Published Quarterly
Mangalore, South India
ISSN 0972-5997
Volume 1; Issue 3; July-September 2002

Original Article

Study on waste from hospital and clinics in Phitsanulok

Suwannee Adsavakulchai
The Joint Graduate School of Energy and Environment, King Mongkut's University of Technology Thonburi, 91 Pracha-Utit Rd., Bangmod, Bangkok 10140, THAILAND.
e-mail : suwannee@jgsee.kmutt.ac.th

Citation: Suwannee A. Study on waste from hospital and clinics in Phitsanulok. *Online J Health Allied Scs*. 2002;3:3
URL: http://www.ojhas.org/issue3/2002-3-3.htm
Open Access Archive: http://cogprints.ecs.soton.ac.uk/view/subjects/OJHAS.html

Abstract:

Waste generation depends on numerous factors such as established waste management methods, type of hospital establishment, hospital specialization, proportion of reusable items employed in hospital, and proportion of patients treated on a day-care basis. This study surveyed the waste from hospital and clinics in Phitsanulok and found the average daily waste generated as general, medical and hazardous waste from all hospitals in Phitsanulok Province at 1.751, 0.284 and 0.013 kg/bed respectively and at 0.323, 0.041 and 0.002 kg/bed respectively from all clinics in Phitsanulok Province. Medical waste from all hospitals consisted of needles, gloves, drain tubes, cottons and gauze, napkins, plastic syringes, swap and body parts with total daily generation at 0.452, 0.480, 0.390, 0.404, 0.018, 0.355, 0.004 and 0.382 kg/bed respectively. Information about proper waste management process is needed to improve hospital waste management. Hospital waste management is an important and necessary component of environmental health protection.
Keywords: Hospital waste, Phitsanulok, Waste generation

Introduction:

Hospitals and clinics are the only one source of infectious waste generation. Hospital wastes are heterogeneous mixtures composed of general refuse, laboratory and pharmaceutical chemicals and their containers, and pathological wastes. As a result, some infectious wastes do not separate from general waste. However, there are only a small percentage of the waste streams. Even then, these may contain potentially infectious wastes and cause the community's waste problem. There is an obvious evidence that these are contaminated in a manner that renders these capable of transmitting disease, and that the only documented transmission of disease from hospitals waste has been from contaminated sharps such as syringes, etc. Therefore, these have to be handled with careful methods wherever they are generated. Inadequate handling of hospital waste may cause serious public health consequences and may also impact on the environment. Hospital waste management is an important and necessary component of environmental health protection.

Aims and objectives:

GTZ initiated this study on waste from hospital and clinics in Phitsanulok Province. To improve hospital waste management, it is important to begin by surveying the facility of current hospital waste practices. A waste survey should therefore be undertaken about the information of the waste planning process. This survey should provide information on types and quantity of wastes, which are arising at each point of production, and methods of storage, handling, treatment and disposal. It should also provide the number of beds and occupancy rate for health-care establishments.

In this study, the definition of waste is divided into 3 groups namely:

1. General waste, mostly all solid waste excluding infectious, chemical, or radioactive waste.
2. Infectious waste with the potential of transmitting infectious agents to humans, consisting of disused materials from hospital activities on humans or animals.
3. Hazardous waste refers to all materials that are improperly disposed of in municipal waste; such as radioactive waste, toxic chemicals and explosives.

The objectives of this project are:

1. To review the existing data of hospital and clinics waste in Phitsanulok with focus on technical review and daily management issues.
2. To survey and sample waste from several sources.
3. To classify the characteristics of waste in Phitsanulok and to create the implementation structures.

In addition, the work attempts to examine the number of clean incinerations and whether it complies with the Ministry of Public Health's emission standards.

Materials and Methods:

Study area: Phitsanulok Province is located in the lower part of northern Thailand, about 390 km from Bangkok. The total area is approximately 10,896.05 square kilometers as seen in Fig.1. There are nine government hospitals under Ministry of Public Health and seven private hospitals, which are located only in the municipality.

