2010

The Development of a model program for the effective management of biomedical waste in the Caribbean. A Review of barriers within public hospitals in the Caribbean.

Andrea Spence

Thesis:

The Development of a Model Program for the Effective Management of Biomedical Waste in the Caribbean. A Review of Barriers within Public Hospitals in the Caribbean.

Andrea Spence
May 06th, 2000

Department of Civil Engineering Technology
Environment Health and Safety

Rochester Institute of Technology
Rochester, NY.

Thesis submitted in partial fulfillment of the requirements of the degree Master of Science in Environment Health & Safety Management

Approved By:

_____ _____
Jennifer Schneider, Sc.D., CIH (Thesis Advisor) Date

_____ _____
Joseph Rosenbeck, Professor (Committee Member) Date

Table of Contents

Works Cited

List of Tables

List of Figures

Acknowledgement

The author would like to acknowledge and thank the following individuals for their support and contribution: Dr Jennifer Schneider, Sc.D., CIH Thesis Advisor, Joseph Resenbeck; Graduate EHS Management Program Chair, Amy Sickles, Administrative Staff in the Department of Civil Engineering Technology, Environmental Management and Safety, Rochester Institute of Technology-Rochester, New York, Hershel Grant-Ismail; Director of Operations & Maintenance Southern Regional Health Authority, Jamaica, Claudette Walters-Simpson; Nurse Administrator, Jamalco, Jamaica, Cynthia Griffith; Teacher, Trinidad & Tobago; Sharmila Maharaj, EHS Consultant, Trinidad & Tobago, Paulette Williams Teacher/Journalist; St. Vincent & the Grenadines

Shauna Newell; Nurse, Jamalco Medical Department Jamaica

Theresa Hyman, Nurse, Jamalco Medical Department Jamaica

Medical Staff at Point Fortin Medical Centre, Trinidad & Tobago

Special thanks to Coleen Phillips, Latoya Palmer, Chavanie Farquharson, Elaine Lawl and Lindley Jarrett for their daily support, prayer and encouragement throughout this project. Lastly, my love and thanks to my mother; Myrtle Spence.

Acronyms

CARICOM	Caribbean Community
CEHI	Caribbean Environmental Health Institute
EPA	Environment Protection Agency
EHS	Environment Health and Safety
HIV	Human Immunodeficiency Virus
HCV	Hepatitis C Virus
HCB	Hepatitis B Virus
NEPA	National Environment and Planning Agency
NRCA	Natural Resources Conservation Authority
OECS	Organization of Eastern Caribbean States
OSHA	Occupational Safety and Health Administration
PAHO	Pan American Health Organization
PPE	Personal Protective Equipment
USA	United States of America

CHAPTER 1.0: INTRODUCTION

1.1 Overview

Biomedical waste refers to waste from hospitals, healthcare centers (clinics), homes and medical research laboratories that pose a hazard and risks to health and the environment. Due to increasing demands for healthcare services the quantity of bio-medical waste generated has increased over the past 10 years. The USA Medical Waste Tracking Act 1988, defines medical waste as "any solid waste that is generated in the diagnosis, treatment, or immunization of human beings or animals, in research pertaining thereto, or in the production or testing of biologicals." This definition includes, but is not limited to:

- blood-soaked bandages
- culture dishes and other glassware
- discarded surgical gloves
- discarded surgical instruments
- discarded needles used to give shots or draw blood (e.g., medical sharps)
- cultures, stocks, swabs used to inoculate cultures
- removed body organs (e.g., tonsils, appendices, limbs)
- discarded lancets

The components of biomedical waste are medical waste and include but are not limited to the above listing and as following.

- Used sharps

- Body parts
- Body fluids and materials saturated with body fluids
- Blood and blood contaminated materials
- Specimens
- Laboratory cultures

When biomedical waste is improperly managed it places healthcare workers, sanitation workers and the general public at risk for contracting infectious/dangerous diseases. Biomedical waste is also generated from individuals in their homes from the use of syringes or diagnostic lancets that are not properly managed. Discarded sharps pose a health risk to the public particularly solid waste workers who may suffer a needle stick injury if they are not properly packaged for disposal. Needle stick injuries can require very expensive testing and treatment and can increase the risk of exposure to infectious blood borne diseases such as Hepatitis and HIV from contaminated needles.

