

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The results of the hospital waste composition survey and hazardous waste management study from surveyed hospitals in Chiang Mai City can be summarized as follows.

1. Non-hazardous material comparable to municipal solid waste was found to be the largest component of overall hospital waste stream. However, some containing hazardous material, approximately 22.7 %of domestic solid waste in the collection container, was found mixed with domestic waste. This indicated improper segregation of hospital waste.
2. The generated rate of hospital waste was found to be varied depend on status of hospital, number of bed (or size) of hospital, rate of occupancy, number of patient and their waste management practices. The generated rate of hospital waste increased in the increasing of occupancy, number of patient and number of bed. The generated rate as *kg/occupied bed/day* in private hospital was found to be rather high compared with public hospital at the same size. However the generated rate as *kg/patient/day* was not much different. The information of the generated rate of hospital waste is shown in Table 5.1.
3. Domestic solid waste was found about 48 and 21-percent of total waste generated from private and public hospital, respectively. The closer examination of municipal solid waste in hospital waste stream revealed that recyclable material amenable to waste minimization were found to be the largest component, 48.5, 13.1, 1.7 and 1.3-percent for, paper, plastic, metal and glass, respectively. This indicated that reuse and recycling this portion of domestic waste should benefit hospital by reducing domestic waste quantity and cost of disposal.

TABLE 5.1 Waste Generated from 12 surveyed hospitals in Chiang Mai City.

Number of Bed	Waste generated rate of private Hospital		Waste generated rate of public Hospital	
	As kg/occupied bed/day	As kg/patient/day	As kg/occupied bed/day	As kg/patient/day
<100	3.98	0.384	2.95	0.391
100-299	4.81	0.789	2.88	0.662
300-499	4.96	1.025	2.75	0.790
500	4.95	1.317	2.38	0.615

4. Medical waste was found approximately 52 and 78-percent of total hospital waste generated from private and public hospital, respectively. Infectious waste, including cultures and stocks; anatomical waste; human blood and body fluid; and contaminated medical equipment, was found to be the largest component of medical waste. The compositions of medical waste generated from private hospital including pharmaceutical waste, sharps, infectious waste, chemical waste and other were found to be 27, 15, 32, 5.2 and 19.8- percent, respectively. And the compositions of medical waste from public hospital including pharmaceutical waste, sharps, infectious waste, chemical waste and other were found to be 22, 18, 38, 6.5 and 15.5-percent, respectively.
5. Segregate waste at the source of generation was found to be the best management practice for managing hospital waste. From this study, waste segregation benefited the hospital by reducing waste management cost more than 20% due to reducing quantity of hazardous waste and infectious waste requiring disposal. Moreover, the management of segregated waste was found to be rather easier compared with mixed waste. The problem of waste segregation in surveyed hospitals was found that the hospital practices some of the classification and separation which is not standardized and need to be improved.

6. Chemotherapy waste account for the largest volume of hazardous waste produced by surveyed hospitals. Pharmacy is the largest source generating chemotherapy waste. Only a small percentage of these wastes contain concentrated amounts of chemotherapy compounds. . From the records of hospital A, the quantity of chemotherapy waste was dramatically decreased with the reducing generation of residual material and ordering appropriately sized containers.
7. Formaldehyde also represents a significant source of hazardous waste at surveyed hospitals. From the record of 2 surveyed hospitals reported that use of RO units allows a reduction in the cleaning frequency requirement of dialysis machines. Other departments, formaldehyde are generally used to preserve specimens with small quantities of waste generated and discharged to the sewer.
8. The photographic developing solutions used in X-ray departments consist of two parts, a fixer and a developer. The generation rate of developer waste from the surveyed hospital with reusing developer in photo processing was found to be lower (approximately, three times) compare to another one without reusing developer. In additional, silver recovery program has been reported decreasing management cost of used film and cartridge.

5.2 Contribution of this work

Quantifying and characterizing the waste stream becomes a very important initial task in pursuing the goal of managing the medical waste. The principal objective of this study was to characterize the hospital waste stream. The result of this study was the benchmark data, which can be used to predict the amount of waste generation from other hospital. Thus characterization of medical wastes from hospitals becomes an integral part of this concept so that management of such wastes can be improved. Other objectives included education of hospital workers and source reduction of waste. This contributes greatly to the research in this field as there was so far no reports regarding hospital waste stream analysis in our country.

Although this work still could not identify exactly the hospital waste management practice, it proposes a few possible alternatives that might have occurred and this will be useful benchmark figure as a tool for hospital waste management in our country and international capability. This information will be essential for the future development of waste management.

5.3 Recommendations

Although large research areas were covered in this work, there are still some points that could not be fully examined. In order to ensure the completeness of this study, further work should be carried out. Some recommendations are inherited during the course of this work and these are summarized as follows:

- 1) In order to manage healthcare waste, composition and generation of special hospital waste should be investigated regarding differentiated composition compared to general hospital.
- 2) Waste treatment methods should be studied for each category of healthcare waste.