Selection of hospital and clinics:

Hospital selection: In this study, twelve hospitals were selected that are divided into five government hospitals and seven private hospitals. However, Buddhachinnarat hospital is the central hospital in the lower part of northern Thailand. In addition, the other four community hospitals are in Nakorn Thai, Chattrakarn, Phrom Phiram and Neon Maprang. Survey forms were designed specially for data collection and analysis.

Clinic selection: 184 clinics were inducted in this study. The sampling strategy for survey was based upon the distribution of clinic establishments in each district.

Methods of study:

Field observation and surveys were designed and conducted to characterize the hospital waste. After survey data was completed, we adopted it for the determination of Phitsanulok Province needs for the hospital waste management.

Questionnaires: Questionnaires were used to survey the hospital waste in terms of collection, transportation and treatment of hospital waste and to collect available information for analysis of the system.

Sampling: Parallel to the interviews, the physical compositions of waste in hospitals and clinics were determined. The waste from hospitals and clinics were collected from storage areas (only red bags). Before segregation, we sprayed these wastes by disinfectant solution (0.5% Sodium hypochlorite). Masks and large forceps were used to segregate waste into several types. During segregation, we weighted each type of medical waste and discarded into red bag. This waste composition study is part of a continuing effort to measure and understand the waste generated in hospitals and clinics. The composition study is based on field sorting events around Phitsanulok Province between November 1 and November 7, 2000. The waste samples were analyzed along a week. The raw survey data was compiled and managed so as to enable the estimation of waste generation quantities/ management practices. The average quantity of hospital/clinic waste was computed on wet weight from the field observation.

Results:

The daily waste generation (kg/bed) in hospitals and clinics in Phitsanulok Province are shown in tables I and II respectively. The medical waste composition from all hospitals in Phitsanulok is shown in Table III.

Table I: Waste generation by waste type in twelve hospitals in Phitsanulok

Name of hospital	Number of beds	Daily waste generation (kg/bed)		
		General	Medical	Hazardous
Buddhachinnarat	948	0.868	0.180	0.001
Bang Kratum	30	1.632	0.196	0.010
Bang Rakam	30	4.085	0.870	0.030
Wat Bot	30	2.245	0.250	0.007
Wang Thong	30	3.340	0.652	0.007
Narasuan	150	0.922	0.069	0.004
Phitsanuveth	250	0.519	0.078	0.002
RumePhat	95	0.555	0.075	0.002
Ratanaveth I/II	100	0.440	0.055	0.009
Intervethchakarn	70	0.347	0.021	0.013
Radiotherapy	49	0.096	0.005	0.032
Eye	12	0.486	0.013	0.011
Average		1.751	0.284	0.013

Table II Waste generation by waste type in clinics in Phitsanulok

Clinics in	Daily waste generation (kg/patient)		
	General	Medical	Hazardous
Muang	0.487	0.048	0.002
Bang Kratum	0.131	0.016	0.001
Bang Rakam	0.440	0.033	0.002
Wat Bot	0.326	0.046	0.002
Wang Thong	0.232	0.061	0.001
Average	0.323	0.041	0.002

Table III Medical waste composition from all hospitals in Phitsanulok

Hospital name	Daily waste generation (kg/bed) for different waste types							
	Needle	Glove	Drain tube	Cotton, gauze	Napkin	Plastic syringe	Swap	Body parts
Buddhachinnarat	0.025	0.032	0.023	0.043	0.018	0.003	0.004	0.033
Bang Kratum	0.070	0.032	0.029	0.035	-	0.029	-	-
Bang Rakam	0.076	0.227	0.189	0.076	-	0.113	-	0.189
Wat Bot	0.016	0.011	0.037	0.027	-	0.027	-	0.133
Wang Thong	0.209	0.117	0.070	0.117	-	0.117	-	0.023
Narasuae	0.018	0.011	0.007	0.036	-	0.018	-	0.004
Phitsanuveth	0.016	0.012	0.011	0.023	-	0.016	-	0.0001
RumePhat	0.004	0.025	0.011	0.021	-	0.014	-	-
Ratanaveth	0.005	0.008	0.005	0.025	-	0.013	-	-
Intervethchakarn	0.010	0.002	0.004	0.001	-	0.003	-	-
Radiotherapy	0.002	0.001	0.001	0.001	-	0.001	-	-
Eye	0.002	0.003	0.003	0.001	-	0.003	-	-
Total	0.452	0.480	0.390	0.404	0.018	0.355	0.004	0.382

