



Status of Transboundary Movements of Hazardous Wastes in Selected GMS Countries

Alice Sharp and Li Liang

Abstract— Hazardous wastes are one of the fast growing solid wastes in the urban environment worldwide. Given the complexity and diversity of collection and management of the hazardous wastes (HW) in the solid waste streams, technologies associating with resource recovery, reuse, and recycling continue to evolve. Review of the literature available from the selected GMS countries shows a lack of clear sustainable HW management systems being implemented in these countries. However, some countries may opt for transporting their hazardous wastes to other countries. This study aims to assess the current status of transboundary movements of hazardous and other wastes in accordance with the Basel Convention in selected GMS countries; i.e., Cambodia, Laos, Thailand, and Vietnam, in order to propose a management mechanism to aid in monitoring transboundary pollution. It was found that the most troublesome of HW in this region was electric and electronic equipment. Therefore, this study focuses on analyzing the issues related to E-waste movement, including the background information on economic status of each country, situation of transboundary movements of hazardous wastes (E-waste), and problems encountered in monitoring transboundary movements of wastes.

Keywords— Basel convention, GMS countries, hazardous wastes, transboundary pollution.

1. INTRODUCTION

Historically, the disposal of wastes was not a major problem; as the population was small and sparsely distributed. Their consumption patterns were simple and mainly generate bio-degradable wastes. However, with rapidly increasing quantity of solid wastes being generated as a result of the increase of populations, the waste management issue becomes serious and urgent. Problems related to solid waste are not only the increasing quantity but also the changing in waste compositions; each of which requires appropriate treatment technology.

Hazardous wastes (HW), much like municipal solid waste, are one of the fast growing solid wastes in the urban environment worldwide. Although each country may have developed various regulations as well as monitoring mechanisms, there is no comprehensive data available to provide an overview of hazardous waste situation both in terms of sources of production and types of HW produced. Quantity of HW produced under the current handling methods were also not clear, especially in developing countries [1]. Given the complexity and diversity of collection and management of the hazardous waste in the solid waste streams, technologies associating with resource recovery, reuse, and recycling continue to evolve. However, some countries may opt for transporting their hazardous wastes to other countries. Annually, there are more than 50,000 tons of HW being imported and exported worldwide with more than 50%

being exported to Southeast Asia [2]. A review of the literature available from the selected GMS countries shows a lack of clear sustainable HW management systems being implemented in these countries.

This study aims to assess the current status of transboundary movements of hazardous and other wastes in accordance with the Basel Convention in selected GMS countries (i.e., Cambodia, Thailand, and Vietnam) in order to propose a management mechanism to aid in monitoring transboundary movement of HW. Other issues analyzed in this study include background information on economic status of each country, issues related to transboundary movements of hazardous wastes especially in the case of E-waste, and problems encountered in monitoring transboundary movements of wastes.

2. DATA COLLECTION AND ANALYSIS

The data collected was divided into two forms; quantitative data (e.g., economic performance data, trade data, and handler survey) and qualitative data (e.g., legislative framework, management mechanisms, and financial motivations).

It should be noted that the data used in this study are based on individual country's reports to various international agencies and such data do not provide information on illegal transboundary movements. Report on those movements was used where appropriate.

Data from some countries may not be available; thus, such countries will be discussed basing only on the documents available.

3. ECONOMIC STATUSES OF STUDIED COUNTRIES

The economic statuses of the countries studied have improved drastically during the last few decades (Table 1). It should be noted that the data on waste generation per capita are the average number of each country. However, there can be a vast difference between waste

Alice Sharp (corresponding author) is with School of Bio-Chemical Engineering and Technology, Sirindhorn International Institute of Technology, Thammasat University, P. O. Box 22 TU-Rangsit Post Office, Pathumthani, 12121, Thailand. Phone: +66-2-986-9009 Ext. 1805; Fax: +66-2-986-9112~3; E-mail: alice@siit.tu.ac.th.

