still, they are very harmful for environment (Yang, 2007). Another type of emission is influenced mainly by the waste composition. When the waste composition is emitted in the air, the contaminants are dispersed in environment and results in the concentrations and impacts climatic conditions, stability of substances and their residence in the environment (Eshet, 2004). The impacts of air emissions also have negative health effects and also effects ecosystem arising from the pollutants. The emissions from air results from the residual waste and their incineration to the disposal sites generated from the landfills which have solid residual waste. The emissions-related impacts are explained to understand the negative consequences of improper waste management system on human health, ecosystem and environment as a whole (Price, 2001). The indication of specific effects of various emissions is also clarified to understand the relative importance of waste management system. Also, these impacts are related in incineration of waste including the displaced impacts which results from disamenity and recovery of energy.

8.2. Impacts of Landfill Disposal

The impacts of landfill disposal are important to be explained in this study as it refers to the disposal of waste to soil or at the particular site in which there is a lot of deposited waste i.e.s a landfill site. There are various designs in which the landfill sites operate and the inputs and outputs to land filling are also different according to the particular site. Usually, the waste and additional resources are required to operate the landfill sites. The additional resources include fossil fuels, land and other auxiliary materials (Vollebergh, 2005). The controlled landfill sites which collect leachate are treated with the help of auxiliary materials and sewage treatment for the particular

tertiary is also given to treat the site. The process of land filling is very typical as the fossil fuels are consumed by vehicles within the site and requires electricity to operate the station. After closing the landfill, it requires energy to monitor the activities in active phase. In the modern landfills, energy is also used to collect and treats leachate. The land amount taken up by the landfill depends on the waste capacity of particular site. The outputs include air emissions, soil and water impacts at site and also, energy recovery from the landfill gas (Cagatay, 2006). The emission of landfill gas in the air generated from waste can also get emitted in soil and water. The landfill sites with gas collection system, landfill gas is recovered and utilized for the generation of electricity and heat. It reduces the impacts of emissions and leachate discharged in the surface water. The landfills receives all types of waste and impacts negatively to whole environment. The impacts can be reduced by segregating the landfill sites according to different types of waste and change in policies of waste management system.

9. RESEARCH LIMITATIONS

The study has faced many challenges while exploring the issues of environmental externalities from landfill disposal and incineration of waste. The pollutants from eclectic sources are adopted by people within the environment and therefore, support from local agencies and government was quite less at the time of providing relevant information about landfill sites and waste management process. The study has also faced issues while sharing the information which was restrained by industrialists and lack of information from other important sources. The people in industries were very reluctant while sharing necessary information. The main concern of study relates to the understanding of environmental externalities from landfill disposal and incineration of waste, waste management system and also, attempts to educate people about impacts of waste and landfill disposals for further improvement. The study has also faced limitations of time and resources at the time of collecting present data related to the study.

10. CONCLUSIONS

The study has established feasible framework for analysis of environmental externalities from landfill disposal and incineration of the waste, system of waste management and related trends within the conceptual environment. The study has provided relevant information about the waste generation, composition and landfill disposal linked with the improper waste management. The environmental externalities from incineration of waste and landfill disposal have major impacts on various socio-economic and policy factors. It can be concluded that the waste management is not proper, and also, landfill disposals are not leading towards waste management at the level of waste generation. The study has also confirmed the landfill and incineration along with their effects and it is clear that the landfill disposals are negatively correlated with the waste management. The additional factors such as commercialization, industrialization are playing a major role in this context. The land filling is completely driven by the environmental costs associated with the waste disposal. As far as the incineration dynamics are concerned, it has been found that the process of incineration is typical and linked to various factors of the environment. It can be summed up that the waste generation and disposal are hazardous and impacts the environment in a negative manner. The diversion of waste from landfill is recommended towards the recycling and incineration processes. The interaction of socio-economic factors should not be overlooked in the scenario of development and

performance in context to waste management. Overall, the study has supported to pursue sustainable ways of waste generation, and disposal and waste should be prevented at the top source itself. The recycling and incineration processes are promoted for the better environment and reducing the negative effects. The targets of waste prevention and innovative benchmarking can help in shaping the waste management policies in future.

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