INFECTIOUS WASTE MANAGEMENT OF HEALTH CENTERS IN MUANG DISTRICT, KANCHANABURI PROVINCE

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ABSTRACT

This study is a descriptive research survey of infectious waste management of 22 health centers in Muang District, Kanchanaburi Province aimed to describe the situation of infectious waste management. Data were collected from 1st January to 30th January 2008 by interviewing and observing the practice of health centers. Data analysis was performed using frequency, percentage, mean and standard deviation to describe the distribution of independent variables and dependent variables.

The result found that over half (68.18%) of the health officers graduated with a Bachelor's degree. Nearly 13.64% graduated with less than a bachelor's degree but only 4.55% graduated with higher than a Bachelor degree. All of the health officers had good knowledge of appropriate methods of infectious waste management. 65.45% of the health centers had appropriate managements. The amount of infectious waste generated per health center was 0.35 kilograms per day. All health centers in Kanchanaburi Province generated an estimated combined total of 50.5 kilograms per day or 1.5 tons per month. Although, the amount of infectious waste at each health center was small, the estimated total amount of all health centers in the country cannot be ignored. Health officers mostly face problems and obstacles in infectious waste management in terms of equipment, support and training on infectious waste management. Health centers were observed handling infectious waste inefficiently.

Infectious waste management should be properly implemented at hospitals or Local Administration Organizations and sent off site for disposal. The health officers need training on infectious waste management and environmental pollution.

KEY WORDS : INFECTIOUS WASTE MANAGEMENT / HEALTH CENTERS

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CHAPTER 1
INTRODUCTION

1.1 Rationale and justification

Nowadays, daily living conditions are being developed in order to satisfy two major human needs, biological needs and social needs (1). These various activities have increased in proportion to the increased population in part of the changing economic situation within the country. With the rapid expansion of healthcare both in public and private sectors, a huge volume of waste or infectious waste has been produced, especially, infectious waste left outside in the open areas due to insufficient personnel and collecting instruments. This has polluted the environment. The infectious waste usually spreads different kinds of diseases that might be harmful to human health and also are damaging to the economy. Based upon the World Health Organization (WHO) 1994 report of hospital waste in America, Netherlands, and France, about 85% of hospital waste was actually non-hazardous waste, 10% was infectious waste and 5% were non-infectious hazardous wastes (2).

Infections from the medical clinic were different depended upon the location, size of the medical clinic and number of patients. The higher the number of patients, the more infectious waste is produced in terms of absorbent cotton, absorbent gauze, hypodermic needles, liquid waste from the patients, blood and puss contaminated with diseases, Improper disposal of infectious waste with other waste materials can contaminate the environment with diseases.

The earth summit for change met in Rio de Janeiro, Brazil June 1992. This largest-ever meeting of world leaders reported that **"**An increasing amount of hazardous waste is affecting human health and the environment. Governments often lack information about how much and what types of pollution are released, and what risk they pose to people and the environment. All national environmental protection plans should include targets for hazardous waste reduction." Waste has the potential

to cause harm to individuals and the environment, and if not handled, collected and disposed of safely can cause serious problems (3). The World Health Organization (WHO) also holds that the waste produced by health care facilities carries a higher potential for hazards and risks from infection and injury than other kinds of waste (2). Poor management of health-care waste can cause serious disease to health-care personnel, to waste workers, patients, the general public, and may severely pollute the environment (4).

The Permanent Secretary of the Ministry of Public Health studied the disposal of medical waste by 820 hospitals in 2006. The result revealed that 723 hospitals (97%) had averaged only 0.46 kilograms per bed per day of infectious waste. Some 62.3% of the 820 hospitals incinerated their own infectious waste. The others had the private sector. The Local Administrative Organizations and other hospitals disposed of the waste for 23.2, 4.9 and 3.9 respectively. The hospital of which the disposal did not achieve the sanitary standard was 1.1%, all in the community hospitals (5).

Table 1 Infectious waste generation in terms of number bed patients in the hospitals under Ministry of Public Health, Thailand, 2006.

Facilities	**Total Number of hospitals**	**Number of bed patients**	**Infectious waste**	**Infectious waste**
			Kg/day	**Kg/bed/day**
Central hospitals (370- 1072 beds)	25	16,922	6,863	0.4
General hospitals (180- 270 beds)	68	23,058	8,212	0.36
Community hospitals (10-150 beds)	727	30,010	17,351.90	0.58
Total	820	69,990	32,427	0.46

The results of this study showed that an increasing number of hospitals had other organizations manage the disposal. Yet there is still no control measure, especially the infectious control, of any part of the incinerating done by those organizations. The study suggested that hospital disposal management take control measures for infectious dispersion, including the use of cleaner technology to reduce the volume of the waste.

Generally, the infectious waste management at most provinces has not been managed in accordance with the set procedures (6), perhaps due to lack of knowledge in management or moral consciousness. This in turn creates many environmental problems. Most of the time medical centers outside of Bangkok assign the responsibility of waste collection and waste disposal to the municipality without separation before collection. Therefore, the risk of the spread of diseases from infectious waste would persist.

In 1992 the Ministry of Public Health implemented the Public Health Service Center Development Decade Project to develop government health centers capacity. In 1996 an appraisal of the health centers found that the performance indicator of Health Center services in random areas per health center was increasing. The sickness and types of service usage of the population of 16 sample villages from a total sample of 872 households with a total population of 2,136 persons found that 80.2%, had experienced sickness in the past 3 months and averaged 1.5 clinic visits/patient (with age groups using the service at high level of 5-14 years at 31.9% These centers experienced staff shortages where educational levels, knowledge and ability of the officials in the areas were still insufficient. There was an inappropriate allocation of national resources, with these centers budgets being very lowly allocated. The study found there were too many reporting systems with suggestions for the public centers improvement; there was a need for further staff continuing education for the development of the quality of public health service, especially in the development of first aid (7).

The Universal Coverage Scheme of health care policy of the present government aims to develop a holistic primary care system for all families across the country. The primary care system is slated to be made more effective and strengthened. Thus, the Ministry of Public Health must hold health services at all levels responsible for adhering to the higher national standard for management of infectious waste.

Health centers have become significantly important since they provide mixed services, from disease prevention, medical attention and nursing to rehabilitation. The results showed that with the increase in the number of patients there is an expanding volume of infectious waste at health centers, especially used materials that had turned to be infectious waste at the health centers. If the health officers lack knowledge to properly deal with the danger of infectious waste, the health centers could become the main source of the spread of diseases.

In November 2007, the researcher conducted a preliminary survey for this research at Muang Chum and Khoa-Din health centers at Tha-Mouang District in Kanchanaburi province. It was found that general wastes have not received sufficient attention and are incorrectly segregating waste. Infectious waste management was not done effectively. Moreover, health officers did not demonstrate awareness of infectious waste management. Infectious waste transportation was the duty and responsibility of the municipalities or districts. However, the staffs of the two health centers are able to maintain the immediate surroundings well.

From the result of the preliminary survey, infectious waste management of each health center was one of the most important issues to be addressed. However, there is not yet a situation analysis of infectious waste management in health centers. For this reason, infectious waste management of health centers should be thoroughly studied to determine problems and obstacles in implementing standards and procedures. Furthermore, the special requirements for the management of certain infectious waste should be done for the planning of safe waste disposal. It will lead to a better developed approach of infectious waste management in health centers.

Therefore, the researcher conducted the study of infectious waste management of health centers in Muang district, Kanchanaburi Province. This can be beneficial to all health centers in Kanchanaburi Province to improve the quality of health services in the future.

1.2 Research Objectives

1.2.1 General Objectives

To describe the situation of infectious waste management of health centers in Muang District, Kanchanaburi Province.

1.2.2 Specific Objectives

1.2.2.1 To describe socio-demographic factors of health officers who are in charge in infectious waste management of health centers in Muang district, Kanchanaburi Province.

1.2.2.2 To describe the knowledge on infectious waste management of health centers in Muang district, Kanchanaburi Province.

1.2.2.3 To describe problems and obstacles on infectious waste management of health centers in Muang district, Kanchanaburi Province.

1.2.2.4 To describe the situation of infectious waste management of health centers in Muang district, Kanchanaburi Province.

1.3 Conceptual Framework

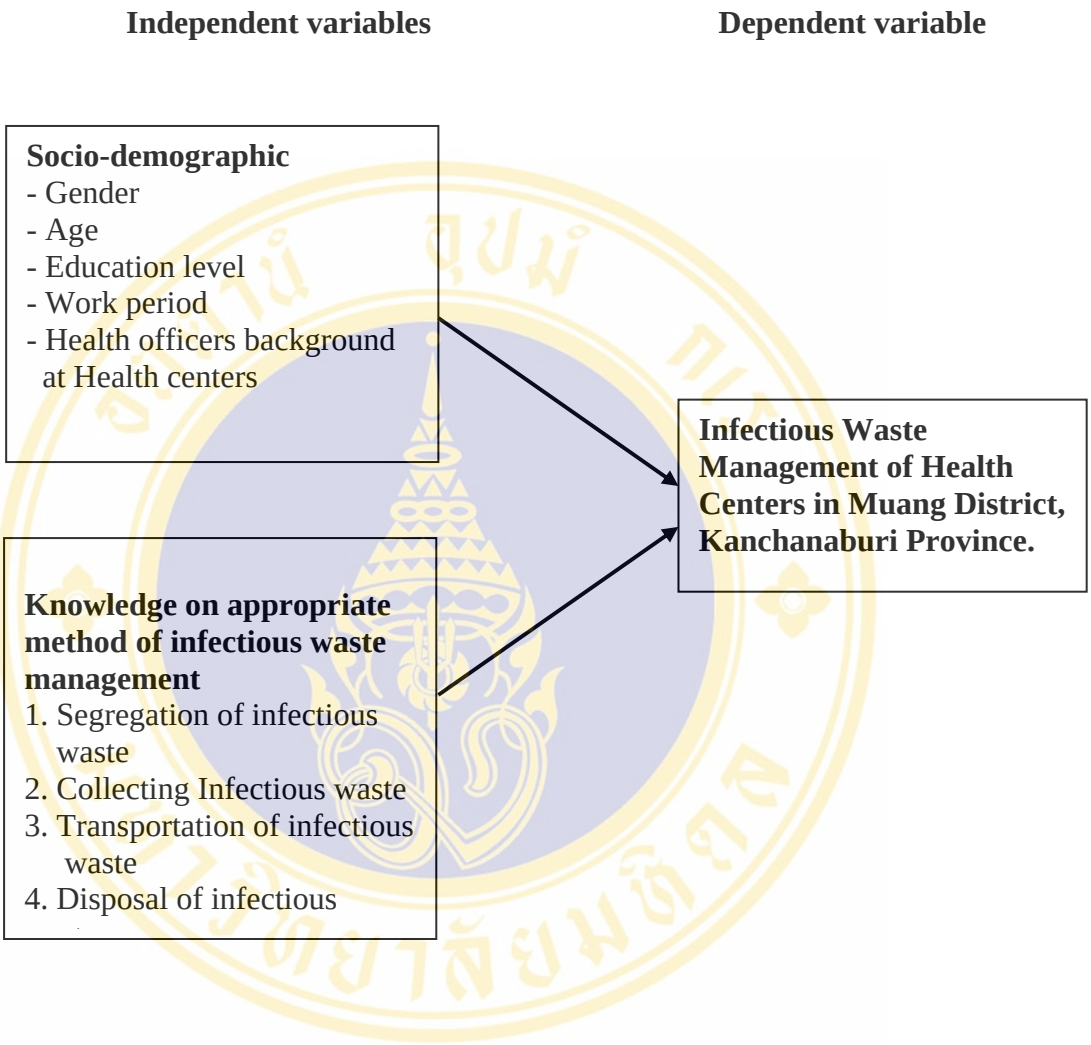

Figure 1 Conceptual Framework

1.4 Operational definition of Variables.

Infectious Waste Management refers to administering or overseeing waste separation, waste collection, waste transportation and proper infectious waste disposal to prevent health hazards and environmental pollution (8).

Infectious waste refers to human waste from medical treatment, differential diagnosis, building resistance to disease, including contaminated liquid substances from patients which may be poisoned and infected or harmful to living creatures.

Knowledge is defined variously as expertise and skills acquired by a person through experience or education; the theoretical or practical understanding of a subject, what is known in a particular field or in total; facts and information or awareness or familiarity gained by experience of a fact or situation.

Knowledge of infectious waste management refers to the understanding of health personnel of health centers about types, hazards, handling segregation, collection, transportation and appropriate method of disposal of infectious waste.

1.5 Limitations of the study

As this is a descriptive research survey on infectious waste management of health centers in Muang district, Kanchanaburi Province, the results would be related specifically to practice in daily work. It reflects infectious waste management only, and may not be representative of the overall country. The results may be limited by health personnel at health centers in only Kanchanaburi province at the time, situation and scope of study.