Figure 1: Study area in Phitsanulok Province, Thailand

Based on observations in all hospitals in Phitsanulok Province, 88% of the total wastes generated by hospitals are general waste. Infectious and sharp wastes represent the majority of the medical waste, these wastes appear up to 15% of the total waste from hospitals as shown in Fig.2-Fig.6. The daily hospital waste generation (kg/bed) from each hospital is presented in Fig. 2. Besides, the average daily hospital waste generation (kg/bed) from all hospitals in Phitsanulok Province is shown in Fig. 3.

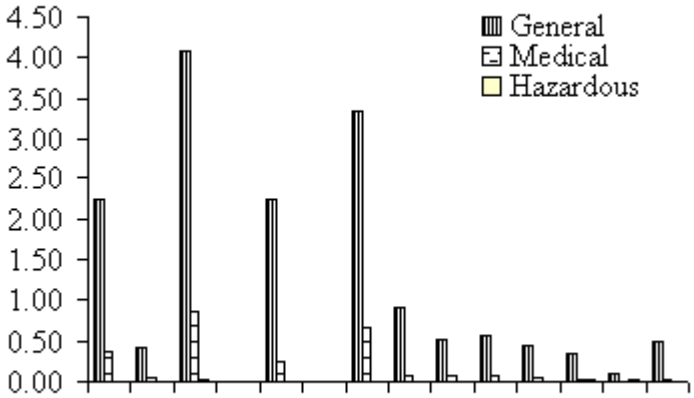

Figure 2: Daily waste generation from twelve hospitals in Phitsanulok

The major hospital waste is from the kitchen, which appears to be food remnants. The majority of infectious wastes are from Emergency department and over 50% of that contained cotton and gauze. From clinics waste characteristics are the same as the hospital waste.

On comparison between government and private hospitals, we found that the daily hospital waste generation (kg/bed) from government hospital was higher than private hospital as shown in Fig. 4.

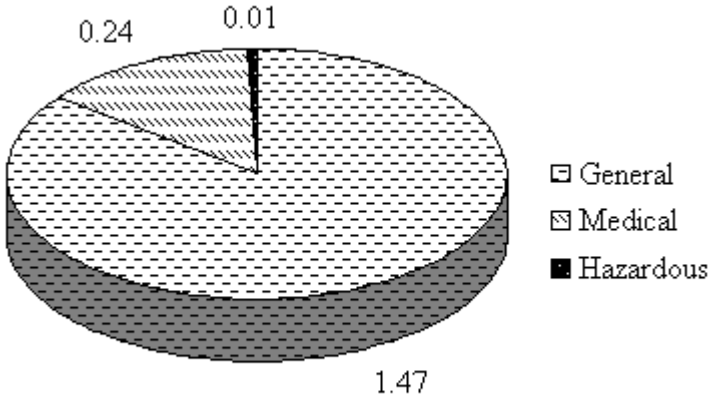

Figure 3: Average daily waste generation (kg/bed) from twelve hospitals in Phitsanulok

In addition, the source size affects the daily hospital waste generation (kg/bed) in government hospitals as shown in Fig 5. The small hospitals generate general waste more than the larger ones. The comparison between hospital waste from hospital and clinics is shown in Fig. 6. In hospitals, daily waste generation (kg/bed) was 4-6 times higher than clinics in all categories of waste. It can be concluded that the higher the number of patients, greater is the waste generation.

