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Greenhouse Gas Emission Potential of the Municipal Solid Waste Disposal Sites in Thailand

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ABSTRACT

Open dumping and landfilling are the prevalent solid waste disposal practices in Thailand. Surveys on the disposal sites revealed the presence of 95 landfills and 330 open dumps. Methane emission potential at these sites was estimated by three methods. Results of the Intergovernmental Panel on Climate Change (IPCC) method, Landfill Gas Emission model (LandGEM), and closed flux chamber technique were compared. The methane emission potential of 366 Gg/yr using the IPCC method was higher than the estimations of the LandGEM and closed flux chamber method of 115 Gg/yr and 103 Gg/yr, respectively. An understanding of the methane emission potential initiated the analysis of upgrading the open dumps into landfills, adding landfills to meet the future needs and utilization of landfill gases. Upgrading the open dumps to landfills increased the methane emission rates and their utilization potential. Approximately 20 additional landfills may be required to meet future demands. Landfill gas (LFG) utilization appears to be feasible in the large-scale landfills.

INTRODUCTION

Thailand generates approximately 14.5 million t of municipal solid waste (MSW) annually.¹ Moreover, a detailed analysis of the composition of MSW in selected municipalities revealed the presence of a high fraction of biodegradable material, in the range of 40–65%. Often, the waste is simply disposed in open dumps, and in very few places in engineered landfills. Environmental problems associated with open dumps are well known; local air pollution due to uncontrolled burning, emissions of greenhouse gases such as methane and carbon dioxide

due to decomposition of organic matter, vector borne diseases, and sanitation/hygiene are a few to mention.

The Clean Development Mechanism (CDM), established by Kyoto Protocol in 1997, aims at the reduction of greenhouse gas emissions. Waste processing and disposal is one of the sectors identified by the CDM for greenhouse gas reduction. Open dumps and landfills, the first choice of waste management and disposal in any developing economy such as Thailand, emit significant quantities of greenhouse gases such as methane and carbon dioxide.

This paper presents the estimation of methane emissions from the open dumps and landfills in Thailand. Universally accepted methods such as the Intergovernmental Panel on Climate Change (IPCC) method,² Landfill Gas Emission model (LandGEM),³ and close flux chamber method⁴ have been followed for the estimation and the results have been compared. In addition, an attempt has also been made to study the potential of these landfills/dumpsites to qualify under the CDM.

OVERVIEW OF SOLID WASTE MANAGEMENT IN THAILAND

Thailand has made improvements in all functional elements of its MSW management system, especially in waste collection and transport, through necessary policy reforms, both at the national and local level. However, the country's effort to manage the waste needs to be continually developed for a proper solid waste disposal strategy.

Waste Collection, Transport, and Disposal

Thailand's current solid waste management strategy focuses on bulk collection and mass disposal. In the recent years, the Thai Government has been trying to implement an "Integrated Waste Management System" that includes waste sorting, composting, and incineration. Waste collection and transport in Thailand has improved in recent years compared with the past decades. Bangkok collects almost 100% of its MSW, whereas in rural areas usually less than 50% is collected. The primary solid waste management system consists of collection of waste at the households in various areas and transporting it to the transfer station. The secondary system includes hauling

IMPLICATIONS

In Thailand, municipal solid waste disposal sites consist of 95 landfills and 330 open dumps. Methane emission potential was estimated using three methods: IPCC, LandGEM, and the closed flux chamber method. The estimations made suggest that open dumps need to be upgraded into landfills, which improves the methane emission potential. Large-scale landfills are feasible for LFG utilization.