There is presently a lack of quantitative data on the number of health risks cases resulting from inadequate management of biomedical waste, however qualitative reports have shown that there is a significant risks due to lack of proper EHS management system. Similarly the costs associated with treatment of persons (healthcare workers, public) infected and treated for injuries associated handling, storage and disposal of biomedical waste is unknown.

Within the Caribbean region there is increasing concern by environmental health agencies and international health organization in the increasing cases of HIV infections. This infection can be contracted through direct contact with infected person body fluids, and biomedical waste/infectious waste. Biomedical waste handling, storage and disposal practices throughout the Caribbean are considered inadequate in preventing the spreading of infectious diseases, preventing occupational injuries and illnesses and other health risk and environmental pollution. In general, biomedical waste management within the Caribbean region is below internationally accepted EHS standards. There are reported incidents of waste stream mixing and hence originally characterized municipal solid waste being is being contaminated with biomedical waste; making the biomedical waste impact more significant. There are reported cases of uncontrolled health hazards and exposures to infection at municipal waste landfills where landfill "workers" who sort through solid waste as part of a formal and informal waste recycles process within the Caribbean. ***(Sources: The Gleaner Newspaper "Inside the City of Riverton" Jamaica, April05, 2009. The Guardian Newspaper Trinidad, February 2009).*** Neither of these landfill workers or hospital staff is provided with training in health and environmental hazards and risks that is associated with biomedical waste being handled.

In the Caribbean the development and implementation of policies, laws and regulations for ensuring safe and environmentally sound management of biomedical waste is in its infancy stage. The potential health risk such as spreading of contagious diseases and environmental pollution of ground and surface water bodies and toxic air pollutants emissions are identified as some of the major concerns with management of

biomedical waste. The majority of the biomedical waste generators are government owned public hospitals and healthcare centers (clinics).

Primary healthcare in the public hospitals is provided at no and/or very minimal cost within the Caribbean region. One of the main disadvantages to this business operating strategy is the lack of financial resources to provide necessary materials, supplies, personnel and training for effective biomedical waste management. There is sometime chronic shortage of needed supplies and materials to properly handle, collect, store and dispose of hospital waste in a safe and environmentally friendly manner.

The disposal of biomedical waste is done mainly through the use of municipal solid waste landfills while incineration is common practice used to treat and reduce biomedical waste volume.(Sources: Paper on Managing Hospital Waste in Jamaica dated May 2004 by Jamaica Environment Trust, Environment Management Authority Case Study on a National Inventory For Hazardous Waste Generation in Trinidad and Tobago, August 2005- March 2006, OECS Biomedical Waste Management in the Caribbean, EIA on Medical Waste Treatment November 2007, Kingston Jamaica) Neither of the two waste treatment and disposal practices are done effectively and in a manner to ensure public safety and environmental protection. (Sources: as listed above) The Caribbean region has many regional institutions that assesses and provide overview strategic leadership on common issues affecting the region. One such agency is the Environmental Health Institute, located in the island of St. Lucia. This institute in recent years has recognized the major concern for biomedical waste disposal and has launched many

workshops and seminars geared towards improving the awareness level of generators in the potential health hazards and risk. (www.CaribbeanEnvironment Health Institute).

1.2 Problem Statement

Bio-medical waste is one of the major environmental health concerns for the Caribbean. A great majority of the Caribbean islands does not have regulations and policies governing the management of biomedical. The lack of financial resources to provide required human resources, materials and supplies for effective management of biomedical waste is a critical factor and challenge for most Caribbean islands. The present practices of managing biomedical waste are potentially hazardous and pose high risk to healthcare service workers and hospital sanitation workers, the general public, solid waste handlers and the environment. The Caribbean as a region is known for its high incidents of AIDS and HIV infection rate and hence requires a greater urgency to ensure effective management of biomedical waste to contain the spreading of contagious disease.

