

# Medical Waste Treatment And Management In Vietnamese Hospitals: Case Study In Thu Duc District Hospital 2015

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**ABSTRACT-** Nowadays, besides the economic development, public health and health activities are concerned. In Vietnam, the number of hospitals and treatment requirements are increasing. Since 1997, the legal texts of hospital waste management are issued. Hospital operation is discharging a large amount of waste types, when not managed and handled efficiently, causing serious environmental pollution, effects on the patients, people living around the hospital. Thu Duc District Hospital is one of the major hospitals, in particular of Thu Duc District, in general of Ho Chi Minh City. The number of patient visiting for healthcare is increasing to 2,466 times/date. However, environmental management in the hospital has many drawbacks. This study assessed the hospital's medical waste management status quo (solid, liquid and gas emissions). Results showed that: the coordination in waste management between the functional departments and among employees is not unified; staff's awareness is not prescribed; the arrangement of medical garbages, hazardous waste, handling systems are not scientific and hygiene; the loss of solid medical waste is difficult to control (1,470 kg solid medical waste/day); passive in handling medical waste by no private incinerator but for centralized processing city. The study proposed solutions included: infection control, hospital sanitation; management measures: the law, policies and measures for planning, building management systems and measures for classifying, collecting, transporting, storing waste, environmental economic measures; technical measures: waste water treatment systems, solid waste, hazardous waste and emissions.

**Keywords:** management, medical waste, status quo, Thu Duc district hospital, treatment.

## 1. INTRODUCTION

### Medical Waste

According to The Waste Management Regulations of Health issued with Decision No 2575/1999/QĐ-BYT dated 08/27/1999 of the Health Minister of Vietnam: medical waste is the waste generated in medical institutions, from health care activities, care, testing, prevention, research and training. Medical wastes may be in solid, liquid and gas. Hazardous medical waste contains: blood, body fluids, excretions; parts or organs of humans, animals, needles and other sharp instruments; pharmaceutical chemicals and radioactive substances for medical use. If the waste is not treated, it will cause harm to the environment and human health. So medical waste management should comply with regulations related to hazardous waste management.

In addition to medical waste, hospital waste generation was normal. This is waste not classified as hazardous waste, no cytotoxicity, no storage, special handling; the waste arising from the living area, office in the hospital: paper, plastic, food, bottles, waste water, waste water canteen, etc.

### 1.2 Thu Duc District Hospital

Thu Duc Hospital is located at 29, Phu Chau, Tam Phu, Thu Duc District, Ho Chi Minh City, Vietnam.

History is from Thu Duc District Health Center, was founded in 1997. After many changes, Thu Duc District Hospital was officially born on July 28/6/2007 [1].

After 8 years of establishment, Thu Duc District Hospital, in People's Committee of Ho Chi Minh City first ranked by the standards of the Ministry of Health by Decision No.5563/QD-Committee November 12, 2014 of the MPC rated hospital in Thu Duc Thu Duc District People 's Committee. Thu Duc Hospital Hospital Districts is the first district Hospital in Viet nam having first ranked [1].

## **2. Study methods**

Methodology to assess the situation and propose solutions to waste management contributes hospital environment protection: study the correlation between the elements' concept, composition, causes and effects of waste disease library, understanding, awareness of hospital waste of personnel, in direct contact with hospital waste, from which to draw conclusions and propose effective management solutions.

Methodology overview document from data on hospital, inherit the information was available from the results of scientific research at home and abroad, through the thematic reports of the authorities and from the related sites are listed in the reference section.

Field survey methods, data collection and formal interviews: officers, employees, student interns, patients and patients' relatives through the questionnaire on the status of waste management in hospital.

Synthetic Methodology: based on aggregate data and information collected and compared with the standards and regulations for environmental management of the Vietnam Ministry of Health, Ministry of Natural Resources and Environment. On that basis, drawing conclusions about the current situation, assessing the impact of hospital waste to the environment, proposals, selection of measures to reduce pollution levels.

Assessment Method Comparison: to come up with the most effective measures.

## **3. Results and discussion**

### **3.1 Medical Waste Classification**

In addition to be sorted by Decision of the Viet Nam Minister of Health No.43/2007/QD-BYT November 30, 2007 promulgating the regulation on management of medical waste, divided in categories: infectious waste, hazardous chemical waste, radioactive waste, the pneumatic cylinder pressure, normal waste.