CHAPTER 2
LITERATURE REVIEW

The purpose of this study is to assess the infectious waste management of health centers in Kanchanaburi province; therefore, the literature review is comprised of the following sections

1. Infectious waste management
2. Problems from Infectious Waste
3. Procedures for Infectious Waste Management
4. Guidelines for Infectious Waste Management
5. Health centers in Thailand
6. Related research findings

2.1 What is infectious waste management?

2.1.1 Infectious waste management

In developing an infectious waste management program for a hospital or other institution, one must realize that there is no one optimum plan. Regulations and/or recommendations must be interpreted by each facility in order to design a safe and effective plan for the handling and disposal of infectious waste at each location and type of facility.

2.1.2 Infectious waste management within the region

Infectious waste management within the Asian region has become a most troublesome and significant problem for the responsible local agencies, particularly municipalities and districts, since their method for waste disposal in general was done by dumping the waste on the ground which proved uneffective and unsanitary.

The responsible agencies for community healthcare, particularly, Division of Health Service, Ministry of Public Health designed incinerators for its hospitals in the region for effectively burning waste. The Ministry of Public Health tried to gain the participation of hospitals by providing the budget for building and purchasing the incinerator for hospitals within the region on every level to solve the problem of contamination of infectious and regular waste. As for hospitals that did not receive the budget, waste has usually been transported from the hospital to municipal or district sites to be disposed of along with waste from communities as well as from health services centers, regular health centers, private clinics and the private hospitals that lacked funds to build the incinerator. Infectious waste from these sources was sent to the district for disposal.

2.2 Problems from Infectious Waste

Hazardous infectious waste must be dealt with in the proper manner otherwise it might be dangerous to the health of health officers and the general public including devastating impact on the environment. According to Insawang P. (1) many of the following problems result from inappropriate waste management.

1. As the origin of various infections is due to concentration of garbage and all filthy materials that had turned into a source of different diseases which were able to grow rapidly and reproduce in an appropriate environment. The longer the time this waste remains in the open the higher volume of diseases, thus enabling their spread to the environment that could be hazardous to human health as well as animals.
2. Breeding ground of carrier-born diseases.
3. Disrupting order and environmental quality.
4. Causing annoyance to nearby places.
5. Creating bad accidents, such as fire hazards where there is plenty of fuel such as paper and plastic which were easy to catch fire or broken glass or metal fragments of razor- sharp materials.

6. Beside these, contaminated liquids from the garbage pile contains organic and inorganic materials and mixtures that could cause the deterioration of the surroundings if allowed to seep into that area.

7. An increase in population combined with the deterioration of environment results in a large number of patients receiving treatment at health centers followed by excessive infectious waste with the inclination towards more in numbers. Without proper management, it could create effects in the following areas.

1. The effect on the health

Eating, breathing, or contact with the toxins from the hospital waste will lead to immediate injuries or death in a short time or exposure to toxins for a long time may cause chronic illness or cancer according to a metropolitan commission report (8). They include

1.1 AIDS
1.2 Cholera
1.3 Leptospilosis
1.4 Tetanus
1.5 Tuberculosis
1.6 Typhoid fever
1.7 Salmonellosis
1.8 Haemophilus influenza (type infection invasive)
1.9 Chancroids
1.10 Diphtheria
1.11 Gonorrhea
1.12 Gas gangrene
1.13 Meloidosis
1.14 Shigellosis
1.15 Meningococcal infections
1.16 Hepatitis A,B and Hepatitis non A,B

The indirect effects from living in an environment which has contaminated water is that living things in the water accumulate toxins that enter the food chain and are a carrier of harmful germs.

2. The effects on environment

Waste from health centers, particularly infectious waste, has created environmental effects such as land, air and water pollution since contaminated liquid of infectious waste had high health risk. Moreover, air pollution from gas or vaporized odor occurred from the decomposition and smoke of burning waste materials.

3. The effects on the economy and society

Evidence can be seen in the communities where dumping grounds for waste have devalued the surrounding lands. Moreover, foul odor and dust made the communities an undesirable place to live and affected tourism as well. As for the effects towards health centers in such communities, the spreading of infectious waste and other hazardous diseases endangers the health officers and patients. Hazardous waste management therefore controls environmental impact, and promotes clean health centers and a pleasant living atmosphere.

Realizing the environmental problems that could arise from infectious waste in relation to the effected living conditions of general population as stated above, it is urgent that proper infectious waste management needs to be implemented in order to prevent these problems from happening.

The unclean and infectious garbage without sanitary disposal per set standards and procedures would be the source to culture germs and diseases carriers. Due to the accumulation of garbage which eventually turn into the place for different kind of animals which might be disease carriers or caused themselves such as, rats mosquitoes, flies, cockroaches and fruit flies.

Unsanitary garbage collection could cause unpleasant scene, foul odor, ashes from incinerated which directly creates social problems and population annoyance.

Therefore, managing infectious waste originated from every hospital must be correctly done to prevent the spreading of diseases and block the source to culture germs and diseases carriers in order to create clean and germ-free environment.

2.3 Procedures for Infectious Waste Management

Although, there had not been any set up for procedures for sanitary disposal for infectious waste in Thailand, the control of garbage disposal was conducted to promote health and welfare protection to the general population, healthcare officers and sanitary officers and also introduced professional ethics regarding infectious waste management. The Ministry of Public Health announced the rules with the support and advice of the Committee on Public Health (9) which was to be implemented subsequently. Infectious waste management was operated in stages as follows:

1. Segregation of infectious waste
2. Collection of infectious waste
3. Transportation of infectious waste
4. Disposal of infectious waste

These main steps should be followed

1. Infectious Waste Segregation

Health center personnel should separate infectious waste from regular waste and the storage must be promptly done at the source of waste. Do not collect the waste to be separated later.

Containers for packing infectious waste should have the appropriate traits as follows.

For sharp infectious waste such as, knives, needles and glass fragments, the container should be made of solid materials, puncture-proof and resistant to chemical corrosion such as solid plastic or metal with a firm cover to prevent the leaking of liquid and for convenience to move it without touching the infectious waste. For

other infectious waste, the containers should be rupture-proof, chemical resistant and able to withstand excessive waste, no leaking and absorbent.

Containers for packing infectious waste should be painted red, dull and marked with the clearly seen messages “Infectious Waste” under the cross skull. Also “Do Not Recycle” and “Do Not Open” messages are to be written. In the case where a health center could not arrange its own disposal, the waste container must be properly labeled with the name of that health center.

Where a container for packing infectious waste is available for use, the container must be strong and durable, chemical resistant, easily cleaned and mechanically locked and unlocked except where it is being placed in a Germ-free room which is frequently in use. Moreover, the container must be clean after each use.

Infectious waste collection and collection should be practiced according to these sanitary rules.

- Immediately collecting or packing infectious waste in the container designed for infectious waste and must be kept not more than 3/4 of the box container and not more than 2/3 of plastic container.

- Arranged a corner of the room for storing container for infectious waste for transportation and never keep for more than one day.

2. Transportation and Infectious Waste Collection

Health center operators should prepare a wheel cart for moving or transporting the infectious waste containers that meets safety standards as follows:

- It should be made of materials which are easily cleaned, no edges which might be the hiding places for diseases and having ventilation that could be open and closed.

- It should have a dull wall and have a tightly closed lid to prevent the access of animals and flies.

- Clearly labeled with red messages written on both sides “Infectious Wheel Cart-Do not use for other purposes”

Health center operators must arrange for the collection points for infectious waste. The collection points should have the following characteristics.

- The building must be in the far away area from other buildings or an isolated place, easily accessible for storage and transport of waste materials.
- Ample room to store waste at least for a couple days.
- Even floor and easy to clean
- Having good drainage connecting with a public water treatment system.
- Airy except in the temperature controlled room to prevent animals or insects from entering. The door must be wide enough in proportion to the storage areas, convenience and able to be locked with the key.
- Having the wash areas for the wheel carts near the storage places with the drainage pipe well connected to the drainage pipe of storage areas. Properly label with the warning “For waste storage” at the place. Clean and disinfect the collection-point or storage areas at least once a week.

Moving infectious waste must be done as follows:

- A person who was in charge of moving and collecting infectious waste must wear equipment to prevent personal harm such as, apron, mouth-covered pad, solid rubber shoes at all times while performing duties.
- Moving must be done with precaution. Do not throw or pull the container packing with infectious waste.
- Moving must be done without stopping at any rest places enroute to the collection point.
- In case, infectious waste scatters during the transportation, don’t pick it up with a bare hand, but use pincers or with thick gloves to return it to the other container and then clean the areas with disinfectant .If it was liquid, wipe it with tissue and put the tissue in the container for infectious waste. After that clean the area as usual.
- Never use the wheel cart for other activities.
- Cleaning the wheel cart and working tool after each use. The operator must wash and clean the body immediately

3. Infectious Waste Disposal

Infectious waste disposal no matter how it can be done or which method to use must be done according to standard organic rules which effectively destroy all bacteria, parasites and fungus. Depending on the case and circumstances, the same standard organic rules once applied with the analysis bacillus stearothermophillus or bacillus subtilis.

General infectious waste disposal as per standard procedures can be done in many different ways (1) such as the following.

3.1 Incineration is the method of burning to destroy the infection and remaining ashes must be disposed in the areas prepared especially for garbage disposal by burning in infectious waste incinerator. There were two types: designed by Department of Health Service, Sanitary Division and Environmental Sanitary Division .The "incinerator" was designed by the Sanitary Division as the small incinerator, is less expensive and able to burn 30-70 kilograms of garbage per hour by using logs or dried leaves as fuel. The cost for building it was estimated at 27,000 to 51,300 Baht (1999).

This type of incinerator is appropriate for small sized hospitals with less than 150 beds. The larger size incinerator designed by the Environmental Sanitary Department could be used for burning as much as 150 kilograms of waste per hour, using diesel and a burner. This type of incinerator was being used with general hospitals with more than 150 beds and hospital centers with more than 500 beds.

3.2 Steam sterilization for disinfection will cause the volume of garbage to remain the same or increase due to the steam moisture.

3.3 Chemical disinfectants were a popular method used in the hospitals for cleaning all the instruments and to destroy the infection on instruments rather than sterilization .The most commonly used chemical are Iodophor Formaldehyde, Alcohol and Glutaraldehyde. The effectiveness of chemical disinfectants depends upon contact time, pH, Temperature and mixing using only one type of primary Sodium hypochlorite to destroy the infection in the infectious waste.

3.4 The newest method and quite effective method is microwaving.

All of these methods had both good and bad points and must be chosen according to application and usage. Findings from various studies found that the most commonly used method was incineration since the infectious waste could be destroyed without trace or because it reduced the volume drastically when compared to the other methods.

4. Storage and disposal of infectious waste by authorized persons.

Authorized persons refers the ones who received permission from the local authority per The Decree 19 of Public Health 1992 to collect or eradicate infectious waste within the local district by conducting a business which would be compensated and must operate according to these regulations.

That contractor arranges for 2 officers who must have at least High School education or equivalence in Science major or different majors in one of these courses: Public Health, Sanitation, Biology, Medical Sciences and one of the officers must be from engineering, particular, Sanitary Engineering to effectively operate the infectious waste disposal system per requirements.

Provided the transportation for collecting infectious waste and the vehicles must be designed to meet these requirements.

- The dense body with inside lining with tough materials ,easy to clean and no leaking.
- Able to control the temperature at 10 Celsius or lower.
- Must be marked with code or authorized number of the person being authorized, required the printed words “For Infectious Waste Only” with clearly seen red alphabets at the body of vehicle.

Arranged for sufficient numbers of collection points and that meet the standard requirements to support the volume. Infectious waste must be disinfected except keeping in the room with the control temperature no more than 10 Celsius.

Monitors both the process and the person controlling process.

Infectious waste disposal must be kept in the vehicle with the controlled temperature no more than 10 Celsius.

Prohibited the use of vehicle for transporting infectious waste in other activities and cleaning and disinfected both vehicle and instruments after each transportation of infectious including the person in charge must thoroughly clean himself.

Monitor the system for infectious waste according to rules and biochemical standards by submitting monthly biochemical results and analysis to the local authority or division in charge of this matter with the exception if the disposal by incineration.

2.4 Guidelines for Infectious Waste Management

Generally, it should be the direct responsibility of the hospital or health center, but in the reality hospitals both in public and private were only collecting infectious waste, the remaining functions had been given to municipal to handle.

The disposal process of infectious waste from hospital should be monitored from the beginning to end of process to ensure the proper and effective procedures had been followed. Implementing the “Cradle to grave” process as the employed method.

For the main purposes, the following 4 steps (10) were involved:

2.4.1 Waste generation

2.4.2 Waste collection storage and Waste transportation

2.4.3 Recycle

2.4.4 Waste treatment and Waste disposal

2.4.1 Waste Generation

The process of disposing infectious waste is to be done promptly with convenience, effectiveness, quick and aiming at prevention of diseases from spreading to general populations. The Cleaning Division Bangkok Metropolis drew up guidelines for waste separation as follows:

1) Separated dry infectious waste and packed into the red plastic bag, tightly sealed. For hazardous infectious waste, pre- treatment should be done before packing in the bag to prevent infectious waste from scattering during the transportation.