Li Liang is with Department of Common and Graduate Studies, Sirindhorn International Institute of Technology, Thammasat University, P. O. Box 22 TU-Rangsit Post Office, Pathumthani, 12121, Thailand. E-mail: liangli08@gmail.com

generation per capita in rural and urban areas. Although not shown here, data collected suggest the change in consumption patterns that lead to generation of hazardous wastes. Change in consumption patterns can be observed from the shift in structure of outputs from agriculture-based to industry- and service-based. Countries that have high proportion of industrial outputs have a tendency to produce a large quantity of hazardous wastes; therefore, these countries should also have in place some mechanisms for HW management.

Table 1 Selected basic socioeconomic indicators (2011)

Indicator	Cambodia	Laos	Thailand	Vietnam
Annual Population Growth (%)	1.5	2.0	0.4	1.0
Urban Population (%)	21.0	33.2 (2010)	36.1	31.7
GDP (Billion US\$) *	12.875	8.289	345.649	123.961
GDPcap (US\$)	900	1,320	4,972	1,411
Growth rate of GDP (%)	7.1	8.1 (2010)	0.1	5.9
External trade change (%)	1. 35.8 2. 25.9	1. 6.1 2. 17.6	1. 11.7 2. 19.1	1. 34.2 2. 25.8
Waste generation per capita (kg/cap/day)	0.52	0.55	0.64	0.61
Human development index *	0.523	0.524	0.682	0.593
Environmental performance index *	55.29	n/a	59.98	50.64

Source: Key Indicator for the Asia and the Pacific 2012

* UNDP Human Development Report 2011 [3]

Table 1 further shows that based on the three socioeconomic indicators in GDP, human development index and environmental performance index, Thailand is ahead of the other three neighboring countries including Vietnam, Cambodia and Laos. Thailand with its higher GDP indicates a possibly higher EEE consumption; thus, may generate more E-waste than other countries. However, due to its higher indices in both human development and environmental performance, Thailand is expected to have established or will establish a better

solid waste management system to achieve its national goals toward regulating the production, sale, and use of EEE and subsequent disposal of E-waste generated. This expectation is based on that a higher environmental performance indicator provides a gauge as to how close a country is to its established national environmental policy goals.

Next to Thailand, Vietnam has the second highest GDP, human development index and environmental performance index as compared to Cambodia and Laos. Therefore, it is expected that Vietnam would be considered an intermediary between Thailand and Cambodia and Laos, to achieve the goal of developing a comprehensive E-waste management system in the country.

4. TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES

HW in the region can be grouped into two main types; E-waste and industrial waste. All countries in this study indicate the significance of E-waste problem; therefore, the following analysis will focus mainly on E-waste and the used electronic and electrical equipment (UEEE).

Table 2. Import control policy on secondhand and other HW

Items considered	Cambodia	Thailand	Vietnam
Significant hazardous wastes	- E-waste	- Industrial hazardous waste - E-waste	- Industrial hazardous waste - E-waste
Secondhand EEE			
Import control	No	Yes	Yes
Controlling method	N/A	Permit needed	Ban
Secondhand commodity being controlled			
Air Conditioner	-	X	X
Cell Phone	-	X	X
Photocopy machine	-	X	X
CRT, LCD TV	-	X	X
PC	Ban	X	X
Printed Circuit Board	-	X	X
Refrigerator	-	X (CFC contained is controlled)	X (includes brand new CFC-R12 is banned)
Restrictions on other HW			
on export to final disposal/recovery	No	Yes	No
on import for final disposal and/or recovery	Yes	Yes	Yes
on transit	No	Yes	Yes

Source: Asian Network for Prevention of Illegal Transboundary Movement of Hazardous Wastes 2012

The import control policies on secondhand HW

adopted in Cambodia, Thailand, and Vietnam are shown in Table 2. As there is no regulation on UEEE in Cambodia, it could be the source of UEEE movement in the region as discussed in the next section regarding the movement of UEEE between Cambodia and Vietnam.

For Thailand, the importation of UEEE for the purpose of retail or reuse, equipment shall be in the original conditions as being manufactured, and in use less than 3 years from the manufacturing date. For recycling, equipment must be economically worth recycling, its importing amount should not exceed the capacity of the recycling facility, and it must be imported from the Basel Convention countries.

The statistics on the import and export of HW for each country are discussed below based on the data available.