This paper sorting waste at a more detailed level in three types of waste water, waste gas and solid waste, as in Table 1 below:

Table 1. Classification of hospital waste

Type of waste	Arising Source
Waste water	Medical Waste water The clinic, operating rooms, laboratories, testing, pasteurization room medical devices with high heat, a detergent, rinse the floor. This waste water contains bacteria, pathogens, blood, chemicals, solvents in pharmaceutical [2].
	Domestic wastewater Toilet, kitchen, washing, washing machine or operate the systems, machines, toilets, septic tanks, hand wash of workers and hospital staff, dormitory, farmers diseases, medical visits, visits to clinic [2].
	Stormwater runoff Being slightly polluted waters, established as clean compared to other waste water, but can be contaminated by pollutants in nature.
Emissions	Dust, traffic emissions Ambulances, motorcycle, truck freight. Dust, dirt entrainment process at hospital staff, patients, etc.
	Vapours Isoflurane (anesthesia), acetone, phenol, odor and organic solvents (alcohol, ether) to evaporate, etc.
	Exhaust gas generator The pollutants from burning fuels affecting air quality surrounding environment.
	Emissions, odor waste incinerator The type of medical waste furnace, hazardous wastes are generated from emissions, cause negative impacts to the surrounding environment.
	Medical Exhaust fumes, aerosols sewage system The odorous gas NH <sub>3</sub> , H <sub>2</sub> S, etc (gas flow in an insufficient Aerotank, large water retention time causes anaerobic decomposition, etc).
	Exhaust fumes, odors surroundings Garbage storage area, restroom areas, emissions from the cook at the kitchen area, laundry activities
	Roughly Emissions The gases from air conditioning, electronic gases, smell from corpses, gas deodorizing machines
Radiation From X-ray rooms, CT Scanner, etc.	

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Solid waste	Domestic trash	The wards (except the isolation ward), from the medical professional activities as the plastic material, the fracture type cast in secret ... no blood and fluid biological and chemical risks hazardous waste generated from administrative work, paper, newspapers and documents, packing materials, cartons, plastic bags, film bags, external waste: leaves, garbage from the suburbs the scene in the hospital, microbial sludge from wastewater treatment systems, waste gas from the medical waste furnace [3].
	Medical trash	From active treatment, care, testing, prevention, research, training containing: blood, body fluids, secretions, body parts, needles and other sharp instruments, pharmaceuticals, chemicals, and radioactive materials used in medical ... [3]

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### **3.2 Current situation and status quo of waste management, treatment assessment in the hospital**

#### *3.2.1 Structure of the administrative waste management*

Nowadays, management structure arrays in hospital environments as Administration Department of Management and Infection Control room, the person responsible for supervision, signed the contract for transport of waste treatment is Chief Executive the Administration; who is responsible for reporting to the Department of Environment as Vice Division infection control, not knowledgeable experts in the environmental field.

The management of hospital waste subject to regulation by the Ministry of Health, there is no particular rules of the hospital.

#### *3.2.2 Sanitation situation of hospital*

The quality of the control environment, the Thu Duc hospital has good management practices:

- Planting trees shade the hospital campus.
- The room was adequate supply of electricity, water, sanitary gloves, brooms, buckets, antibacterial solution, etc
- There are enough garbage cans with lids, to the hallway and in the departments.
- Ceilings, walls, sills, door linings tiles, smooth materials dry, waterproof: disinfection of floors, toilets disinfected with sodium hypochlorite and effective solution dedicated Surfanios Anios, periodicals twice daily.
- Disinfection of air in the chamber and treatment with ultraviolet machine. Medical equipment, linens, blankets, etc are sterile cleaning regulations.

- The means of transport such as wheelchairs, chairs, etc were cleaned every day by chemical sterilization.
- Hospital laundry organize separate focus but member hospital clothes, clothes patient linens, clothing fabrics infectious ward.
- There are rules of hygiene clinical order, guiding patients and conducted the visiting room.

However, along the corridor still littering condition, in the area of hazardous garbage, wastes, office equipment were also indiscriminate disposal, not neat unsanitary.

### *3.2.3 Waste management test, monitoring and direction*

The hospital was quick to disseminate knowledge, process classified waste collection to all health workers in hospitals, organizing training on hygiene, infection prevention and occupational safety for officers entire hospital staff periodically 2 times/year.

However, the issue of managing the amount of waste generated in these departments are not recognized in each department but recorded at the brothel before the Urban Environment Company to collect. These data protection by storing, previous statistics, new periodicals transferred to the Administrative Administrative room storage and handling.