2) Liquids infectious waste should be pre-treated and self-managed disposal.

3) Separated infectious waste from regular waste and placed into red plastic bag, tightly sealed.

4) Used gloves should be cut prior to disposal before throwing in the red plastic bag and prevent recycling.

5) Needles, surgery knives and other sharp objects such as, glass or metal bottles need to be packed and tightly sealed in the container before putting it into a separated bag and clearly labeled for disposal.

6) Irregular waste that required ample room such as big pieces of flesh should be put in the separate bag.

2.4.2 Collection, storage and transportation

1) Internal collection storage and transportation

1.1) Clinical waste must be disinfected or sterilization to get rid of various infections before packing in the red bag. Sharps objects such as needles or blades should be packed in puncture-proof containers (9). Sharps objects used with HIV patients or Hepatitis B should be pre-soaked in Sodium hyperchloride before sealing the container and put in the autoclave. Next step, pack it in red plastic bag with regular infectious waste.

1.2) Collection or segregation and the appropriate packing of waste according to the division of infectious waste as regulated by the World Health Organization 1985 should be handled by experienced specialists in this area. Therefore, the periodic training is arranged by the administrative division to increase expertise. Waste is divided into 3 main groups, household waste, clinical waste and sharps.

1.3) Storage or packing waste after separation is done by putting it in the thick plastic bag that is tough enough to prevent regular waste from puncturing and liquid from leaking. For requirements of single or double bag depends upon the use such as double bag for liquids. However, results of the test had shown that using single or double bag made no difference if the object was contaminated. Using double bags would incur unnecessary expenses. In general, plastic bags for packing waste should have certain features.

1.4) Single-use, moisture-proof bags should be solid enough to prevent regular waste from puncture and being clearly color coded. Color coded bags are needed to pack different wastes such as ,infectious waste in the red bag, regular waste in the black bag and also proper labeling of the bag such as, radiation waste, chemical waste, infectious waste and sharps. Waste should be packed only 2/3 of the bag in order to leave some space for a tight seal.

2) External collection, storage and transportation for infectious waste disposal outside the hospital. The vehicle for transportating infectious waste must be designed especially for this purpose, with tightly closed cover and controllable temperature. Able to hold bags or containers of infectious waste without tearing them during the transportation, causing the liquid waste to spill from vehicle. However, the liquid waste, such as blood, lymph and puss were not suitable to transport this way since the chance of leaking were very high.

3) Having the proper method for collecting infectious waste for cleaning staff (11).

3.1) The infectious waste collector must be trained in the proper methods of handling infectious waste by wearing thick gloves, cover mouth and nose with cloth pad, wearing apron and rubber boots at all times while performed the duties.

3.2) The collection cart should be made of polished materials such as stainless steel with dull side panel, smooth surface, hole on the floor or cork for

drainage with the handle to push. Never use the collecting cart for other purposes than collecting infectious waste. It must be cleaned at least once a day.

3.3) Storage areas should be designed in the corner of the area in the hospital which is easily accessed for the infectious waste container. The building should be permanently built, have ample space, good ventilation with screens on the top of the wall for air flow and to prevent animals from entering. The floor and wall should be made of smooth material, easy to clean with drainage on the side. Arrangement should be made for cleaning areas near the infectious storage areas for washing the collecting cart. The door must be closed at all times only to be opened during the moving. Infectious waste must be kept separately from regular waste. When done with collecting cart, clean both the cart and the storage areas and prohibit unauthorized persons to enter the areas.

3.4) Moving Garbage

- Pick up the garbage bag at the opening area where it is tied and hold it away from the body. Never carry the garbage bag on the shoulder, in one's arm or dragging it.

- Gently place it on the floor with the bag opening right side up. Do not throw or place heavy objects on the infectious waste bag.

- After packing the infectious waste in the collection cart, tightly cover it. The collection cart should be taken to the common storage areas as soon as it is filled.

- At the common storage areas, take the bag out of the collection cart and pick it up by the rope or bag tie, carefully arranging the bags.

3.5) Cleaning

The proper cleaning method is to wear wearing gloves to pick up the waste if any remained. Wash the gloves with water and cleaning solution. Pour the wastewater into the wastewater treatment of hospital. Gloves and apron boots must be soaked in the Hypochlorite solution 0.5% for 30 minutes before normal wash.

4) Dealing with infectious waste on the floor

When infectious waste is accidentally dropped on the floor or on other objects, use thick gloves or pincers to pick them up and put it in the bag. Wipe off the surface with solution and clean the area.

When moving infectious waste inside the hospital, the container for infectious waste must be constantly checked for possible leakage. The movers were required to wear gloves, mouth and nose pad and uniform at all times. The storage areas must be designated for keeping infectious waste only, never used for storing normal waste and located in the suitable place with a temperature of approximately 15 Celsius. Infectious waste waiting to be disposed of should be kept no longer than 3 days.

5) Collection of Radiation Waste and Chemical waste (10).

5.1) Radiation Waste Management

These wastes include containers of items such as absorbent paper, protective clothing, medicine bottles and hypodermic syringes. The best method for disposal is by packing the radiation contaminated objects in the special box made of lead. Store the pending decay objects for 1-2 days before putting in regular plastic bag to be stored with normal waste from departments, waiting to be incinerated.

5.2) Chemical waste Management

This waste includes gloves, needles and saline bottles. They must be packed within the plastic bag before putting the bags with other departments waiting for incineration or sanitary landfill.

2.4.3 Recycle

Certain waste produced on site may benefit from further segregation, so as to enable the waste to be re-cycled such as (10)

Aluminium cans,

Cardboard and packaging,

Newspapers,
Glass,
Pallets,
Clothing.

2.4.4 Treatment and disposal

Clinical waste after being disinfected or sterilized, the best method to dispose was the incineration, next the burial. All infectious waste should be burnt at the temperature not lower than 800 Celsius and there must be equipment to control the pollution from incineration. For sharps, the best method was being incinerated.

If the container for infectious waste was plastic bag or plastic container, used only one time by incinerated with normal waste. If it was made of durable materials such as, stainless which needed recycle, then it must be disinfected before or perhaps double plastic bags before burning in the incinerator with normal waste. For stainless steel container, disinfected every times before the next use and type of container must be the same required.

Ashes from incinerator must be buried in the ground or sent to the responsible local government agency to dispose per set requirements.

2.5 Health Centers in Thailand

The primary public health service has been established for very long time. The prominent one was the so called “Health Center” which was the primary public health service, the most intimate with the population, and the most transitional point between a community to public health service system. First mission is to the provide combination of public health services inclusive of public health promotion, prevention diseases, medical treatment and rehabilitation for people in the localities (12).

A health center is a sub district or village level health service unit first line unit, covering a population of about 1,000-5,000, with health staff including a health worker, a midwife and a technical nurse. Ministry of Public Health (MOPH) is now in the process of assigning a dental auxiliary, professional nurse and health technician to

each large health centers. Services provided at this level include health promotion, prevention and curative. Health center staffs run health programs according to the standard procedures established by the MOPH (12).

The International Conference on Primary Health Care, meeting in Alma-Ata this twelfth day of September in the year Nineteen hundred and seventy–eight declaration : Primary Health Care is essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at cost the community and country can afford to maintain at every state of their development in the spirit of self-reliance and self-determination. It forms an integral part both of the country's health system, of which it is the central function and main focus, and of overall social and economic development of the community. It is the first level of contract of individual, the family and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first element of continuing health care process. All government should formulate national policies, strategies and plans of action to launch and sustain primary health care as part of comprehensive national health system and in coordination with the other sectors (13).

Health centers are subdistrict-level health agencies which are responsible for providing integrated health services for rural population and supervising the training, as well as overseeing the operations, of village health volunteers and village health communicators. The health center is headed by health center officer, and answered directly to the district health office. Its responsibilities include administration, provision of services and supervision and training of volunteers, as well as other responsibilities assigned by the district health office (14).

Duties and Responsibilities of Health center (15).

A. Health service work for people in the assigned areas are in the following 5 subjects:

1.1 Health promotion service covers all the basic health activities for every target group and focusses on the properly aggressive strategic development such as

1.1.1 Maternal and child health care, service taking care of the mother from the beginning of the pregnancy including the children 0-5 years old in the area of the growth, the mental health development, the nutrition monitoring for the pregnant women, 0-5 years children and the school children

1.1.2 Family Planning, service giving the family planning service to the entertainment places, searching, monitoring and giving family campaign to every target group.

1.1.3 The school children and youth care giving the sanitation service to the children, planning and giving sanitation services in the assigned school including supporting the health services and sanitation to the school children and the outside school youth.

1.1.4 The public health care supporting the exercise to the public for the good health and giving iodine substance to the remote area

1.1.5 The dental service to the public in the assigned area and supporting the public and the community in the area of dental development on the basis of the fundamental health including the academic development and the volunteer training

1.1.6 The consumer health protection giving the public information, supporting the people to have knowledge, getting the correct news, selecting the healthy food, bewaring of the illegal and unhealthy food and supporting the consumer protective group

1.2 Rehabilitation service are based on the community problems in the assigned area such as remote area, rural area, urban area, agricultural area by fulfilling the mission both in and out of the service area, having the capacity in the operation including the curing of general illnesses

1.2.1 The work criteria developing the nursing service such as inspecting endemic disease in the laboratory room, giving the basic aids to the patient and referring the serious case and emergency patient including the treatment of disability and chronic patients.

1.2.2 The capacity in the operation in the area of the nursing aids, the laboratory result analysis, the caring and treatment of the chronic patient from the hospital such as surgical and dental patients.

1.2.3 The patient treatment according to the ministry standard 207 diseases both the treatment and referral.

1.3 Prevention, control and monitoring of chronic patients as follows:

1.3.1 Infection control using the precaution system which gives health knowledge and training to the public, teachers, students and the campaign in destroying the disease sources such as

1) General contact diseases such as water and food connected disease, worm infestation, respiratory disease and zoonosis.

2) Disease infection by insects and mosquitoes such as malaria, blood disease, encephalitis and elephantiasis.

3) Contracted disease such as tuberculosis, leprosy, sex transmitted disease and aids disease.

4) Vaccine protected diseases such as diphtheria, poliomyelitis, pertussis and tetanus.

1.3.2 Non-infectious diseases by giving health promotion and prevention that adjust the inappropriate behavior.

1.3.3 Environmental sanitation preventing the diseases in food, air and toxics by using the proper technology as

1) Providing clean and safe water

2) Environmental sanitation using of the proper toilet, the insect eradication, the polluted water eradication, the rubbish destroying, the cleaning, the housing discipline and the improvement of the sanitation in school and working places.

3) Environmental quality inspecting and monitoring the environment such as contaminated chemicals and germs in the public pools and air pollution.

4) Food sanitation work supporting the people to understand and aware of the importance of eating clean food, teaching people to consume properly, protecting the interest of themselves including the support of the standard food store.

1.3.4 Sanitation work supporting quality health service to every professionals including the protection and controlling of the disease and the accident due to the job responsibilities.

1.4 Rehabilitation and chronic patient by receiving the patient transfer from the hospital, recovering the patient or preventing the patient from being the crippled and helping the crippled in the assigned community covering every target group.

1.5 Other health services support health knowledge in the area of infection control, nursing care, health support and recovery among the various target groups in and out of the service area including the academic institutions.

B. The basic health support work and life quality development

2.1 The basic health work developing the people potential in taking care of their health and the community by supporting and doing the basic health work covering the assigned area including the community support in the area of resource and knowledge exchange.

2.2 The life quality work analyzing the community problems by coordinating with 6 major ministries including the supervising and evaluating the job completion for better quality life of the people in the country

C. Service job

3.1 General administration: Arranging the filing, financial, material, vehicle, building, and construction system.

3.2 The planning and evaluation planning, reporting, giving the information and infection control guidelines.

3.3 Coordination and public relations with 6 major ministries, local communities and private organizations to distribute information on activities in every level.

D. Academic work

Doing the basic research which helps to analyze problems with the entertainment establishments and health conditions in the assigned area including applying research results to the assigned area.

There are 13 districts in Kanchanaburi Province, Muang district had been chosen by using purposive sampling. Muang district has 22 health centers as shown in Table 2.

Table 2 The list of health centers from each district

No.	District	Total of health centers
1	Muang Kanchanaburi	22
2	Tha Moang	14
3	Tha Makha	15
4	Phanomtuan	9
5	Laokhan	13
6	Bo-phloi	10
7	Sai Yok	12
8	Thong Pha Phum	13
9	Sri Sawas	8
10	Sangkhla Buri	7
11	Dan Makhamteiy	7
12	Nong Phru	7
13	Huay Kha Joa	6
	Total	143

2.6 Related research findings

Related research findings regarding infectious were as follows:

Chanphai P. (16) studied the survey of knowledge, vision and behavior toward protection from contacting infectious disease during medical treatment by nurses in the community hospital at Ubon Raj Thani. The results shown that nurses retained knowledge, vision and behaved toward protection from contacting infectious disease during medical practice at moderate level and not much difference during the medical practice in hospital with 10, 30 and 60 beds up in the same time finding that nurses had accidentally exposed to diseases, totaled 89.88 %. Most accidents resulted from the wound or cut from medical objects such as needle, sharp glass or touching liquid substances from patients.