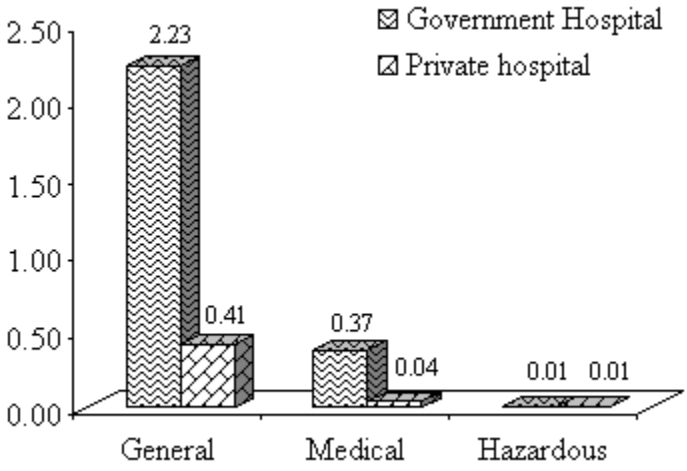

Figure 4: Comparison between daily waste generation (kg/bed) from Government hospital and Private hospital in Phitsanulok

Medical waste has been divided into eight categories and the daily waste generation (kg/bed) from each hospital is shown in Table 3 and Fig. 7. In terms of medical waste, glove is the highest percentage (19.3%), and swap is the lowest percentage (0.15%). Apart from that the highest medical wastes in clinics are needles.

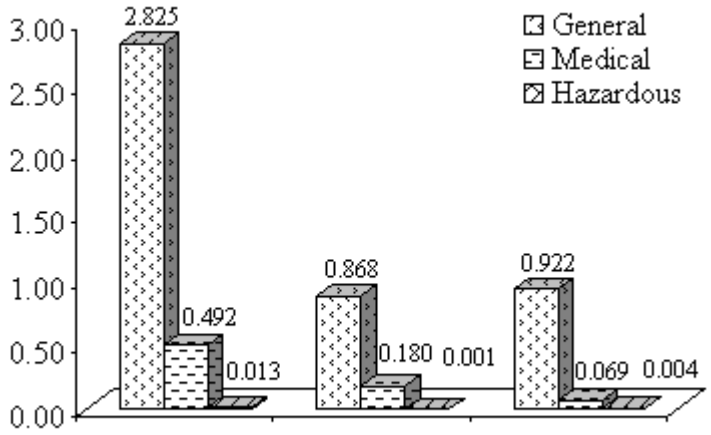

Figure 5: Daily hospital waste generation (kg/bed) from government hospital according to source size - small (30-100 beds), medium (100-500 beds) and large (500-1,000 beds).