### *3.2.4 Safety of waste management ensurement*

- Fully equipped rubber gloves, face masks, antiseptic soap for employees. All working employees must abided by the regulations, if not to review an example, stricter sanctions prevent relapse later.
- Types of used rags, used in disease prevention, only used once.
- When out in the faculty to replace medical attire, discarding the equipment was used before leaving the work area and after they were contaminated.
- For the equipment and personal protective Used in the correct position prescribed disposal as trash, items stored for washing, disinfection and reused or destroyed.
- Wear the appropriate gloves when in contact with the waste is capable of various infections. If gloves are torn, peeling, perforation or contamination must be immediately replaced by another one completely intact.
- For other types of gloves can be used many times, it can be disinfected before reuse.

### 3.2.5 Hospital waste management

#### 3.2.5.1 Solid waste

Process management in hospital solid waste has sequential phases: separation of waste at source, keeping in departments, collection and transport of the hospital's general store and the treatment final stage.

The number of bins for the garbage out at the hospital equipped with three types: small, medium, large. Each department equipped with 6 medium trash, in the aisles, in the hospital campus about 70 trash sized, 6 barrels with two orange external medical garbage and blue contained in municipal waste. Therefore, the total number of bins offer 90 faculties and 90 medical trash bins medium activity.

Particularly sharps containers as per cancellation needles, hospital purchasing large quantities on a quarterly basis ie 3 months/time, containers are transported only in the store when the number of syringes filled. At home use 6 barrels containing 240 liters large.

According to this statistics in hospital infection control, solid waste amount between 2011 and the first 6 months of 2015, increasing trend in recent years, as shown in the table 2 below:

Table 2. Solid waste quantity of Thu Duc district hospital from 2011 to 6 months of 2015

Years	Domestic solid waste quaty (ton/year)	Medical waste quantity (ton/year)
2011	318.485	134.453
2012	294.595	102.394
2013	302.827	123.485
2014	348.161	110.558

*Source: Thu Duc district hospital, 2015.*

At the hospital the average amount of solid waste per day is about 1,470 kg, including medical waste of 408 kg accounted for 27.75%, the rest is municipal waste, data from Jan 1<sup>st</sup> 2015 to June 30<sup>th</sup> 2015.

Currently, the amount of waste generated in hospitals Managing Administration noted in the company kept the Urban Environment to transport the Binh Hung Hoa incinerator for disposal. Each time storehouses provide quality medical instruments to each department have signed confirmation, but the process used and discarded in each department has no specific recognition daily emissions. Therefore, the probable amount of the loss that hospital wastes could not be controlled.

- *Medical waste classification and collection at stationary sources*

Process medical waste classification has been elemented quite well:

- Each department is equipped with the nylon bag with color prescribed by the Viet Nam Ministry of Health: recyclables (white nylon), municipal waste (nylon blue), medical waste (yellow), junk risk harmful, swabs (black), sharps (needles destroying bottles).

- Each hospital trash is labeled as medical waste or domestic garbage, with foot pedal and always cleaned regularly.

- The bag is also clearly outlines inscription no storing beyond this line at 2/3 bag and stuck with symbols of hazardous if the hazardous waste.

Responsible for collecting and transporting garbage to the brothel by the sanitary staff team undertook a day between 2-3 employees. Time to organize collection and transport are clearly defined as 2 times/day, around 6:30 am, afternoon about 1h. In case of too much garbage collectors will conduct contrary provisions hours.

However, the collection process has some drawbacks:

- Many employees are unaware collection high in bringing labor protection because they feel encumbered, dyspnea collection operations.

- Trolley junk still quite full quality, no lid closed during transport.

- *Medical waste transportation*

- Due to the limited area of the hospital, so the entrance transport of medical waste from the hospital departments with integrated parking areas, paths through patient care areas and function rooms.

- Daily garbage collection are shipped on time as prescribed

- Staff nurse responsible for collection and transportation of garbage.

- When complete in every trash garbage, staff nurses are focused on the pillar pocket and fixed positions in each department after adequate room will begin shipping.

- *Solid waste storing*

- There carriage trails from outside.

- There shielding roof and chiller, divided into 2 parts: the container containing domestic trash and medical solid waste.

- Arrangement of 01 chiller to maintain a low temperature in the whole area of medical garbage. There is a wall, floor waterproofing; instrumentation, chemical toilet.

- The area is still insufficient to meet current trash.

Waste storage time in the hospital up to 24 hours, then will be taken and processed. However, public sector landfills to integrate as parking, no separate shielding fence, near the center and functional areas, where travel and convalescence of the patient; located near the tailgate garage company Urban Environment easily transportable, each day at 6 am.

### 3.2.5.2 *Waste water*

Sewer inspected regularly, regular maintenance 2 months/time, to avoid flooding, odors, leaks.