Soonthornlap S. (17) studied knowledge and practice of waste disposal and garbage in the household within a municipal district. The results showed that population had practiced collecting and separating waste at a moderate level. Factors that had the greatest influence upon behavior were, age, numbers of household members, length of residence and previous domicile.

Suksoonthorn P. (18) studied attitude of staff at the Noparut Rajthani Hospital towards infectious waste management. The results showed that the attitude of staff was excellent. Result from analyzing the relationship between attitude and study factors suggested that educational level, position, work experiences and knowledge of infectious waste were related with attitude. On the contrary gender, age and digesting news of infectious waste were not related with attitude with a statistical difference at only 0.05%. The problems and barriers in managing infectious waste were mixing of infectious waste with non-infectious waste, personnel ignorance, no pre-treatment of waste such as hypodermic needles, blades and inadequate storage areas for infectious waste.

Kornarthit J. (19) studied infectious waste management of medical centers in the municipal area of Khon Kean. The results showed that separation of infectious waste of every hospital was not effectively done. The normal practice was to throw regular waste in with infectious. As a result, the volume of infectious waste had increased. Most (95%) medical centers had not been practicing pre-treatment before disposal. For hospitals with less than 30 beds, infectious waste was sent to municipal centers to be disposed. To summarize, infectious waste management of hospitals in the municipal district of Khon Kean including separation and treatment of waste was still ineffective. In addition, infectious waste from medical centers with less than 30 beds and medical centers without any beds generated infectious waste equal to 27.15% kilograms per day or 10 tons annually that was being disposed along with regular waste from communities, thus creating the risk for people and the environment. It is essential that standards in infectious waste management should be implement to avoid the possible cause of contamination that may effect the quality of living, environment and health and welfare of general populations.

Monakarn P. (20) studied factors effecting behavior of nursing staff in infectious management from the hospital. Results from the study of hospitals of the Ministry of Public Health with at least 500 beds in Nonthaburi Province suggested the infectious waste disposal was being neglected by not putting waste in the right places. Fragments of cans, soda bottles and left-over foods were found in the red plastic containers. Gloves were found in the waste water treatment pool. These obviously were wrong places and some hospitals were lacking procedures in waste collection .Sometime, infectious waste was taken away by the building maintenance crew one or two bags at time without putting it at the designed areas due to convenience. Therefore, training has been an essential requirement for giving knowledge to nursing staff in every level in order for them to create the right attitude.

Promalee P. (21) studied infectious waste management at Siriraj Hospital. She found that infectious waste management at Siriraj Hospital had been divided into two types. The first one, regular waste packed in black plastic bags and infectious waste in the orange plastic bags. These two types of bags were being collected by the staff

from patient ward or administration room, using the wheel cart and sometimes carried down to storage areas. The bags were placed on the ordinary cement floor without a certain boundary which then became the storage areas for regular waste as well as infectious waste. The route for moving the infectious waste, ready for the pick up by garbage truck of Bangkok Metropolis was the same route such as the side walk or road that was commonly used in the hospital. Although, Siriraj hospital had set up many division such as, pathology and nursing, they did not coordinate various departments, resulting in an unorganized system which eventually led to dysfunctionality of the organization. Therefore, there should be coordination between different divisions regarding infectious waste which could lead to more effective controls.

Kusol N. (22) studied infectious waste management in the private medical center without admission beds, namely, Pattaya Province, Chonburi. Finding that rate of infectious waste was 0.06 kilogram per day per person. Composition of most infectious waste was absorbent cotton, gauze pads and sharps.. No medical center had guidelines for standard infectious waste management. Most staff in the medical center lacked knowledge and understanding of infectious waste management. The study found the similarity in the operation with the draft rules of the ministry.

Miyazaki M, Imatoh T, Une H. (23) studied the current situation in Japan regarding treatment of infectious waste arising from home health and medical care services. They recommended that the management of such materials has become increasingly important in order to protect municipal workers from disease .Strict guidelines for disposal of home health and medical care services waste materials by patients and their families must be established and enforced. Medical- related facilities should manage home health and medical care services (e.g., sharp objects, injection needles), while municipal governments should manage other home health and medical care services waste materials .In addition, the Japanese Ministry of Environment should establish broad regulations to systematize the implementation of such a program.

Qdaus HA, Rabi A, Abdulla F. (24) studied characteristics of the medical waste generated at Jordanian hospitals. They found that the average generation rates ranged from 0.29 to 1.36 kg/bed/day, while the ration of waste to patients was from 0.36 to 0.87 kg/patient /day. The total daily amount of medical waste generated at the Jordanian hospitals was estimated to be 6 tons /day. The study concluded that all hospitals covered by the survey are practicing segregation of hazardous medical waste from general medical waste. However, the segregation process in some hospitals is still inefficient and there is a potential for improvements toward minimizing the hazardous medical waste generation.

Da Silva C.E, Hoppe A.E, Ravanello M.M, Mello N. (25) studied medical waste management in southern Brazil. They found that the management practices in most healthcare facilities do not comply with the principles stated in Brazilian legislation. All facilities demonstrated a priority on segregation of infectious – biological wastes. Average generation rates of total and infectious-biological wastes in the hospitals were estimated to be 3.245 and 0.570 kg/bed/day, respectively.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Study design

The study was designed as a descriptive study conducted in Kanchanaburi Province, Thailand, with the objective to analyze the current situation of infectious waste management. This study not only focusses on differences in infectious waste management of health centers but also emphasizes efficient practices in infectious waste management of health centers.

3.2 Population and selection of study area

Kanchanaburi is the largest central province or the third largest of Thailand. The province is located 130 km west of Bangkok and covers 19,480 km^2 and borders Myanmar at the north-west. The population in 2006 was 830,458 with 95 Tambons, 959 villages and 264,016 households. The province is subdivided into 13 districts. Muang is the capital district of the province. About 154,450 inhabitants live in Muang district. The report of Kanchanaburi Province Office of Public Health in 2006 showed that the top diseases were respiratory tract infection, skin infection and parasitic infection. The cause of death from tuberculosis infectious agents was 10.19 percent of patients who smeared positive in Kanchanaburi province. This smearing was to check against the amount of infectious waste being produced in the community area.

Unsafe management and disposal of waste can readily lead to adverse health consequences. Exposure can also occur via the environmental transfer of disease-causing organisms or harmful substances due to unsafe disposal. However, waste can be managed and disposed of in ways that prevent harm from occurring. Muang District is the most densely populated district in Kanchanaburi Province. Infectious

waste from health centers relates to transportation and disposal. Therefore, Muang District was selected for this study

3.3 Population

Population consisted of 22 health centers in Muang District, Kanchanaburi Province. Muang district has 22 health centers shown below;

1. Ban Yang	2. Ban Nong Songton	3. Ban Nong Boa
4. Ban Ladyah	5. Ban Nongkah	6. Ban Tha-Manoa
7. Ban Tha-Tum	8. Ban Thub-Sila	9.Ban Tha-Thungna
10. Ban Nong-Yah	11. Ban Wang-Phamu	12. Ban Kang-Loan
13. Ban Koar	14. Ban Huay-Namkao	15. Ban Lam-Thahan
16. Ban Phu-Namroan	17. Ban Wang-Yen	18. Ban Nong-Samphan
19. Ban Koa-Phurang	20. Ban Thakean-Kham	21. Ban Wang-Dong
22. Ban Kang-Sean		

3.4 Data collection tools and methods

This study was divided into 2 groups such as quantitative data and qualitative data. Quantitative and qualitative data were collected from health officers responsible for health centers. The sample size was 22 centers. We chose Muang District by using non -probability sampling.

The data was collected by interviewing and observing the head of health centers by the researcher. Where the head was not available; the researcher asked other health officers. The questionnaire was comprised of 3 major parts and was designed according to the following aspects.

Data collection by interviewing included:

Part 1 Socio-demographic factors

The questionnaire of this part included health officers background at health centers characteristics of respondent in terms of age, gender, work period, education level work periods and occupation etc.

Part 2 Knowledge on infectious waste management

The questionnaire of this part comprised about knowledge on appropriate method of infectious waste.

1. Segregation infectious Waste.
2. Collecting Infectious waste.
3. Transportation of infectious waste.
4. Disposal of infectious waste.

This part consists of 30 questions about knowledge on appropriate method of infectious waste.

The score will be given to 1 for the correct answer and 0 for the wrong answer in each statement. The maximum total score is 24 and the minimum total score is 0. Based on the Benjamin Bloom criteria, the total knowledge score will be classified into three levels as follows;

Good of knowledge: The score is higher than 80%
Fair of knowledge : The score is between 60% to 80%
Poor of knowledge : The score is less than 60%

Part 3 Infectious waste management

This part consists of 11 questions about knowledge on appropriate method of infectious waste management.

The score will be given to 1 for the correct answer and 0 for the wrong answer in each statement. The maximum total score is 8 and the minimum total score is 0.

Based on the Benjamin Bloom criteria, the total knowledge score will be classified into three levels as follows;

Appropriates	: The score is higher than 80%
Fair	: The score is between 60% to 80%
Need improvement	: The score is less than 60%

Part 4 Problems, obstacles and recommendation for infectious waste management of health centers

The questionnaire of this part included supporting towards the infectious waste management protocol and training. There 2 sections as follows:

Section 1 Infectious waste management protocol and training by interviewing.

Section 2 Problems and obstacles and supporting data from observation used open ended questions.

Data collection by participant observation

The researcher frequently checked open ended questions with small samples and the observations were noted based on various variables

3.5 Data collection procedure

A structure questionnaire entirely covering the study's objectives was reviewed and analyzed by and expert for content validity only.

Before conducting the research, the letter of recommendation from the ASEAN Institute for Health Development was sent to the Executive Officer of the Provincial Public Health Offices in Kanchanaburi Province for the purposes of requesting the cooperation and delivering these questionnaires. At the same time, it data was collected from public health officers by appointment. Data was then collected from each health center as well as questionnaires for assessment and analysis. Health officers in charge of waste management were interviewed. The

researcher observed the environment and infectious waste management using the standard checklist. (Appendix)

3.6 Data analysis procedure and statistics used

The compiled data was checked for validity before entering them into the design code manual and made ready to be analyzed using the program Statistical Package for Science. Descriptive statistics were used to calculate frequency, percentage, mean and standard deviation to describe the distribution of independent and dependent variables.

CHAPTER 4
RESULTS

This study aimed to describe infectious waste management of health centers. For that purpose a total of 22 health centers were studied in Muang District, Kanchanaburi Province. The results of the study are divided into 5 parts.

4.1 Socio- demographic of the health officers

4.2 Knowledge of infectious waste management

4.3 Infectious waste management of health centers

4.4 Problems and obstacles in infectious waste management of health centers

4.5 Observations of infectious waste management

4.1 Socio-demographic of the health officers

The distribution of gender, age, education, professional background, total number of the health officers at health centers and working experience of the health officers is shown in table 3.

Male health officers were slightly more (54.55%) than female health officers. The majority (86.36%) of the health officers were middle- aged 31-50 years old, while only 9.09% of the health officers were over 51 years old and only 4.58% were under 30 years old. Over half (68.18%) of the health officers graduated with a Bachelor's degree. Nearly 27.28% finished less than a bachelor's degree but only 4.55% graduated higher than a Bachelor's degree.

Based on the professional background of the health officers who were interviewed 40.91% were administrative health officers. The community health officers were 27.27%, public health technician were 22.73% and the rest were equivalent to professional nurses at 9.09% respectively out of the total sample.

The proportion of positions of the health officers at each health center were as follows: 32.84% of the positions were community health officers. The administrative health officers were 31.34%, technician public health were 17.91%, professional nurses were 11.94%, technical nurses were 4.48% and only 1.49% were dental assistants.

Working experience of the health officers was as follows: 59.09% had been working over 20 years. Those who had worked between 11-20 years numbered 27.27% and around 13.64% had been working less than 10 years. Almost all the health officers (86.36%) resided in Kanchanaburi Province and only 13.64% were not residing in this Province.

Infectious waste generation at health centers in Muang District, Kanchanaburi Province, Thailand for 2008 is shown in Table 4. The total daily amount of infectious waste generated from different health centers was estimated to be 0.35 kilogram/day.