Cambodia

Based on the inventory report [4], the trend on imported UEEE in Cambodia has changed. **Figure 1** shows that among the six types of UEEE imported, importation of TV sets has gradually reduced in number while that of secondhand mobile phones has increased dramatically since 2004. The imported mobile phones have reduced in number in 2006 due to the fact that most people who can afford to own mobile phones have already acquired their phones. In general, there is a decreasing trend in imported UEEE due to two main reasons: 1) those people who are capable of buying UEEE have bought it already; and 2) people have switched to cheap brand-new EEE from China.

The imported UEEE will be distributed to the vendors for repairing, reassembling or dismantling. However, the data on excess imported UEEE are difficult to obtain. In some cases, excess UEEE are illegally exported to such countries as Vietnam. Information on illegal trafficking of UEEE into Vietnam will be discussed later on in this section.

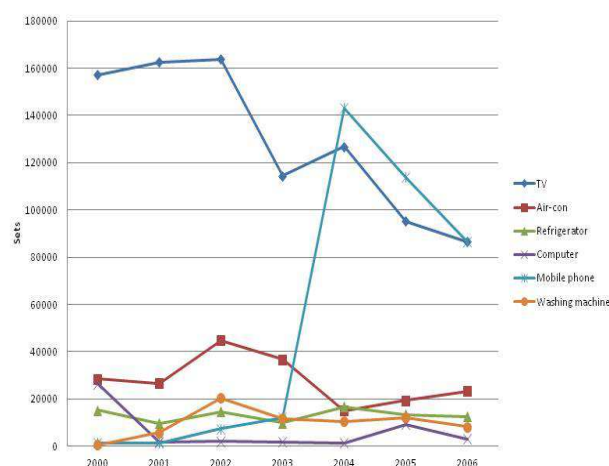


Fig. 1. Statistics on imported UEEE into the Kingdom of Cambodia in 2000-2006

Source: Technical Report on National Inventory of UEEE in Cambodia, 2007

Thailand

Thailand, with the highest GDP per capita among the countries studied, has played important roles both as exporter and importer of hazardous wastes. In 2006, the country exported 20,420 tons of hazardous wastes (UEEE), increasing from that of 17,340 tons exported in 2005. On the import side, the quantity imported has no significant differences, 5,925 tons and 5,379 tons in 2005 and 2006, respectively [5].

In terms of import and export of industrial HW, the Thailand Department of Industrial Work reported that the quantity of HW imported and exported had decreased in 2009 compared with that of 2008 (**Figure 2**).

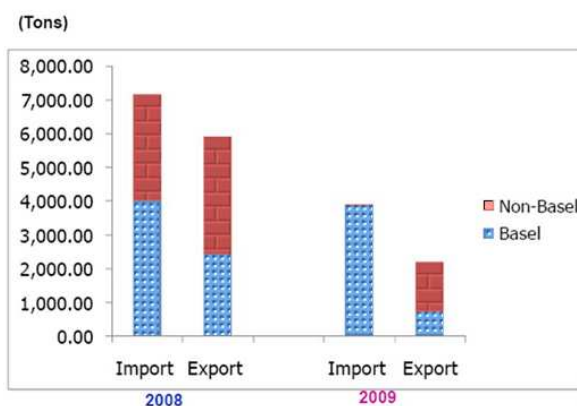


Fig. 2. Statistics on industrial hazardous waste import and export

Source: Thailand Department of Industrial Work 2010

Among the HW exported, electronics scraps are the largest component followed by solder dross/tin alloy and ashes and residues. The destinations of the HW exported vary with the nature of business and the contact firms involved. Most of the countries are in Asia, including Japan, Republic of Korea, Singapore, and China.

The imported HW is mainly electronic wastes, electrical equipment, parts for industrial process, and used toners. The countries of origin include China, Malaysia, and Singapore [6].

Vietnam

Cambodia and Vietnam share certain common characteristics in transboundary movement of HW. Firstly, both countries have large quantity of UEEE. These products have short life span, contributing greatly to the generation of E-waste in the respective countries. Secondly, both countries have strictly prohibited the importation of HW. For the case of Vietnam, UEEE is also prohibited for final disposal/recovery but no specific restrictions on the export of HW.

Shinkuma & Huong [7] stated in their study on material flow of secondhand EEE and E-waste scrap in Asia that although the import of secondhand EEE and E-waste scrap is banned in Vietnam, there are considerable amount of the secondhand products available in the markets. It is suspected that illegal movement of HW from China could have been responsible for the availability of UEEE in the North Vietnam while the illegal movement from Cambodia could be used to explain the similar situation found in the South Vietnam.