1.3 Project Focus

The focus of this project is the compare case studies on the management of biomedical waste within the Caribbean region public hospitals and how the process of controlling and preventing infections is managed. The content of the project include biomedical waste regulations, healthcare sector health and safety regulations, policies and standard, waste handling, storage, collection and disposal, infection prevention and control and training/education from three Caribbean islands public hospitals.

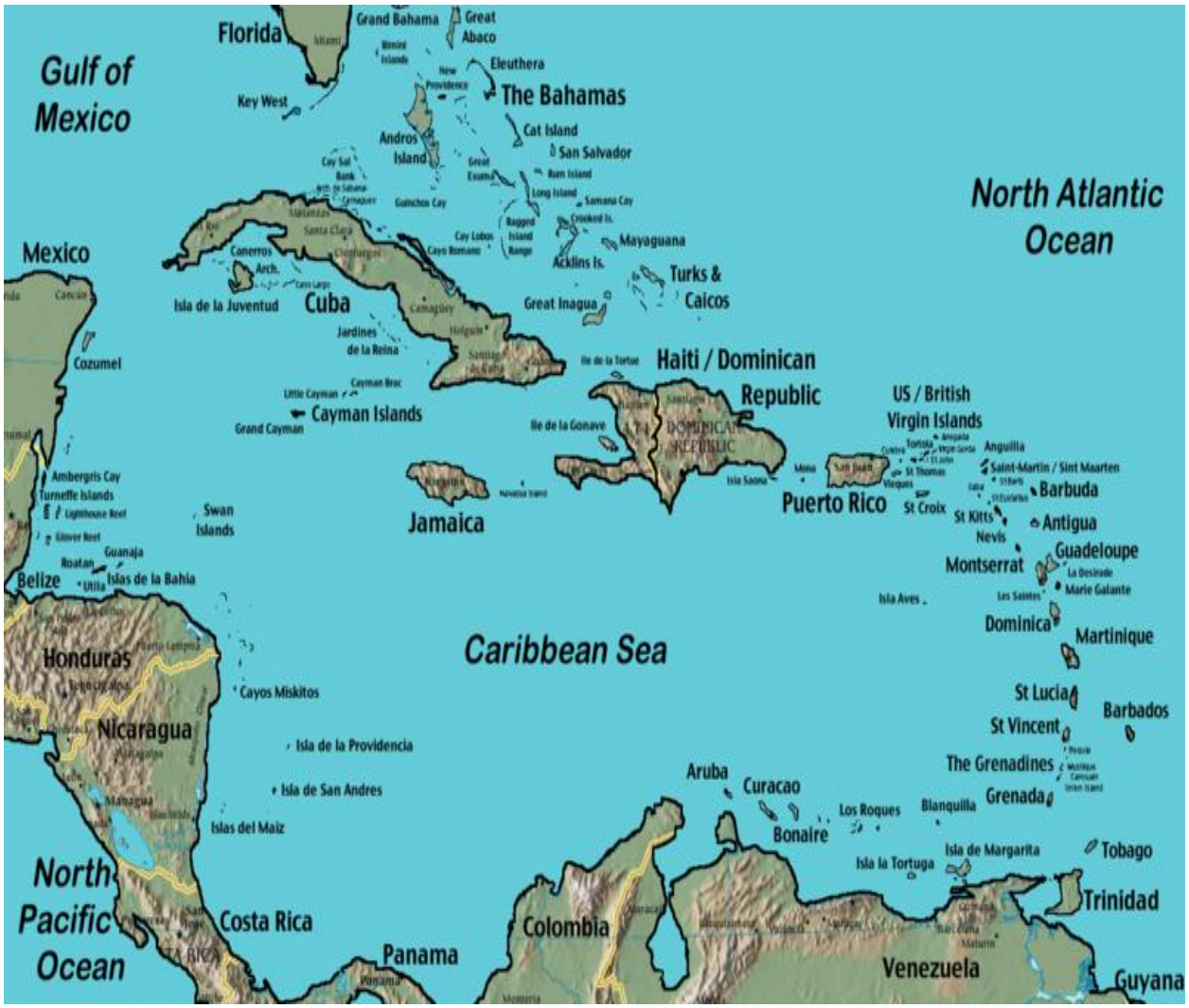
The selected islands will be based on location within the region to ensure representation of the western, central/eastern and southern areas of the region.