Table 3 Number and percentage of the health officers by general factors

General factors	Number (N)	Percent %
Gender		
Male	12	54.55
Female	10	45.45
Age (years)		
≤30	1	4.58
31 – 50	19	86.36
≥ 51	2	9.06
Educational level		
Lower than Bachelor degree	3	13.64
Bachelor degree	15	68.18
Higher than Bachelor degree	1	4.55
Others	3	13.64
Professional background		
Administrative Health Officer	9	40.91
Public Health Technician	5	22.73
Community Health Officer	6	27.27
Professional Nurse	2	9.09
Technical Nurse		
Dental Assistant		
Total Number of health personnel at health centers		
Administrative Health Officer	21	31.34
Public Health Technician	12	17.91
Community Health Officer	22	32.84
Professional Nurse	8	11.94
Technical Nurse	3	4.48
Dental Assistant	1	1.49
Working experience (years)		
≤10	3	13.64
11– 20	6	27.27
≥ 20	13	59.09

Table 4 Generation rate of infectious waste per day at each health center

HEALTH CENTERS	Total (kilogram)
Health center 1	0.15
Health center 2	0.6
Health center 3	0.15
Health center 4	0.7
Health center 5	0.5
Health center 6	0.72
Health center 7	0.5
Health center 8	0.42
Health center 9	0.5
Health center 10	0.5
Health center 11	0.3
Health center 12	0.1
Health center 13	0.15
Health center 14	0.5
Health center 15	-*
Health center 16	0.1
Health center 17	0.2
Health center 18	0.3
Health center 19	0.15
Health center 20	0.2
Health center 21	-*
Health center 22	.25
Min=0.1 Max= 0.72	**Total =6.99 kgs**
Mean=0.35 Median=0.3	**S.D.= 0.2032 Q.D.= 0.15**

***Data were not available.**

4.1.1 Training on Infectious Waste Management and Environmental Pollution

All of the health officers had never been trained the training on infectious waste management and environment pollution as shown in Table 5.

4.1.2 Present situation and Usage of Incinerator

At presented in Table 6 we found that all of the health centers had never been informed against to accuse on infectious waste management. And also any health center does not have standard incinerator.

Table 5 Number and percentage of the health officers by training on infectious waste management and environment pollution

Training	Number	Percent
Training on Infectious Waste Management		
Yes	0	0
No	22	100

Table 6 Number and percentage of present situation and usage of incinerator for infectious waste disposal

Present Situation and Usage of Incinerator	Number	Percent
Do you have ever informed against to accuse on infectious waste management?		
Yes	0	0
No	22	100
Do you have standard incinerator in your health center?		
Yes	0	0
No	22	100

4.2 Knowledge on infectious waste management

Appendix A illustrated the 30 questions about knowledge on infectious waste management consisting of knowledge of segregation infectious waste, infectious waste collection, infectious waste transportation and infectious waste disposal. The criteria for standard procedure were scaled with 3 levels as good, moderate and poor. For health officers with the correct answers at 80% and up were considered at the good level. The correct answers of 60% to 80% were considered at moderate level. Lower than 60% correct answers were considered a poor level of knowledge on infectious waste management. The majority of the health officers had good knowledge equivalent to 81.82% and only the remaining few (18.18%) had a moderate level, as illustrated in Table 7. None of the health officers had poor level of knowledge. (Mean=25.14, median=25.5, S.D. =2.17, Min=20, Max=28).

The question numbers 1, 7, 8, 9, 10, 15, 16 and 30, are about the segregation of infectious waste management based on standard procedures for infectious waste management. The result of knowledge of segregation of infectious waste also divided into 3 levels: good, moderate and poor with the same criteria a per above. The health officers with the correct answers 7 scores up were considered as good level. The correct answers 5-7 scores were considered as moderate level. The correct lower than 5 scores were considered as poor level. The results recorded in Table 7 found that the health officers shows that all of the health officers had good level of knowledge (Mean=7.09, median=7.00, S.D. =0.75, Min=6, Max=8).

The question numbers 2, 3, 4, 6, 11, 12, 23 and 25 are about infectious waste collection management by standard procedure for infectious waste management. The result of knowledge of infectious waste collection divided into 3 levels such as, good, moderate and poor in the criteria for standard procedures. The results in Table7 show that most of the health officers (90.91%) were at good level, and only small percentage of the health officers (9.09%) were at poor level. No one had moderate knowledge about infectious waste collection (Mean=6.54, median=6.5, S.D.=1.14, Min=4, Max=8).

The question numbers 18, 19, 20, 21, 22, 24, 26, 27 and 28 are about infectious waste transportation management by standard procedure for infectious waste management. The result in Table 7 showed that 86.36 % of the health officers were at good level and 13.64 of the health officers were at moderate level. None of the health officer had poor knowledge about infectious waste transportation (Mean=7.5, median=7.55, S.D.=1.06, Min=5, Max=9).

The question numbers 5, 13, 14, 17 and 29 are about infectious waste disposal management by standard procedure for infectious waste management. The result in Table 7 showed that 59.09 % of the health officers were at a good level and 40.91% of the health officers were at a moderate level of knowledge. (Mean=7.5, median=7.55, S.D. =1.06, Min=5, Max=9).

Table 7 Number and percentage of the health officers by knowledge on infectious waste management

Level of Knowledge	Number (N)	Percent (%)
Good (>24)	18	81.82
Moderate (18-24)	4	18.18
Poor (<18)	0	0
Mean=25.136 median=25.5 S.D. =2.167 Min=20 Max=28		
Segregation of Infectious Waste (total 8 score)		
Good (>7)	22	100
Moderate (5-7)	0	0
Poor (<5)	0	0
Mean=7.091 median=7.00 S.D. =0.75 Min=6 Max=8		
Infectious Waste Collection (total 8 score)		
Good (>7)	20	90.91
Moderate (5-7)	0	0
Poor (<5)	2	9.09
Mean=6.545 median=6.5 S.D. =1.143 Min=4 Max=8		
Infectious Waste Transportation (total 9 score)		
Good (>7)	19	86.36
Moderate (5-7)	3	13.64
Poor (<5)	0	0
Mean=7.5 median=7.550 S.D. =1.058 Min=5 Max=9		
Infectious Waste Disposal (total 5 score)		
Good (>4)	13	59.09
Moderate (3-4)	9	40.91
Poor (<3)	0	0
Mean=4 median=4 S.D. =0.96 Min=3 Max=5		

4.3 Infectious waste management

Regarding appropriation of infectious waste management at health centers shown in Table 8, the health centers had appropriated management averaging 66 %.

Actually, the result of infectious waste management were classified into 3 levels, appropriate, fair and need improvement based upon the standard procedure for infectious waste management. As illustrated in Table 9, over half of the health officers (63.64%) had fair management while 27.27% of health officers needed improvement on infectious waste management. Only 9.09% officers said they had a proper infectious waste management system.

Table 8 Number and percentage of correct answers at each health centers regarding appropriate infectious waste management (total score=11)

	Total (n=11)	percent
Health center 1	10	90.91
Health center 2	8	72.73
Health center 3	7	63.64
Health center 4	8	72.73
Health center 5	8	72.73
Health center 6	5	45.45
Health center 7	8	72.73
Health center 8	8	72.73
Health center 9	8	72.73
Health center 10	6	54.55
Health center 11	7	63.64
Health center 12	7	63.64
Health center 13	9	81.82
Health center 14	5	45.45
Health center 15	8	72.73
Health center 16	7	63.64
Health center 17	6	54.55
Health center 18	7	63.64
Health center 19	8	72.73
Health center 20	5	45.45
Health center 21	7	63.64
Health center 22	7	63.64
Mean=7.227 median=7 SD=1.27 Min= 5 Max =10		

Table 9 Number and percentage of the health officers by level of management toward infectious waste management

Level of Management		Number (n)	Percent (%)
Appropriates	(>8)	10	45.45
Fair	(6-8)	9	40.91
Need Improvement	(<6)	3	13.64
Mean=7.28 median=7	SD=1.27 Min =5 Max= 10		

4.4 Problems and obstacles on infectious waste management of health centers

As far as the problems and obstacles of health centers for the equipment for infectious waste management noted by health officers, the majority of health centers were insufficient in equipment for infectious waste management as shown in Table 10. The result in Table 11 shows that the equipment for infectious waste management were solid rubber shoes (25%), pincers (21.88%), aprons and thick rubber shoes (18.75%), red plastic bags (9.38%) and last one mouth-covered pads (6.25%).

The result in Table 12 shows that the health officers mostly faced problem and obstacle for infectious waste management lack of standard incinerator (50%). Next, were lacks of knowledge on infectious waste management (15.38%), insufficient equipments (11.54%). Only 3.85% faced the problem of lack of health awareness, lack of waste water treatment, lack of equipments to eliminate sharps, lack of garbage management by local authority, lack of disinfectant and lack of equipment to eliminate needles.

The result in Table 13 shows that the need of supporting for infectious waste management 27.59% of the health centers requested for supporting about incinerator, 20.69% requested protective equipment, 17.24% needed more budget, 13.79% needed

promoting and supporting to health officers to get training, 6.90% needed support from the local authority for disposal waste and only 3.45% needed information for Environment Pollution and equipment to eliminate sharps respectively.

The result in Table 14 shows the recommendation for infectious waste management of health centers such as providing training on infectious waste management (23.08%). Only 7.69% of the health officers mentioned about supporting the budget for incinerator at health center, controlling local authority for supporting on infectious waste management, promoting of education to health officers at health centers on interventions to decrease waste, supporting local dumping areas in communities, providing a few incinerators in each province, promoting of education to health officers at health centers on interventions to decrease waste, making policy at national about prevention dumping waste from other countries, decentralizing to Local Administration, supporting the garbage cover and provide training on infectious waste management in local administration.

Table 10 Number and percentage of the health centers by sufficient of infectious waste management

Equipment	Number	Percent
Sufficient	9	40.91
Insufficient	13	59.09

Table 11 Number and percentage the equipment for infectious waste management of health centers need support.

Categories of the equipment for infectious waste management	Number	Percent
Red plastic bag	3	9.38
Thick rubber Glove	6	18.75
Mouth and nose mask	2	6.25
Solid rubber shoes	8	25.00
Apron	6	18.75
Pincer	7	21.88

Table 12 Number and percentage of the health centers by problems and obstacles for infectious waste management.

Problem for infectious waste management of health centers	**Number**	**Percent**
Lack of knowledge on infectious waste management	4	15.38
Insufficient equipment	3	11.54
Lack of health awareness	1	3.85
Lack of waste water treatment	1	3.85
Lack of equipment to eliminate sharps	1	3.85
Lack of a standard Incinerator	13	50.00
Lack of garbage management by local authority	1	3.85
Lack of disinfectant	1	3.85
Lack of equipment to eliminated needles	1	3.85

Table 13 Number and percentage of the health centers by the need of supporting for infectious waste management of the health centers

Supporting for infectious waste management of health centers	**Number**	**Percent**
Protective Equipment	6	20.69
Health officers training	4	13.79
Handling of infectious waste at health centers	2	6.90
Support to obtain an incinerator	8	27.59
Local authority for disposal of waste	2	6.90
Information for environmental pollution	1	3.45
Higher operating budget	5	17.24
Equipment to eliminated sharps	1	3.45

Table 14 Number and percentage of the health centers by recommendation for infectious waste management.

Recommendation for infectious waste management	Number	Percent
Budget support for Incinerator at health centers	1	7.69
Provide training on infectious waste management	3	23.08
Control by local authority of infectious waste	1	7.69
Promote knowledge of waste management among youth	1	7.69
Support local dumping areas in communities	1	7.69
Provide a few incinerators in each province	1	7.69
Train health officers at health centers on interventions to decrease waste.	1	7.69
Make policy at national level preventing dumping of waste from other countries.	1	7.69
Decentralize waste management to Local Administration	1	7.69
Support the use of garbage covers	1	7.69
Provide training on infectious waste management in Local Administration	1	7.69

4.5 Observations of infectious waste management

Infectious waste management among health officers at health centers in Muang District, Kanchanaburi Province were observed as follows:

General conditions of the health centers

All of the health centers were government -designed, one- storeyed buildings with a high basement. The first floor provides services for health care and the second floor is located for the management of the organization. The first floors are used as a nursing room, examination room and store room etc. However, the health centers have the appropriate physical environment as shown in Picture 1-22.

Environment Surroundings of the Health centers

As illustrated in picture 1-22, Muang District in Kanchanaburi Province is a diverse community based on the community schools and temples. Most health centers have a good landscape and have constructed concrete fences only in the front of the health centers and the other sides with wired barb. Health officers create space variations to accommodate work at each health center.

Segregation of Infectious Waste of the Health Centers

Table 15 shows that the majority of the health officers separate infectious waste but do not follow the standard procedure of the Office of Health and Sanitation (86.36%). A minority fails to separate waste (13.64%). Regular waste containers had no cover (59.09 %) but some did (40.91%). 54.55% of the containers for infectious waste were made from stainless steel but had no cover and 45.45% had covers. Most types of bags for segregation of infectious waste were red plastic bag (43.18%) and only 38.64% were black plastic bags. Some (18.18%) of the health officers used both black and red plastic bags.