Auctions of UEEE in Phnom Penh have a number of Vietnamese dealers participated in these auction sales.

Although import of HW into the country is prohibited, the Vietnamese government allows importation of certain categories of scrap materials for use or recovery as secondary materials for industrial production. Also allowed by the Vietnamese government is to export HW, which has been carried out with the prior consent from the receiving countries such as Singapore and Republic of Korea.

5. THE LEGISLATIVE FRAMEWORK

5.1 The Basel Convention

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal aims to control the movement of HW by placing the responsibility for safe disposal of HW on its producer at the same time banning the export of HW to developing countries [8]. It regulates the transboundary movements by two means, which are 1) the written Prior Informed Consent procedure, and 2) the environmentally sound manner for the management and disposal of hazardous wastes. Examples of the wastes regulated by the Basel Convention are biomedical and healthcare wastes, used oils, used lead acid batteries, persistent organic pollutant wastes, chemical wastes, and electronic and electrical wastes. However, while the Convention regulates the movement of wastes, it does not extend to cover functioning secondhand goods and some E-waste scrap (even though the scrap contains materials under controlled in Annex I of the Convention).

All the countries studied have ratified the Basel Convention with Laos being the latest country to join the Convention in 2010. This explains the reason for the delay in planning and implementation of the Convention in Laos and also the lack of data availability in relation to HW transboundary movement in that country. Data from Laos will be shown only when available.

5.2 Other relevant domestic laws

Cambodia

In Cambodia, HW is defined as any substances that are radioactive, explosive, toxic, inflammable, pathogenic, irritating, corrosive, oxidizing, or other chemicals which may cause danger to human and animal health or damage plants, public property and the environment [9].

There are several regulations related to HW management and control, Solid Waste Management Sub-Decree (1999), Water Quality Management Sub-Decree (1999), and Air Pollution Control and Noise Disturber Management Sub-Decree (2001), for instance. Apart from these regulations there are also other measures such as licensed charges for some industries to handle HW.

The Sub-Decree on solid waste management has a provision on the export and import issues of HW.

- Article 20: the exportation of the hazardous waste from the Kingdom of Cambodia to abroad could be conducted if there are and agreement from the Ministry of Environment, export license from the ministry of Trade and permit from the import

country. The exportation shall be consistent with the provisions and principle of the Basel Convention.

- Article 21: the importation of the hazardous waste from abroad into the Kingdom of Cambodia is strictly prohibited.

Thailand

Although Thailand has no national definition of waste used for the purpose of transboundary movement of waste; however, the country uses the definition of hazardous waste for the purpose of transboundary movement management instead [10]. HW to be controlled for the import and export are defined in the list of hazardous substances specified in the Notification of Ministry of Industry on List of Hazardous Substances (2003). The hazardous substances are divided into four groups: 1) HW that is ignitable, corrosive, reactive, toxic and leachable substances; 2) HW from non-specific sources; 3) HW that are discarded as commercial chemical products, container residues, and spill residues; and 4) chemical wastes.

The country has also defined the UEEE and their parts and components as hazardous substances that are needed to be controlled for import into the country. The imported UEEE shall follow strictly the procedure specified in the Notification of the Department of Industrial Works on the Criteria for approval of the import of UEEE into the Kingdom of Thailand (2003). Plastic wastes require special consideration when subjected to transboundary movement issues.

Vietnam

The Law on Environmental Protection of 2005 (effective in July 2006) defines the wastes are substance in form of solid, liquid or gas that are discharged from manufacturing processes, services, living activities or other activities [11]. Hazardous wastes refer to wastes that contain toxic, radioactive, inflammable, explosive, abrasive, contagious, poisonous or else harmful. Later in 2006 the Ministry of Natural Resource and Environment issued the list of HW which consists of wastes that are always HW and wastes that are suspicious to be HW (where further analysis on concentration is needed). It should be noted that electric and electronic appliances are considered as HW.

Apart from the above mentioned law, the Vietnamese government has made a decision on extended producer responsibility that will gradually require manufacturers and importers to take back and treat their sold products.