Table1. Case Study Population

COUNTRY	**SIZE**	**POPULATION**	**Public Healthcare Services Facilities**
Jamaica	4,244 sq miles	2.673,800 (2006)	22 hospitals 331 health centres
St. Vincent & Grenadines	130 sq miles	118,000 (2008)	2 hospitals 30 health centres
Republic of Trinidad and Tobago	1,864 sq miles. and 116 sq miles	1,303,188 (2007)	8 hospitals 107 health centres

Source: BUREAU OF WESTERN HEMISPHERE AFFAIRS, USA.

Figure1. Map of the Caribbean.



Source: www.Caribbean Islands.

CHAPTER 2.0 BACKGROUND

2.1 Description

Biomedical waste is generated from the healthcare industry to include hospitals, health centers, laboratories, and private homes. There is a lack of formal systems for the measurement and tracking of the quantity of biomedical waste generated on an ongoing basis. Special projects conducted have attempted to give a brief summary of the types and quantity of biomedical waste generated in the Caribbean region. (Sources: Managing Hospital Waste in Jamaica, May 2004, Environmental Trust, Case Study on Inventory of Hazardous Waste in Trinidad & Tobago, October 2005 to March 2006, Biomedical Waste Management in the Eastern Caribbean, December 2007, Caribbean Environmental Health Institute Workshop on Biomedical Waste Management in the Caribbean March 2008, and Guardian Newspaper March 12, 2009, Trinidad & Tobago). A new and potentially increasing waste stream for biomedical waste is used sharps from home usage. An increasing number of Caribbean residences are administering self treatment for diabetes, which requires the use of needles. This waste is then discarded and final disposal is at municipal solid waste landfills.

The majority of biomedical waste generated in the Caribbean is treated by incineration and final disposal of ash in municipal solid waste landfills. The greater percentage of these incinerators used by public hospitals for the treatment of biomedical waste is old (greater than 20 years old) and lack controls to prevent release of toxic air emissions such as dioxins. The incinerators are generally located onsite at the hospitals

and are operated contrary to design specification and also poorly maintained; therefore contributing to low efficiencies and a major environmental pollution source. The practices associated with the collection, storage and final disposal of biomedical waste is such that there is significant potential health risk and environmental hazard. Unsafe handling of biomedical waste can result in healthcare workers exposed to health risk associated with infections and diseases. Other possible exposed groups are; sanitation workers, waste handlers and landfill site workers and residence who sort through municipal solid waste at the landfill for useful salvages. Not only is the hazardous incinerator ash a potential health risk but also the disposal of biomedical waste without treatment at these landfills. The practice of residence and landfill workers sorting through waste piles and children playing in nearby surface water streams is very common in the some Caribbean islands. Reports from public newspaper in Jamaica and Trinidad and a special research on biomedical waste in St. Vincent and the Grenadines have reported occurrences of these practices. (Sources: Managing Hospital Waste in Jamaica, May 2004, Environmental Trust, Case Study on Inventory of Hazardous Waste in Trinidad & Tobago, October 2005 to March 2006, Biomedical Waste Management in the Eastern Caribbean, December 2007, Caribbean Environmental Health Institute Workshop on Biomedical Waste Management in the Caribbean March 2008, and Guardian Newspaper March 12, 2009, Trinidad & Tobago).

The risks and impacts associated with weaknesses in biomedical waste management are difficult to measure. There is inadequate data on number of persons injured or contacted illness, and the costs for treatment and compensation that is directly related to poor management of biomedical waste with public hospitals in the Caribbean.