Infectious Waste Management of segregation, collection, transportation and disposal

The result in Table 16 from the observation on infectious waste management about segregation, collection, transportation and disposal, revealing that 59.09% of the responsible of health centers tied the bag when they collected infectious waste and 40.91% of the health officers did not tie of the bag when they collected infectious waste. Around 63.64% of the health officers felt uncertainly how much they filled the volume of infectious packed in the infectious waste bag, 13.64% of the health officers filled ¾ of the volume of infectious packed in the infectious waste bag. 22.73% of the health officers filled 2/3 of the volume of infectious packed in the infectious waste bag according to the standard. No health centers had undertaken pre-treatment of infectious waste. The manual handing of waste from the point of collection to the

point at which it is to be transported revealed that all of the health centers handled the infectious waste by hand.

We observed that the health centers have no standard infectious incinerators. Half of the health centers disposed infectious waste by burning it in the open, burning in the incinerators and in concrete tanks (18.18%), sending to district or municipal contractor (9.09%) and no disposal (4.55%) respectively as shows in Picture 1-22.The incinerators were observed, incinerator could operated only 1 health center or 4.54% and 3 health centers or 33.33% were not good but incinerators were operated.

Table 15 Number and percentage of the health centers by segregation of infectious waste.

Separation of Infectious Waste in Health Centers	**Number**	**Percent**
Separation of infectious waste		
Separated per health and sanitary standard	0	0
Separated but not following the standard	19	86.36
No separation, put waste together	3	13.64
Type of Container		
Regular waste container		
Plastic: Cover	9	40.91
No cover	13	59.09
Type of container for infectious waste		
Stainless: Cover	10	45.55
No cover	12	54.55
Type of bag for infectious waste		
Black plastic	17	38.64
Red plastic	19	43.18
Both black and red plastic	8	18.18

Table 16 Number and percentage of health centers on infectious waste management about segregation, collection, transportation and disposal.

Infectious Waste Management	Number	Percent
Collection methods		
Tied the bag		
Yes	13	59.09
No	9	40.91
Volume of infectious matter packed in the infectious waste bag		
2/3 of infectious waste bag	5	22.73
3/4 of infectious waste bag	3	13.64
Volume uncertain	14	63.64
Pre-treatment		
Chemical	0	0
Steaming	0	0
No pre-treatment	22	100
Transportation		
Self-carry	22	100
Infectious garbage removal cart		
Methods of infectious waste disposal		
Burn in the incinerator	4	18.18
Burn in open	11	50.00
Pick up by district and municipal collectors	2	9.09
No disposal	1	4.55
Concrete tank	4	18.18
Situation of incinerator		
On line (n=22)	1	4.54
Off line	0	0
Other (n=22)	3	33.33

CHAPTER 5
DISCUSSION

The study on infectious waste management in Muang District, Kanchanaburi Province, describes the situation of infectious waste management of health centers. Muang District is a diverse community near the border of Myanmar. It was so complicated and difficult to collect the data at each health center. This study can be beneficial to the health centers of Kanchanaburi Province which can affect the quality of health services in the future. We chose Muang district by using non-probability sampling.

The data were collected by interviewing and observing 22 health centers by quantitative data and qualitative data. The interviews were with the responsible health officers. This chapter is divided into 5 parts: socio-demographic factors, knowledge, management, problem and obstacles and observations.

5.1 Socio-demographic factors

This study showed that the health officers were slightly more males than female. The majority of the health officers were middle- aged 31-50 years old. Over half of the health officers graduated with a bachelor's degree. The health officers in this study were administrative health officers. The classification of the total number of the health officers at each health center had community health officers at every health centers. The average respondent had been working over 20 years. However, Insawang's study (1) showed that the variables of gender, age, length of employment and level of education were not significant factors on infectious waste management.

Interestingly, the amount of infectious waste generated was 0.35 kilogram per day. The maximum waste generated was 0.72 kilograms per day and the minimum

was 0.1 kilograms per day. All health centers in Kanchanaburi Province generate an estimated total of 50.05 kilograms per day or 1.5 tons per month.

Surprisingly, none of the health officers have been ever trained on infectious waste management and environment pollution. None of the health centers have a standard incinerator. However, there were no complaints from local people.

5.2 Knowledge on infectious waste management

Nearly all of the health officers had high knowledge on the appropriate method of managing infectious waste. More than 81.82% of the health officers had high knowledge. Knowledge on infectious waste management can be classified into 4 parts.

On knowledge of segregation of infectious waste, all of the health officers had high level of knowledge. On knowledge of infectious waste collection, most of the health officers (90.91%) had high knowledge and only a small percentage of the health officers were at poor level (9.09%).No one had a moderate knowledge about infectious waste collection. On knowledge of infectious waste transportation, most health officers (86.36 %) had high knowledge and 13.64% of the health officers had a moderate knowledge. None of the health officer had poor knowledge. For knowledge of infectious waste disposal, around 59.09% of the health officers had high knowledge and 40.91% of the health officers had a moderate knowledge. No one had poor knowledge about infectious waste disposal.

This result was similar to Insawang's study (1) that showed 55.3% of the health officers have a high level of understanding on infectious waste management. And Kraisak J.'s study (26) resulted that most of medical personnel had a moderate level of knowledge (69.6%).

5.3 Infectious waste management

Base on the standard procedure for infectious waste management, the management of the health centers was classified into 3 levels: appropriate, fair and needs improvement. Correct scores over 8 (>80%) were considered as appropriate. The correct scores of 6-8 (60-80%) was considered as fair and below 6 correct scores (<60%) was considered as needs improvement. There were 45.45% of the health officers who appropriately managed infectious waste. Around 40.91% of the health officers managed at a fair scoring level and only 13.64% of the health officers needed improvement. By comparison, Kraisak's study (26) found that 61.8% of medical personnel had a moderate level on infectious waste management. This finding revealed higher percentage than the finding of the present study.

5.4 Problems and obstacles on infectious waste management of health centers

5.4.1 Health officers face obstacles related to the equipment for infectious waste management. The majority (59.09%) of health centers had insufficient equipment for infectious waste management. The equipment for infectious waste management were solid rubber shoes (25%), pincers (21.88%), aprons and thick rubber shoes (18.75%), red plastic bags (9.38%) and mouth and nose masks(6.25%).

The health officers mostly faced problems and obstacles for infectious waste management in the lack of a standard incinerator (50%). Next, were problems of a lack of knowledge on infectious waste management (15.38%), insufficient equipment (11.54%) but only 3.85%. faced the problem of lack of health awareness, lack of waste water treatment, lack of equipment to eliminate sharps, lack of garbage management by local authority, lack of disinfectant and lack of equipment to eliminate needles.

5.4.2 Regarding the need of supporting for infectious waste management, 27.59% of the health centers requested support to obtain an incinerator, 20.69% protective equipment , 17.24% higher operating budget, 13.79% health officer

training, 6.90% wanted local authority for disposal of waste and only 3.45% need information for environmental pollution and equipment to eliminate sharps.

5.4.3 Health centers recommend receiving training on infectious waste management (23.08%). Only 7.69% of the health officers mentioned about funding for obtaing an incinerator at their health center, local authority control of infectious waste management, promotion of education for health officers at health centers on interventions to decrease waste, support of local dumping areas in communities, providing a few incinerators in each province, the need for national policy about prevention of dumping waste from other countries, decentralizing to Local Administration, supporting the garbage cover and providing training on Infectious waste management in the Local Administrative Authority.

Similarly Insawang's study recommended to provide training on infectious waste management among the health officers of health centers. Kusol N.'s (22) found that no medical center had guidelines for standard infectious waste management. Most staffs in the medical center lacked knowledge, understanding and infectious waste management practices. Whereas Monakarn(20) found that the infectious waste management has been an essential requirement for giving knowledge to nursing staff in every level in order for them to create the right attitude.

5.5 Observations of infectious waste management

Referring to the picture 1-22, observations of infectious waste management among health officers at health centers in Muang District, Kanchanaburi Province made the following descriptions.

General conditions of health centers

All of the health centers were government- designed, one-storeyed buildings with the raised basement. The first floor provides to health care services and the second floor is for management of the organization. The first floor included a nursing

room, examination room and store room. However, the health centers have an appropriate physical environment.

Environmental Surrounding of Health Centers

As illustrated in picture 1-22, Muang district in Kanchanaburi province is a diverse community with schools and temples. Most of health centers have good landscape and have constructed a concrete fence only in the front of the health centers and with barb-wired fences on the other sides. The health officers created a varied space to accommodate work at each health center.

Segregation of infectious waste of health centers

The health officers incorrectly segregated waste. The waste separation was not done effectively.

Infectious waste management by segregation, collection, transportation and disposal at health centers

The health officers lacked knowledge on infectious waste management. Moreover, infectious waste transportation at 2 health centers was the responsibility of the municipalities or districts. This result was similar to the study of Kornarthit(19) who found that separation of infectious waste at all hospitals was not effectively done. If the infectious waste is contaminated with general waste, it should be considered as infectious waste, and be separated from infectious waste (27).

Summary

1. The problem of infectious wastes generation is on an increasing trend, according to observations recorded in this study. This is similar to the research study of Miyazaki, Imatoh and Une. (23).
2. Health officers had good knowledge on infectious waste management which similar to the studies of Chanphai (16) and Soonthornlap (17).
3. This study showed that 41% of the health officers did not perform appropriately management similar to the research studies of Suksoonthorn (18), Kornarthit (19), Monakarn (20) and Kraisak (26).

CHAPTER 6
CONCLUSION AND RECOMMENDATION

This chapter summarizes of the conclusions from analysis and offers recommendations.

6.1 Conclusion

The descriptive research survey on infectious waste management was conducted in Kanchanaburi Province, Thailand from January 1-30, 2008. The objective of the study was to describe the situation about infectious waste management. This study not only focused on differences in infectious waste management practices of health centers but also emphasized efficiency in infectious waste management of health centers. The data of the study was quantitative and qualitative data. These were collected from health officers who were in charge of waste management at the health centers, the sample size consisted of 22 health centers. The data were collected by interviewing and observing the practice of health staff by the researcher. Where the head of health centers was not available, the researcher interviewed other health officers at health centers in Muang District, Kanchanaburi Province.

Over half of the health officers had graduated with a Bachelor's degree. Most of the health center staff participating in this study was health administrators. Surprisingly, none of the health officers had been trained on infectious waste management or environment pollution.

All of the health centers performed inefficiently in the area of infectious waste management. The amount of infectious waste generated on average was 0.35 kilograms per day. The maximum of waste generated was 0.72 kilogram per day and

the minimum of infectious waste generated was 0.1kilogram per day. All 22 health centers generate about 50.05 kilograms per day or 1.5 tons per month.

All of the health officers had high knowledge on appropriate method of infectious waste management. Management of infectious waste was scored as appropriate (45.45%) fair (40.19%) and needs improvement (13.64%).

With regard to problems and obstacles of health centers respecting the equipment for infectious waste management, the majority (59.09%) of health centers had insufficient equipment for infectious waste management. Most of the health centers faced problems about lack of standard incinerator, lack knowledge about infectious waste management, have insufficient equipments, lack health awareness, waste water treatment, equipment to eliminate sharps, garbage management by local authority, disinfectant and equipment to eliminate needles.

Health centers requested support for obtaining an incinerator, protective equipment, operating budget, promoting and supporting health officers to get training, local authority for disposal waste and information for Environment Pollution and equipment to eliminate sharps.

All health centers were observed by researcher. The first floor provides health care services and the second floor for management. The first floor included a nursing room, examination room and store room. However, the health centers have the appropriate physical environment. The diverse community is served by schools and temples. Most of health centers have good landscape and have constructed a concrete fence only in the front of the health centers with barbed wire covering the other perimeters. The health officers created a variety space to accommodate work at each health center.

Observation on infectious waste, the practice of the health officers incorrectly segregated waste. The separation of waste was not done effectively. No health center had a standard incinerator. Infectious waste does not receive sufficient attention and is

incorrectly segregated. Appropriate infectious wastes management was not done effectively. As a result, infectious wastes are still generated below the standard procedure of infectious waste management. There are many problems that planners and decision makers should overcome to achieve sustainable development.

Moreover, health officers require additional knowledge on infectious waste management. Furthermore, there is a need to gather more information on the present practices and impacts of infectious waste management at health centers.

6.2 Recommendation

The study recommends that infectious waste management of health centers requires training on infectious waste management, support for the budget for an incinerator for one province. Control of the local authority on infectious waste management, promotion among health officers at health centers on interventions to decrease waste, support of local dumping areas in communities, provision of a few incinerators in each province and promotion at health centers on interventions to decrease waste. Policy at the national level must strengthen prevention of dumping waste from other countries, decentralization to Local Administration, provision of garbage covers and training on infectious waste management for the local administration.

In conclusion, this study makes 5 recommendations.

1. Infectious waste management should be properly implemented by health centers, hospitals and the Local Administration Organization and sent off site for disposal. Although the amount of infectious waste at each health center is small, the estimated total amount of all health centers in the country cannot be ignored. A national management plan should assign responsibility to municipality clusters to provide incinerators.

2. For disposal of the waste from each health center to treatment, facilities adequate infrastructure should be provided.

3. The health officers need to be properly trained on infectious waste management and environmental pollution.

4. A manual should be prepared for infectious waste management at health centers.

5. Formulation of objectives and planning for the achievement of objectives is important for improving infectious waste management at national, regional and local levels.