6. ILLEGAL TRAFFICKING OF HW

Illegal imports cases do exist in all countries involving various types of hazardous wastes (e.g., mercury waste in Cambodia, lead acid batteries in Vietnam and Thailand, and used electronic appliances and waste plastics in Thailand). Countries with sea ports tend to suffer more from the illegal transboundary movement as large amount of containers entering at each port daily while only limited number of containers can be inspected. Illegal movement of HW makes it difficult to estimate

the real status of HW movement as there is a large gap between the data with and without including those HW moved through illegal trafficking.

7. MANAGEMENT MECHANISMS EMPLOYED

Mechanisms employed in the HW management vary from country to country; however, it can be divided into 4 major groups. The first mechanism is to adopt legislation to manage HW. For all countries, the regulations on HW do exist however; the level of enforcement may vary. For example, Thailand does have legislative measure to control the import of UEEE and its parts/components. Importation of UEEE is allowed only for 1) activities of resale, reuse, repair/refurbish as its original purposes, 2) disassembling and recycle/recovery with different conditions, and 3) only from parties to the Basel Convention.

The second mechanism is to establish HW inventory in order to be able to track and properly design the management system that will be appropriate for the local conditions. Management system such as data reporting system, tracking system and prior informed consent process should be employed.

The third mechanism is to collect HW separately. Therefore, capacity building of local authorities and citizens to raise their awareness and understanding of various types of HW should be of importance.

The fourth mechanism is on the waste treatment system and facilities. In terms of the treatment facility, Thailand has the highest number of HW related facilities (as of 2009): 139 for HW treatment, 962 for segregation and disposal, and 255 for recycling [5]. Vietnam also has set up a number of such facilities. Cambodia and Laos should also plan for establishing their required treatment facilities.

Table 3 shows the status of regulation and management strategies in some developing Asian countries. It should be noted that the original table was made for the E-waste stream; however, the authors adapted it to cover the other type of HW as well.

Table 3 shows that the status of HW management in each country still has room for improvement. The better the HW facility in a country, the higher the possibility would be to reduce HW transboundary movement.

8. CONCLUSION

The quantity of hazardous wastes generated tends to increase at an alarming rate in most countries. However, the nature of the wastes generated varies with countries; wastes of industrial origin for Thailand and Vietnam, and UEEE for Cambodia, Laos, and Vietnam. Inappropriate treatment or lack of treatment facility remains problematic in most countries. Lack of treatment facility leads to export of HW and illegally transboundary movement.

Table 3. Regulation and management strategies of HW. Adapted from [8]

Level	1	2	3	4
Practice	Rudimentary ← Best			
Legal Framework	Legal framework does not exist	Legal framework to be issued or enforced in the near future	Some enforcement but legal framework is not evenly conducted	Full enforcement and best practice
		KHM, VNM	THA	
Inventory	Inventory for MSW exist but not for HW	HW inventory is under planning and preparation	All HW inventory exist but lack of some data	HW inventory exist and publicly available
	VNM	THA, KHM		
Collection of HW	Unregulated Pick up of HW only the valuable items	HW is collected by local mechanisms, some pilot project	Collection system exists and leads to env. sound disposal	Collection system fully operated
	KHM, VNM	THA		
Recycling Technology	Only recyclable and reusable HW is reused by local	There is a plan to set up HW facilities	Some facilities exist, can accommodate some HW	State-of-the-facilities can accommodate all HW in the country
	KHM		THA, VNM	

Note: KHM-Cambodia, THA-Thailand, and VNM-Vietnam

Majority of the countries in the GMS do not have complete set of data on generation, export or import of HW. HW inventory data/secondhand EEE inventory is needed both for the management of HW at the national level and for the development of international policy. Most countries in the region have their own national laws/regulations to manage transboundary movement of HW and other wastes; however, specific laws and regulations are still needed for specific items such as UEEE, which is not considered as waste and is not controlled by HW regulations.

Most countries have been taking measures for reducing the transboundary movement of hazardous wastes, including the ban on the import of hazardous wastes. However, due to the lack of infrastructure in HW management, illegal trafficking of waste is still one of the most important environmental concerns in the region. International cooperation should be strengthened in order for effective monitoring and control of the illegal movements of HW.

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