Wastewater generated current estimate is 270 m<sup>3</sup>/day, including waste water and domestic healthcare. Domestic wastewater has two categories: primary water distribution in the toilets, will be collected and put on the pedestal septic tank, medical waste from health care activities, water rinsing X-ray film, wastewater washing and hygiene and disease prevention; water after treatment is discharged common drainage system with water from the sink to wash, wash the floor and led to treatment station. Both types of waste water and health are separate pipeline system.

All waste water is transported along the tube put on the wastewater treatment system of the hospital after treatment to meet Level B Standard, will be discharged into the sewerage system of the region.

### 3.2.5.3 Emissions

Because the hospital is not builded solid waste incinerators and sewage system, virtually no rise in hospital pollutant emissions, mainly just waste gas, dust in the garage due to traffic flow in hospital.

### 3.2.6 Waste treatment Status quo

#### 3.2.6.1 Solid waste

The highly infectious garbage always handled the early stages before disposal into bins and garbage bags:

- Hazardous medical wastes, contaminated Asoka is sterile and packed nylon laminated, clear labeling
- The chemical, pharmaceutical overdue return corresponding pharmaceutical companies.
- Pressure cylinder used hospital with very low numbers, about 1-2 times/year, also return the unit to purchase.

The hospital is currently processing contract with the company and Urban Environment City by mass processing.

Solid waste is collected and processed by the establishment of Ward Democratic Organization garbage.

Currently the hospital has stopped running medical waste incinerators by no funding, all medical waste is transported to Binh Hung Hoa for treatment. Almost of the hospitals in Ho Chi Minh City are now applying the process model of hospital groups solid waste treatment. Binh Hung Hoa incinerator is HOVAL GG42 capacity 7 ton/day of Belgium [4], as in Fig 1.

Incinerator use principle thermal pyrolysis effect. Incinerator 2 suites: Burners for gasification chamber, the second chamber combustion chamber gases generated from scratch. This is a static furnace, continuous operation, divided into 3 phases: loading garbage (8 hours), burning (8 hours), cooling (8 hours) [4].

Currently incinerators are in overload due to increased medical waste from hospitals is increasing. Therefore, if continued processing model for hospital groups, the City needed more investment incinerator operators to reduce overcrowding.

The model is as follows:

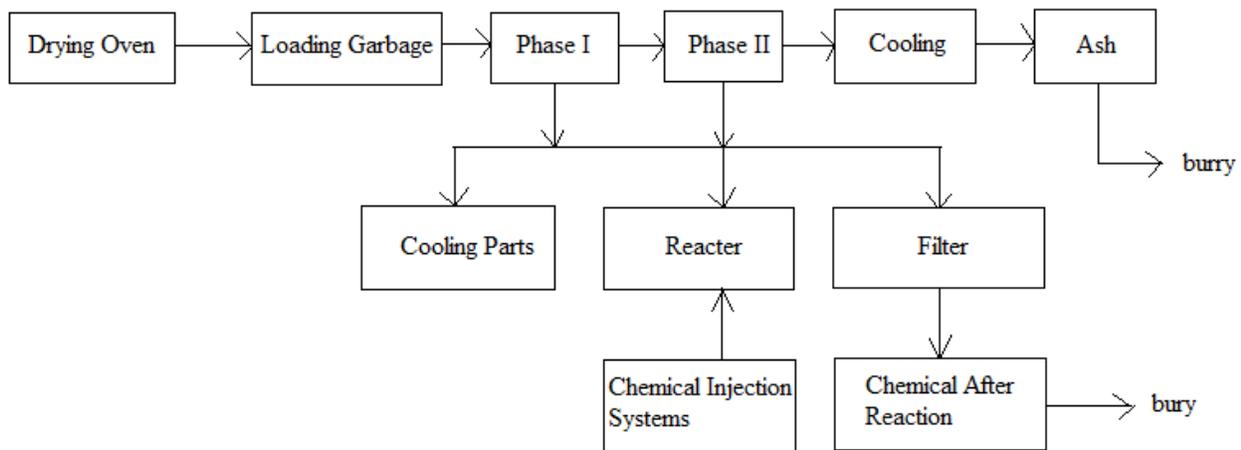


Fig 1. Diagram HOVALGG42 incinerator operation [5]

#### 3.2.6.2 Waste water

Thu Duc District Hospital currently operates open sewage system: an old system biofilter technology 70 m<sup>3</sup>/day; Wastewater treatment systems New technology testing AAO operates from early 2015, the capacity of 300 m<sup>3</sup>/day 80% efficiency, output of waste water complies with national wastewater standards class B. The system is located far from medical care and function rooms.