Recommendation for further studies

1. Further studies should focus on developing a national guideline on infectious waste management at the level of health centers using participatory rural appraisal.

2. Further studies should include study sites representing every region in order to conduct national survey on infectious waste management and environment pollution in Thailand.

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APPENDIX

APPENDIX A

Interview Questionnaire

Infectious waste management of health centers in Muang District, Kanchanaburi Province.

Instructions: there are 4 parts

Part 1 General data of research subject

Part 2 Knowledge of infectious waste management

Part 3 Infectious waste management of Health centers

Part 4 Problem and Obstacle in infectious waste management of health centers.

Part 1 General data of research subject

1 Health center (Name) ……

2 Location Sub district …… District Muang

3 Gender

1 Male 2 Female

4 How old are you?...../years

5 What is your education?

1. Lower than Bachelor degree ……

2. Bachelor degree……

3. Higher than Bachelor degree ……..

4. Other please specify……

6 What is your profession background?

Your position 1. Administrative Health Officer level……..

2. Technician Public Health level……..

3. Community Health Officer Level……..

4. Professional Nurse level……

5. Technical Nurse Level……

6. Dental Assistant level……..

7 How long you have been working in this health center? Months / years.

8 Domiciles

1 Kanchanaburi Province

2 Other please specify……

9 Number of patients ……. /day

10 How many health personnel have been working in this health center?

( ) Administrative Health Officer ….. Persons

( ) Technician Public Health ……. persons

( ) Community Health Officer … persons

( ) Professional Nurse … persons

( ) Technical Nurse … persons

( ) Dental Assistant level… persons

11 Do you have received any training on infectious waste management? If yes, please answer next questions.

( ) No (if "no" skip to question no.12)

( ) Yes

What type of training…….

Organization by…….

When ……

12 Do you have been training on "Management of environmental pollution"?

( ) No

( ) Yes

13 Do you have ever informed against to accuse on infectious waste management?

( ) No

( ) Yes

14 Do you have incinerator in your health center?

( ) No

( ) Yes Model……

15 How many kilograms of infectious waste do you have in your health center?

Kilograms/day

Part 2 Knowledge of infectious waste management of health centers

Please mark (/) in True answer and mark (x) in False answer

No.	Knowledge of infectious waste management	True	False
1	All of the waste of health centers is infectious waste.		
2	We should be used Red Bag for sorting infectious waste at health centers.		
3	We should be used container with puncture proof for keeping sharps infectious waste.		
4	We should be used black plastic bag for keeping miscellaneous infectious waste before being disposed.		
5	We should not be sorted to infectious waste before disposed.		
6	We should be done with the bag if it filled with 2/3 of infectious waste and seal tightly before transport.		
7	The benefit of separation infectious waste from normal waste is decrease the waste before being disposed in incinerator.		
8	The correct way to manage infectious waste is safety precaution and infection control.		
9	Infectious waste should be separated from regular waste and the storage must be promptly done at the source of waste.		
10	We should dispose used gauze cotton or gauze pad by the patient at regular waste.		
11	We should be done by correctly to infectious waste and regular waste and be separated later.		
12	Bags should be rupture –proof, chemical resistance and withstand excessive waste, no leakage and absorbent.		
13	The recycle infectious waste container should be cleaned by detergent and airing.		

No.	Knowledge of infectious waste management	True	False
14	We should not clean the recycle infectious waste container because it is not directly contacted infectious waste.		
15	The right procedure is to sort infectious waste at the origin.		
16	The danger of infectious waste can become the most hazardous to health.		
17	The health center sends the infectious waste to burn at the health center in the open.		
18	We should be used pincer or hand picked by wearing gloves when the infectious waste is scattering.		
19	We should lift up infectious waste from the storage and prevent risk of spillage.		
20	We need not to prevent risks of spillage because each bag was fastened with adhesive tape and of content.		
21	We should clean and disinfect in the collection-point or storage area at least once a week.		
22	The storage areas must prevent animal, insects from entering.		
23	We must wear the equipment to prevent personal harm such as apron, mouth-covered pad and solid rubber shoes at all time when moving and collecting infectious waste.		
24	We should not use “Infectious Wheel Cart” for other purpose.		
25	For sharps infectious waste such as, knives, needle and glass fragment, the container should be made of solid materials, puncture-proof and resistance to chemical corrosion such as, metal with firm cover to prevent the leaking of inside liquid and convenience to move without touching the infectious waste and must be disposed of in a Red Bag.		
26	The Wheel Cart should be made of a material which was easily cleaned.		

No.	Knowledge of infectious waste management	True	False
27	We should clean the wheel cart and working tool every time after use.		
28	We can use the wheel cart for other activities.		
29	Incinerator could be appropriate used for infectious waste.		
30	Effect of infectious waste toward health that could arise from infection to environmental and community.		

Part 3 Infectious waste management of Health centers

1. How do you separate infectious waste from regular waste at health centers?

( ) separate ( ) by ( ) Black bag ( ) Red bag

( ) Not separate

( ) Other please specify……

2. What kind of container should be used to dispose absorbent cotton, gauze pad, and bandage after each use?

( ) Container for infectious waste

( ) Container for general waste

( ) Plastic basket

( ) Other please specify……

3. How do you manage sharps objects such as knives, hypodemic needle?

( ) Put in the infectious waste bag

( ) Put in the box or container with puncture proof

( ) Put in the general waste bag

( ) Other please specify……

4. How should we deal with infectious such as cotton pad, cotton gauze when accidentally on the floor?

( ) Hand picked and put in infectious waste bag

( ) Pick up with pincer or hand picked by wearing gloves and put in infectious waste bag.

( ) Using pincer or hand picked by wearing gloves and put in regular waste bag.

( ) Other please specify……

5. How do you pre-treat the infection on sharps objects?

( ) Chemical

( ) Steaming

( ) No pre-treat

( ) Other please specify……

6. How do you transport or dispose infectious waste?

( ) Daily

( ) Every other day

( ) Once a week

( ) Other please specify……

7. What kind of safety protection equipment should be used during the waste collection for own safety precaution, at all time?

( ) Rubber gloves

( ) Thick rubber gloves

( ) Hand picked

( ) Other please specify……

8. How do you manage after infectious waste collection before doing other activities?

( ) Wash hand every time

( ) Wash hand once daily

( ) Occasionally wash hands

( ) Other please specify……

9. What should be done with the bag if it filled with 2/3 of infectious waste?

( ) Change new bag

( ) Add more waste in

( ) Change new bag and seal tightly before transport

( ) Other please specify……

10. How do you manage infectious waste at health canter?

( ) Daily burnt in the incinerator

( ) Daily burnt in the open

( ) Transport to municipal or district for disposal

( ) Other please specify……

11. How do you manage the liquid infectious such as, blood and pus?

( ) Put in infectious waste bag

( ) Put in regular bag

( ) Put in Plastic bag and tightly seal

( ) Other please specify……

Part 4 Problem, obstacle and recommendation for infectious waste management of health centers.

1. Do you have received the equipment for infectious waste management and sufficient or not? If insufficient, please check the items there below.

( ) Sufficient

( ) Insufficient such as

( ) Red bag

( ) Thick rubber Glove

( ) Mouth-covered pad

( ) Solid rubber shoes

( ) Apron

( ) Pincer

2. What are the problems for infectious waste management in your health center.

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3. What would you like Ministry of Public Health to support the effectiveness infectious waste management in your health center?

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4. Recommendations

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Observation Questionnaire
Infectious waste management of health centers
in Muang District, Kanchanaburi Province.

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Health center …… **Sub district** .....**District** Muang

1.General conditions of health centers

General characteristic of the health center

……

Environment……

……

2 Observation of infectious waste management of the health personnel.

( ) separation (Use standard procedure)

( ) separation (Not use standard procedure)

If health centers do not use standard procedure for infectious waste, what else?

( ) Regular waste

( ) Infectious waste

( ) Do not separate.

3. Infectious waste collection

- Type of Plastic Bag

( ) Black plastic bag

( ) Orange or red bag for infectious waste.

( ) Other please specify

- Container

Type of Regular waste ( ) Stainless ( ) Plastic ( ) Basket

( ) Cover ( ) Non- cover …… (Number of items)

Type of Infectious waste ( ) Stainless ( ) Plastic ( ) Basket

( ) Cover ( ) Non- cover …….. (Number of items)

4. Pre-treatment

( ) practiced pre-treatment by ( ) Chemical ( ) Streaming

( ) Other

( ) Non practiced pre-treatment

5. Collection method of infectious waste (leaking of inside liquid, not separate waste)……

……

6 Collection method of infectious waste

Tied the bag opening

( ) Yes

( ) No

Volume of infectious packed in infectious waste bag

( ) 2/3 of infectious waste bag

( ) 2/3 of infectious waste bag

( ) Volume uncertain, please specify……

Transportation

( ) Safe carry

( ) Good practice……

( ) Equipment

( ) Use ( ) Thick rubber Glove ( ) Apron

( ) Mouth-covered pad ( ) Solid rubber shoes

( ) No use

7. What do you do if the infectious waste drops on the floor?

( ) Yes

( ) No

Please specify…….

8. Method of infectious waste disposal at health center.

( ) Yes ( ) Burn in incinerator ( ) Burn in open

( ) Send to district and municipal

( ) No.....

8. Available of incinerator

( ) Yes ( ) work ( ) not work model

( ) No……

9. Infectious waste disposal

……

……

10. Operate Infectious waste management

……

……

11. Problems/ Obstacles for infectious waste management

( ) Segregation……..

( ) Transportation …….

( ) Collection …….

( ) Disposal……..

12. Recommendation and supporting from Ministry of Public Health ข้อเสนอแนะ

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APPENDIX B

Table 17 Number and Percentage of Knowledge of infectious waste management of health centers

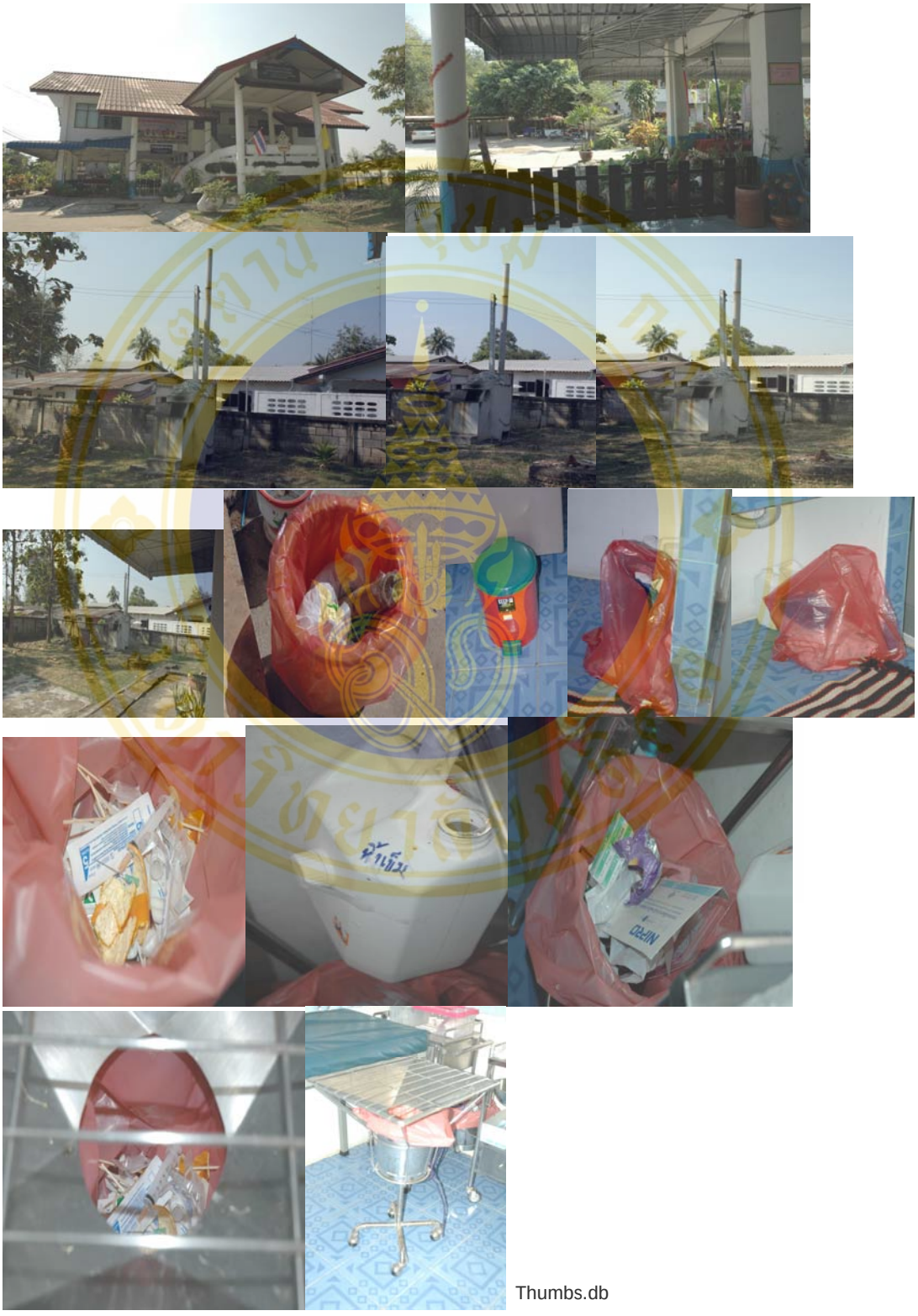
	Questions	Correct	
		Number (N)	Percent (%)
1	All of the waste of health centers is infectious waste.	16	72.73
2	We should be used Red Bag for sorting infectious waste at health centers.	22	100
3	We should be used container with puncture proof for keeping sharps infectious waste.	12	54.55
4	We should be used black plastic bag for keeping miscellaneous infectious waste before being disposed.	18	81.82
5	We should not be sorted to infectious waste before disposed.	21	95.45
6	We should be done with the bag if it filled with 2/3 of infectious waste and seal tightly before transport.	17	77.27
7	The benefit of separation infectious waste from normal waste is decrease the waste before being disposed in incinerator.	12	54.55
8	The correct way to manage infectious waste is safety precaution and infection control.	22	100
9	Infectious waste should be separated from regular waste and the storage must be promptly done at the source of waste.	19	86.36
10	We should dispose used gauze cotton or gauze pad by the patient at regular waste.	22	100
11	We should be done by correctly to infectious waste and regular waste and be separated later.	18	81.82
12	Bags should be rupture –proof, chemical resistance and withstand excessive waste, no leakage and absorbent.	21	95.45
13	The recycle infectious waste container should be cleaned by detergent and airing.	13	59.09
14	We should not clean the recycle infectious waste container because it is not directly contacted infectious waste.	21	95.45
15	The right procedure is to sort infectious waste at the origin.	22	100