2.2 Biomedical Waste Regulatory Framework

Biomedical waste regulations within the Caribbean region are in its development and early implementation stage amongst most islands and non existence in others. (Sources: Case Study on Inventory of Hazardous Waste in Trinidad & Tobago, October 2005 to March 2006, Biomedical Waste Management in the Eastern Caribbean, December 2007, Caribbean Environmental Health Institute Workshop on Biomedical Waste Management in the Caribbean March 2008, and EIA for South Eastern Regional Health Authority Medical Waste Facility). In Jamaica and St. Vincent and the Grenadines there are no regulations governing the generation, collection, storage, treatment and disposal of biomedical waste. (Sources: Biomedical Waste Management in the Eastern Caribbean- December 2007, EIA for South Eastern Regional Health Authority Medical Waste Facility). In Trinidad and Tobago there is a draft 2008 Hazardous Waste Regulations, which include requirements for waste generated at hospitals and healthcare centers.

All three Caribbean islands (ST. Vincent and The Grenadines, Jamaica and Trinidad and Tobago) have in place public health regulations however these does not provide for effective management of potential health hazards and risks within the healthcare industry. Training for healthcare industry staff and other affected persons is inadequate with little or no training done for these exposed groups. The solid waste regulations and laws do not provide requirements for mandatory training for waste handlers. (Sources: www.Ministry of Health/Trinidad & Tobago; www.MOH.gov.jm; www.MinistryofHealth/St. Vincent.)

2.3 Financial resources for public hospitals

Public primary healthcare facilities are operated on limited government budgets (operating and capital). Service fees and charges range from no cost to minimal cost to users of these facilities (Ministry of Health and Ministry of Finance websites in each country). A common challenge faced by most Caribbean islands is limited government funds to fully sustain and improve the quality of public healthcare services and facilities. This has contributed to poor management of hospital waste and health risk to healthcare workers, waste handlers and the public in general.

2.4 Definitions

Approved Biomedical Waste Containers: containers used in healthcare facilities for the collection and storage of biomedical waste. The container carries a biohazard warning label.

Biomedical waste: Solid, and liquid or liquid wastes, including their containers and any intermediate products, which are generated during the diagnosis, treatment or immunization of human being or animals, in research pertaining thereto, or in the production or testing of biological and the animal waste from slaughter houses or any other similar establishment. All biomedical waste is classified as hazardous waste hazardous.

BMW – Biomedical Waste

Caribbean Community (CARICOM): organization of 15 Caribbean nations and dependencies, with the main purpose to promote economic integration and corporation amongst its members.

CEHI - Caribbean Environmental Health Institute

Blood – human blood, human blood component, and products made from human blood

Hazardous Waste - is a waste that poses substantial or potential threat or public health and the environment, (wikidepia.org).

Hepatitis B – A serious disease caused by a virus that attacks the liver. The virus, which is called hepatitis B virus (HBV) can cause lifelong infection, cirrhosis (scarring of the liver), liver cancer, liver failure and death.

Hepatitis C – A liver disease caused by the hepatitis C virus (HCV), which is found in the blood of persons who have the disease. HCV is spread by contact with the blood of an infected person.

HIV – Human Immunodeficiency Virus

Infectious waste - Infectious wastes (also called biomedical waste) include human waste, animal waste and objects and materials contaminated with blood and body fluids containing disease-causing micro-organisms or viruses, (www.ccohs.ca).

Lancets – Medical devices used to test blood sugar level

Medical Waste - Medical waste is all waste materials generated at health care facilities, such as hospitals, clinics, physician's offices, dental practices, blood banks, and veterinary hospitals/clinics, as well as medical research facilities and laboratories, (Source: USA EPA regulations).

Municipal Waste – is predominantly household (domestic waste) waste often added with commercial waste and collected by municipality within a given area. They are either solid or semi solid and generally exclude industrial hazardous waste, ((wikidepia.org).

OECS - Organization of Eastern Caribbean States: An inter-governmental organization dedicated to the harmonization integration, protection of human and legal rights, and the encouragement of good governance between countries and dependencies in the eastern Caribbean.