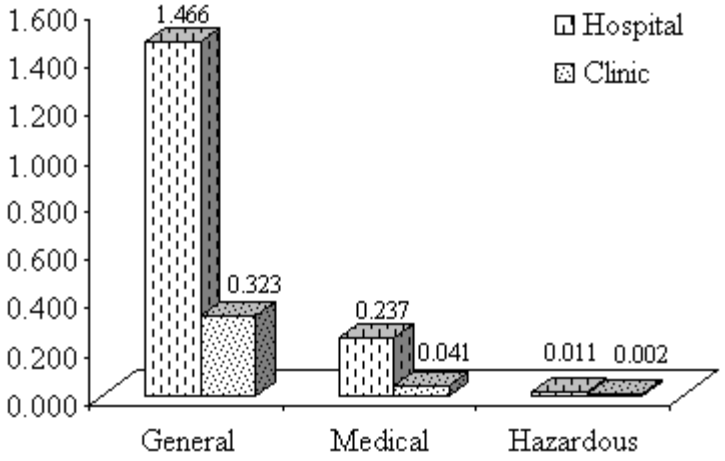

Figure 6: Comparison between hospital waste according to source size

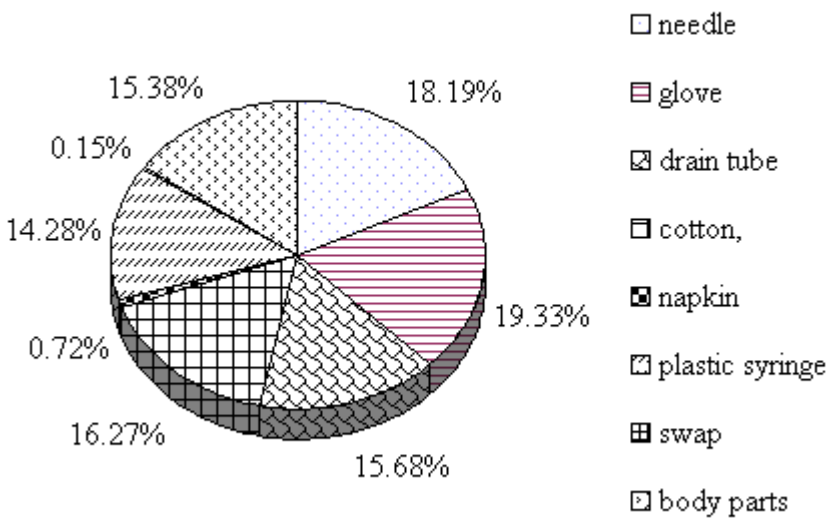

Figure 7: The total medical waste from all hospitals according to waste composite

Discussion:

The results of this study involving a total of 196 health care facilities in Phitsanulok Province can be summarized as following:

1. The average daily waste generations in general, medical and hazardous from all hospitals in Phitsanulok Province is 1.751, 0.284 and 0.013 kg/bed, respectively.
2. The average daily waste generations in general, medical and hazardous from all clinics in Phitsanulok Province are 0.323, 0.041 and 0.002 kg/bed, respectively.
3. Medical waste from all hospitals is consisted of needles, gloves, drain tubes, cottons and gauze, napkins, plastic syringes, swap and body parts, the total daily waste generation of which are 0.452, 0.480, 0.390, 0.404, 0.018, 0.355, 0.004 and 0.382 kg/bed, respectively.

This information can be used in allocating resources for treating hospital waste. This waste must be treated separately from other wastes in view of its potential infectious constitution. We make the following recommendations:

1. The average of general waste in hospital is 88.0% of the total waste. A high proportion of it is generated from organic material from food preparation and remnant and the others are paper, plastic bottle, etc. The further management of this waste can be proceeded into by 4 methods viz. 1) municipality system 2) landfill 3) sales for pastures 4) recycle.

2. The average of medical waste in hospital is 10.6% of the total waste, with the maximum being generated from emergency department (ER), and a small portion by wards, laboratory, etc. The management of this waste can be proceeded into 4 methods that is, 1) autoclaving and chemical sterilization 2) incineration 3) landfill 4) recycle.

3. The average of hazardous waste in hospital is 0.4% of the total waste, the highest resulting from the X-ray lab., the others are work place i.e. fluorescent lamp in the office, etc. The further management of this waste can be proceeded into by 3 methods viz. 1) landfill 2) incineration 3) recycle i.e. photographic fixing solution.

Hospital waste generation differs not only in each country, but also within a country itself.(4) The waste generation depends on numerous factors such as waste management methods, type of hospital establishment, specializations of the hospital, ratio of reusable items in use, ratio of day care etc. It is therefore suggested that these data can only be used as examples, but it cannot be used as a basis for waste management within an individual hospital establishment.(5) Though this survey has been limited, it still provides more reliable data on local waste generation than any estimation that is based on data from other countries or types of establishments.

Generally, there are four key steps of hospital waste management (6): 1) segregation into various components, including reusable and safe storage in appropriate containers 2) transportation to waste treatment and disposal sites 3) treatment 4) final disposition.

The current waste management practice has been observed at many hospitals. It appears that all wastes, such as potential infectious waste, waste from office, general waste, food, construction debris, and hazardous chemical materials are all mixed together while they are being generated, collected, transported and finally disposed of. Imposing segregation practices within hospitals to separate biological and chemical hazardous wastes (less than 10% of the waste stream) will result in a clean solid waste stream (90%), which can be easily, safely and cost-effectively managed through recycling, composting and land filling the residues. The resultant general waste stream has a high proportion of organic wastes (food) and recyclable wastes (paper, plastic, metal). Actually the numbers of recyclable wastes are very little and they are mostly disposed after use. Several hospitals in Phitsanulok have already set up segregation programs in locals. If proper segregation is achieved through training, clear standards, and tough enforcement; it will effectively decrease infectious waste; however some of it still need special treatment.(7) Apparently the segregation programs have decreased the number of waste; on the other hand, it has increased resources for the programs.