The old system of wastewater into the street guide Tam Chau, the new system leads to Phu Chau Street.

#### 4. Conclusion

Environmental quality controlment in Thu Duc District hospital has management measures but in some areas the inspection and supervision have not been closely interested. Therefore, these are solutions the hospital should element:

- Scrupulously comply with some laws, standards and national regulations: Decree No.59/2007/ND-CP on management of solid waste; Decree No.25/2013/ND-CP on environmental protection for waste water; Decision No.155/1999/QD-TTg dated 16/07/1999 of the Prime Minister promulgating the Regulation on management of hazardous waste; Joint Circular No.2237/1999/TTLT BKHCNMT-BYT dated 12/28/1999 guiding the implementation of radiation safety in healthcare; Decision No.3733/2002/QD-BYT-Standard occupational health-Ministry of Health; NTR 05:2013/BTNMT\_National technical standards for environmental quality ambient air; NTR 28:2010/BTNMT\_National technical standards for medical waste.

- Strengthening international cooperation with countries in the region and around the world. Positive scientific research, summarize and draw clinical experience, enlist the help of our partners, establish relationships for investment projects in

infrastructure, equipment and conservation hospital environment, prevent pollution and combat infectious and safety for healthcare workers.

- Promote cooperation and coordination between the head of management with the room, science; improving professional issues for the unit responsible for managing environmental issues for hospitals, strengthening the audit and strict handling of objects not abide by the rules of environmental protection, as in Fig 2.

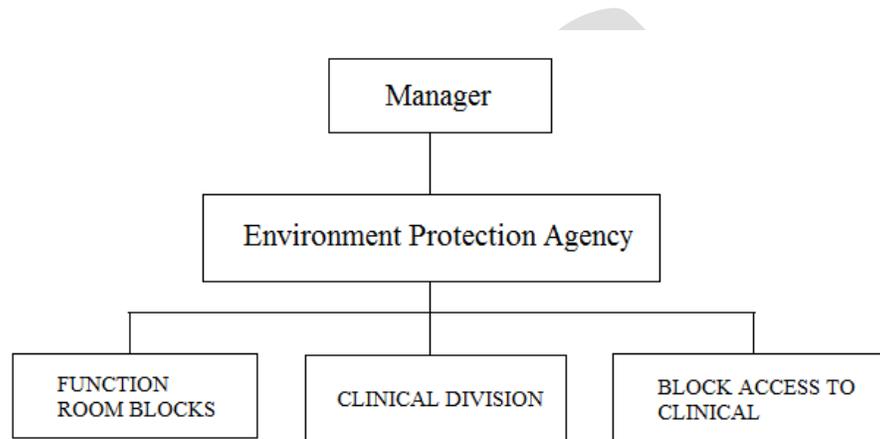


Fig 2. The administrative system for environmental management for Thu Duc District Hospital [6].

- Fix overlapping, vacant for some management areas, with reasonable assignment and close coordination between the departments in the organization of environmental protection activities.

The remedies exist in management, waste management of the hospital now:

- *Emission:*

- Organization of rational traffic management for the workers and employees, patients, family members or the transport vehicles and equipment materials for medical treatment.

- Regularly 2-3 guard duty promptly engaged traffic control during peak hours to avoid congestion in the hospital.

- Limit the time the engine vehicle in the hospital campus to avoid generation emissions, noise.

- *Wastewater*

- Regularly clean, because hospitals are concreted almost completely stagnant water should be avoided in the hospital campus.

- Implement the environmental monitoring program to monitor and evaluate the effectiveness of treatment promptly detect incidents.

- Strict management of the impact from the waste water to the area two function rooms, examination, treatment and convalescence.

- *Solid Waste*

- It should be clear statistical input and output numbers in the departments, and prevent leakage of waste is difficult to control.

- The garbage needs shielding fence, do not take advantage of the parking lot, located close to the wastewater treatment system, to organize well drained, avoid accumulation stench long days, often spraying all kinds mosquito repellent in appropriate dosage to prevent odors from being developed [7].

- Staff collected and transported to the complete protective equipment, compliance with regulations on the collection, transport medical solid waste.

- Strict management of the impact of pollution from the storage of hazardous waste, office waste too close to the area by functional departments and clinical areas.

- Strengthen waste reduction at source, recycling, reuse, select the product supply materials can be recycled safely.

- Due to insufficient funding hospital and under the guidelines of the process model medical solid waste current City and Binh Hung Hoa incinerators still operating well should medical solid waste hospital treatment can maintain this way.

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