PAHO – Pan American Health Organization.

Regular Waste: waste other than potentially infectious waste that is generated from routine daily activities. Locally this is referred to as garbage. Examples are paper, cuttings from trees, etc.

Sharps –syringes and needles

CHAPTER 3.0 LITERATURE REVIEW

3.1 History of Biomedical Waste Management

Biomedical waste is classified as a special solid/medical waste with unique characteristics and is a potential hazard to human health and the environment. The challenges associated with proper management of biomedical waste have been a worldwide concern due to its significant risk to the safety and health of healthcare workers, waste handlers and sanitation workers. Countries such as India, Pakistan and the Caribbean region have completed case studies and assessments of biomedical waste in the past five years. (Sources: EnviroNews Article entitle Hospital Waste An Environmental Hazard and its Management by Hem Chandra, July 1991 India, Pollution Prevention in the Health Sector, Fact Sheet Canadian Centre for Pollution Prevention; www.c2p2on;ile.com; Hospital Waste Management, PARN; Pakistan, March 2007, www.healtcarewasre.org) With the increasing incidents of HIV and AIDS across the world and specifically Africa and the Caribbean, biomedical waste management has become a main focus worldwide.

Biomedical waste is a small percentage of the total waste generated by hospitals. However this waste stream has the greatest health risk to workers and the general public. In recent years there is increasing demand for more healthcare facilities (nursing/retirement homes, hospitals), the used injections at home, and medical research, the generation of biomedical waste has increased significantly. Biomedical waste is not only being generated at designated healthcare facilities such as hospitals but also within private homes, schools, and workplace, nursing homes and children homes.

Wastes generated in these smaller facilities including homes are not managed according to regulations to which hospitals are held for compliance.

For developed nations of the world, biomedical waste management is at an advanced stage regarding technology, management systems, regulations, education and training. Local, regional and international governments have implemented laws and regulations geared towards the effective and efficient management of biomedical waste. The healthcare industries in these nations are generally operated under strict licenses and code of practices, along with environment health and safety regulations. The world health organization also have charters and codes to which these nations are signatory. (Source: www.worldhealthorganization.com,www.useepa.com;www.europeanhealthstandards.com) Notwithstanding there exist within these nations continued challenges to improve biomedical waste management practices to lower health risk associated with the management of biomedical waste in the entire industry. This includes ensuring that all small healthcare facilities, home treatments practices and schools are in compliance with laws, codes and regulations. It involves the prevention of biomedical waste mixed with municipal solid waste and the disposal of biomedical waste at unauthorized landfills. There are specific health and safety standards and regulations for the healthcare industry to prevent and control of injuries and illnesses.

For developing nation's biomedical waste management have significant challenges ranging from lack of and inadequate laws and regulations, weak healthcare industry operating codes and practices, inadequate financial resources, lower education of citizens and a general lower level of environmental health and safety awareness.

Countries such as India, Pakistan (Hospital Waste and Environmental Hazard and Its Management, Hem Chandra), China, Africa and the Caribbean have had and continue to have major challenges in the biomedical waste management. (Sources: EnviroNews Article entitle Hospital Waste An Environmental Hazard and its Management by Hem Chandra, July 1991 India, Pollution Prevention in the Health Sector, Fact Sheet Canadian Centre for Pollution Prevention; www.c2p2on;ile.com; Hospital Waste Management, PARN; Pakistan, March 2007, www.healtcarewasre.org). The Caribbean region is especially experiencing significant challenges due to its potentially high risk in public health associated with a general solid waste management issue, occupational health and safety regulations and infrastructure development. Availability of funds for capital investment is identified as a potential challenge to having good management practices for biomedical waste in developing countries.

3.1.1 Caribbean Challenges

Biomedical waste management is a concern for Caribbean islands, due to its potential health risk and the dependency of most islands on a strong tourism industry. This major concern is based upon the potential hazard to public health and environmental pollution. Biomedical waste is known to pose high risk to the spreading of infections, injury and environmental pollution due to inappropriate and poor waste management practices. This type of solid waste was recognized by the Caribbean Environmental Health Institute (CEHI) as significant issue for Caribbean healthcare industry and governments to address.