Proper management of hospital waste can minimize the risks both within and outside healthcare facilities. The first priority is to segregate wastes into reusable or non-reusable, hazardous or non-hazardous components.(8) An important management is to set the institution of sharps management system, waste reduction, avoidance of hazardous substances as far as possible (e.g. PVC-containing products, mercury thermometers). Besides, it has to ensure workers' safety and provide secure methods of waste collection and transportation. Moreover it should provide necessary installations for safe treatment and disposal mechanisms.If the good segregation program is successful, it can reduce less than 8% of their waste stream. It is critical that wastes should be segregated before disposal.

This most important management is to safeguard the occupational health of health care workers.(9) Hospitals currently burn wastes or dump wastes in municipal bins, which are transported to unsecured dumps. Some wastes have contained mercury and other heavy metals, chemical solvents and preservatives (e.g. formaldehyde) which are known carcinogens, and plastics (e.g. PVC). When the wastes are combusted, they produce dioxins and other pollutants, which pose serious human health risks not only to workers but also to general public through food supplies. Next is the risk to the general public which occurs in three ways: 1) accidental exposure from contact with wastes at municipal disposal bins; 2) exposure to chemical or biological contaminants in water; and 3) exposure to chemical pollutants (e.g., mercury) from incineration of the wastes.

The mismanagement of hospital waste poses risks to people and the environment, healthcare workers, patients, waste handlers, waste pickers, and the general public are exposed to their health risks from infectious waste (particularly sharps), chemicals, and hazardous waste.(10,11) Improper disposal of hospital waste, including open dumping and uncontrolled burning, increases the risk of spreading infections and the risk of exposure to toxic emissions from incomplete combustion. For these reasons, occupational health and safety should be considered in a component of hospital waste management plans. As a result of this failure to establish and follow segregation protocols and infrastructure, the waste leaving hospitals as a whole is both potentially infectious and potentially hazardous (chemical). At greatest risk are the workers who handle the wastes (hospital workers, municipal workers and rag pickers).

Finally, the proposed central incinerator in the large hospital is the best way in hospital management in Phitsanulok Province. This comes with the benefit of lesser investment and easier maintenance than their own present day incinerators. In addition, autoclave could be the alternative technology for medical waste treatment because it is air pollution free.

Acknowledgements:

This study has been funded by The Deutsche Gesellschaft fÜr Technische Zusammenarbeit (GTZ). All government officers from Phitsanulok Municipality including all hospitals and clinics support technical data. The help rendered by Mr. Pirit Sukkad and Mr. Bundit Aoywatananukul in carrying out waste sampling, segregation and weighting in completion of this project is thankfully acknowledged.

References:

1. The Deutsche Gesellschaft fÜr Technische Zusammenarbeit. Management of solid and liquid waste at small healthcare facilities in developing countries. 1999.
2. Kungskulniti, N. et al. Solid Waste Scavenger Community: An Investigation in Bangkok, Thailand. Asia-Pacific Journal of Public Health. 1991; 5(1):54-65.
3. Ministry of Health. Handbook of hazardous hospital waste management in 10-bed and 30-bed community hospitals. Bangkok. 1995.
4. World Health Organization. Safe management of wastes from health-care activities. 1999.
5. Huong P.T. Soild Waste Management in Hanoi Vietnam: A case study of Hospital Waste Management. 1996.

6. U.S. Environmental Protection Agency. EPA Guild for Infectious Waste Management, EPA/530-SW-86-014. (NTIS PB86-199130). U.S. EPA Office of Solid Waste.1986.
7. World Health Organization. Teacher's Guide – Management of wastes from health-care activities. 1998.
8. United Nations. Recommendations on the transport of dangerous goods: model regulations, 10th revised ed. New York, United Nations (ST/SG/AC.10/1/Rev. 10).1997.
9. U.S. Environmental Protection Agency. Handbook Operation and Maintenance of Hospital Medical Waste Incinerators, EPA/625/6-89/024.1990.
10. Wilson E, Willmore J, McDougall F. Towards Integrated Management of Municipal Solid Waste. Report for the European Recovery and Recycling Association, Brussels. 1998. Available at http://www.erra.be/.
11. Paranan E. Upgrading of Hospital Waste Management. A case study in Bangkok, Thailand. 1997.