	Questions	Correct	
		Number (N)	Percent (%)
16	The danger of infectious waste can become the most hazardous to health.	22	100
17	The health center sends the infectious waste to burn at the health center in the open.	16	72.73
18	We should be used pincer or hand picked by wearing gloves when the infectious waste is scattering.	22	100
19	We should lift up infectious waste from the storage and prevent risk of spillage.	22	100
20	We need not to prevent risks of spillage because each bag was fastened with adhesive tape and of content.	18	81.82
21	We should clean and disinfect in the collection-point or storage area at least once a week.	8	36.36
22	The storage areas must prevent animal, insects from entering.	21	95.45
23	We must wear the equipment to prevent personal harm such as apron, mouth-covered pad and solid rubber shoes at all time when moving and collecting infectious waste.	22	100
24	We should not use “Infectious Wheel Cart” for other purpose.	19	86.36
25	For sharps infectious waste such as, knives, needle and glass fragment, the container should be made of solid materials, puncture-proof and resistance to chemical corrosion such as, metal with firm cover to prevent the leaking of inside liquid and convenience to move without touching the infectious waste and must be disposed of in a Red Bag.	14	63.64
26	The Wheel Cart should be made of a material which was easily cleaned.	15	68.18
27	We should clean the wheel cart and working tool every time after use.	20	90.91
28	We can use the wheel cart for other activities.	20	90.91
29	Incinerator could be appropriate used for infectious waste.	17	77.27
30	Effect of infectious waste toward health that could arise from infection to environmental and community.	21	95.45

Table 18 Number and Percentage of Research Subjects per questions regarding management toward Infectious Waste Management

Question	Appropriate Management		Inappropriate Management	
	No.	%	No.	%
1. How do you separate infectious waste from regular waste at health centers?	21	95.45	1	4.55
2. What kind of container should be used to dispose absorbent cotton, gauze pad, and bandage after each use?	22	100	0	0
3. How do you manage sharps objects such as knives, hypodermic needle?	22	100	0	0
4. How should we deal with infectious such as cotton pad, cotton gauze when accidentally on the floor?	18	81.82	4	18.18
5. How do you pre-treat the infection on sharps objects?	5	22.73	17	77.27
6. How do you transport or dispose infectious waste?	11	50	11	50
7. What kind of safety protection equipment should be used during the waste collection for own safety precaution, at all time?	15	68.18	7	31.82
8. How do you manage after infectious waste collection before doing other activities?	18	81.82	4	18.18
9. What should be done with the bag if it filled with 2/3 of infectious waste?	9	40.91	13	59.09
10. How do you manage infectious waste at health canter?	15	68.18	7	31.82
11. How do you manage the liquid infectious such as, blood and pus?	3	13.64	19	86.36

Health Center 1



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Health Center 2

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Health Center 8

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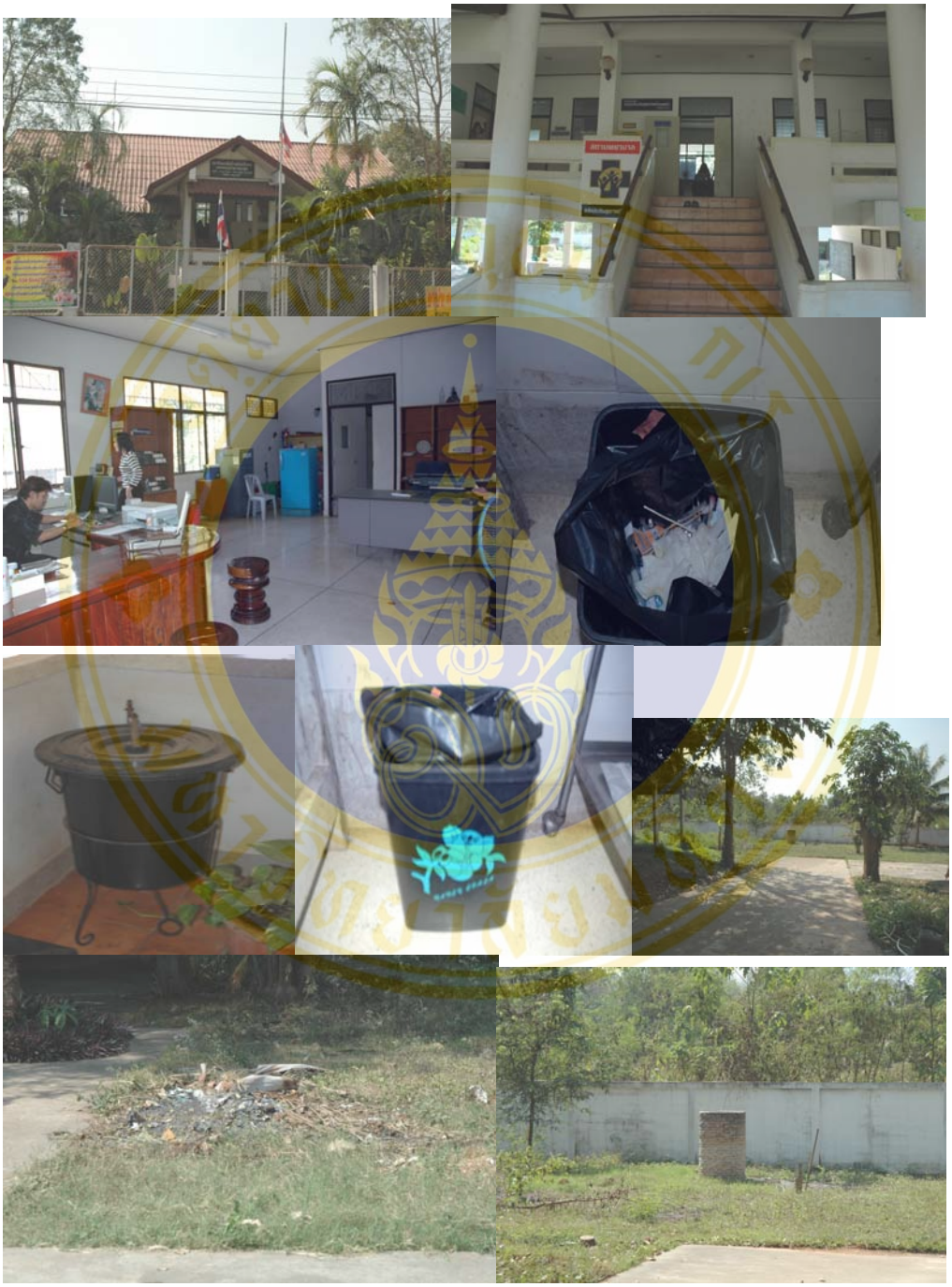
Health Center 14



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Health Center 15

Health Center 16

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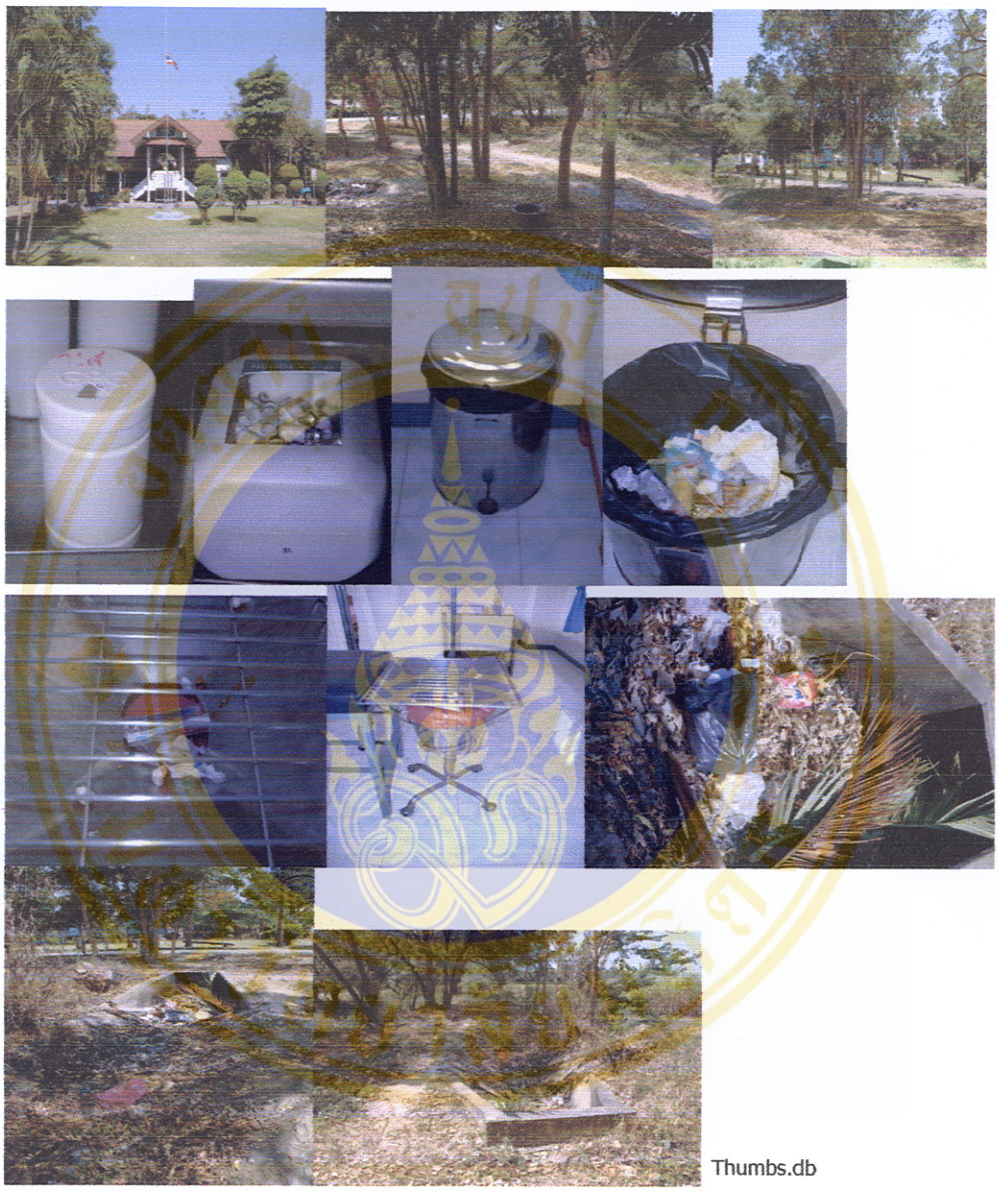
Health Center 17



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Health Center 18

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Health Center 19

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Health Center 20

Health Center 21

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Health Center 22

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BIOGRAPHY

NAME	Plernpis Kanchanabul
DATE OF BIRTH	August 15th, 1955
PLACE OF BIRTH	Bangkok, Thailand
INSTITUTION ATTENDED	Mahidol University, Thailand Faculty of Nursing, Bachelor of Nurse, 1981-1984 Mahidol University, Thailand ASEAN Institute for Health Development Master of Primary Health Care Management, 2007-2008
PRESENT POSITION	Public health Technician Section of Health Research and Development Bureau of Health Service System Development Department of Health Service Support Ministry of Public Health, Thailand