In 2008, the CEHI facilitated a workshop for directors and managers of healthcare facilities to review existing practices and potential risk associated with biomedical waste. With the incident rate of HIV and AIDS high in the Caribbean region, the time has come for a greater focus on this infectious waste.

In 2007, a research on the practices of biomedical waste within the eastern Caribbean islands revealed that biomedical waste management practices is far below acceptable standards with very high potential for spreading infections, (Dr. Martin Foote, Pan American Health and Education Foundation).

Poor infrastructural development and the lack of technology and regulations within the public primary healthcare sector coupled with insufficient financial resources are the main barriers/challenges faced within the Caribbean islands biomedical waste management program.

3.1.2 Biomedical Waste Generation (sources)

There are many commonalities amongst hospitals in islands of the Caribbean and yet many differences. The management of biomedical waste is one area where there exist many challenges and opportunities for improvements for the Caribbean islands. Biomedical waste generation within the islands is generally from hospitals (public and private). There are also private sector companies that have their own medical facilities which also generate biomedical waste. Examples are the petroleum /oil industry, mineral manufacturing, mining and chemical industries.

In some Caribbean islands there also exists nursing homes and an increasing number of sick at home generating biomedical waste. The tourism industry is one of the largest foreign exchange earners for Caribbean islands. There are many thousands of hotels, apartments, villas and guest houses that also have their onsite medical stations. How well these facilities managed biomedical waste is an area for investigation as the industry has expanded in recent years.

Based on infrastructural development, population and industrialization, the generation and management of biomedical waste at public hospitals on each island vary. Historically, the management of biomedical waste is limited to the main generators, the hospitals, with little or no focuses on schools, homes, hotels and private companies. Biomedical waste was generally treated as municipal solid waste in some Caribbean islands while in others, it's burned. A reported significant challenge with biomedical waste management in the Caribbean was due to lack of segregation of biomedical waste and other municipal waste. This would result in biomedical waste sent to landfills and managed in backyard garbage disposal. (Source: Hospital Waste Management in Jamaica, May 2004, EIA for Medical Waste Treatment Facility, November 2007 Jamaica; Biomedical Waste Management in Eastern Caribbean, December 2007, Case Study on Hazardous Waste Inventory in Trinidad and Tobago, October 2005 to March 2006).

According to a Pan American Health Organization study (Dr. M. Foote- December 2007) on biomedical waste management within the eastern Caribbean, standards, policies and disposal practices associated with biomedical waste is lacking.

A recent newspaper reported that in Trinidad the improper disposal of medical waste such as syringes, body parts, theatre tubing's, soiled linen, medical coveralls, and mattresses had been loaded onto a truck and improperly dumped at a Solid Waste Management Company Limited (SWMCOL) landfill. (Source: Guardian Newspaper March 12, 2009) Medical waste is of particular concern since it raises issues of infectious diseases, poisoning and physical injury. Hospital instruments such as needles and scalpels can cause injury and spread diseases. There are also risks associated with the improper disposal of blood and body parts and pharmaceuticals. In some instances, radioactive waste is also involved, (The Guardian Trinidad Newspaper March 19, 2009).

In Jamaica a study by the Ministry of Health (by CL Environmental, September 2007) into biomedical waste management in the Southeast region of the island (region with the greatest number of hospitals), revealed that improper disposal of biomedical waste is a major risk to healthcare workers health and also landfill workers where biomedical waste are also sent when mixed with municipal solid waste.

Due to the close proximity of these islands to each other and the interdependence of its people, potential health risk associated with biomedical waste is the concern of the entire Caribbean. Biomedical waste poses health risk in its potential for spreading infections. Healthcare workers are especially at risk to disease such as HIV, Hepatitis and AIDS. Healthcare workers are continually exposed to infections from biomedical waste due to poor and unsafe handling and storage practices. As the Caribbean region continues to struggle with its increasing HIV/AIDS incident rate, the effective management of biomedical waste is mandatory.

This thesis will focus on the management of biomedical waste for three case studies in public hospitals within the Caribbean, looking specifically at challenges associated with its effective management within three islands, and proposing a model program for improvements. The ultimate goal is that the risk level to health will be significantly reduced and environmental pollution also eliminated/ reduced to a minimum level. The selected public hospitals are: five in Jamaica, one in St. Vincent and Grenadines and two in Trinidad and Tobago. The selection is based on their geographical location within the Caribbean, population/size and social development. Comparisons will be made on the biomedical waste management systems and practices in public hospitals on each island and a general conclusion and proposed improvement model for the Caribbean.

3.2 Review of Laws, Regulations and standards

In order to do a comprehensive review of biomedical waste management challenges, a review of applicable environmental health and safety laws and regulations is required. Hospitals are managed under license from the Ministry of Health and must assure certification of professional healthcare staff. Each independent island has its elected government consisting of a Prime Minister and the cabinet who are charged with responsibilities for laws and regulations and compliance. Biomedical waste regulations are normally included in solid waste management regulations. In general biomedical waste regulations and rules similar to that existing in the USA do not exist within the Caribbean. The USA Environmental Protection Agency –EPA, Resource Conservation and Recovery Act and the Occupational Safety and Health Administration- OSHA, have associated regulations regarding environmental pollution prevention and workers safety

and health. These three principal environment health and safety regulations along with the Public Health Regulations have provided effective framework for the management of biomedical waste.

In Jamaica the Ministry of Health and the Environment through the National Environmental and Planning Agency (NEPA) is responsible for the effective management of the country's natural resources and pollution prevention. The Natural Resources Conservation Authority Act was passed into law in 1999 and with it a permit and licenses system. This system requires initially all new development and operations to obtain an environmental permit and was discharge licenses as applicable. This includes hospitals and similar healthcare facilities, all primary healthcare facilities in Jamaica were in operation prior to the NRCA regulations, permit and licenses system. Solid waste is regulated by four (4) main regulation and acts. The Public Health Act does not mandates specific requirements for collection and disposal of garbage, The Anti- Litter Act which prohibits disposal of garbage in public spaces and the Natural Resources Conservation Authority Hazardous waste regulations 2002. This hazardous waste regulation is very limited and specific to the movement of hazardous waste across the country or the export of the same. There is also the NRCA Air Quality Regulations 2006 which sets out air pollutant limits for certain air pollutants, specifically the criteria air pollutants. There is no law or regulations for the management of biomedical waste in Jamaica

In St. Vincent and the Grenadines there is a Solid Waste Management Act (2000) and attendant Regulations (2006), which govern the management of waste in general.

There is no biomedical waste management specific legislation and regulations. There is no effort currently under way to develop these.

In Trinidad and Tobago the government has enforced environmental pollution restrictions through the Environmental Management Act 2000 and the 2008 draft waste management rules. The draft waste management rules has listed within it clinical and hospital waste defined as hazardous waste. It mandates specific requirements for permits and license of waste generators, handlers and transporters. The waste rules does not specifically address waste handling, storage and disposal practices, labeling requirements and training. These waste management rules are new and not yet enforced by the government.

3.3 Review of Biomedical Waste Generation and Disposal Methods in Three Selected Caribbean Islands

There are twenty two (22) public and eight (8) private hospitals and approximately 300 health clinics generating biomedical waste in Jamaica. Biomedical waste management practices within all hospitals and health clinics are managed in similar manner and the common waste disposal method is incineration/burning and landfill in sanitary landfills. (Source: www.moh.org.jm). According to a study by CL Environmental on behalf of the Ministry of Health, approximately 83% of all biomedical waste generated in the Southeastern region of Jamaica is by the public sector and 17% by private sector. At least 26 of the total 29 biomedical waste incinerators at these hospitals are over 20 years old and are performing far below standard requirements. Biomedical waste practices are such that there is contamination of this waste with other waste

generated and this waste is disposed of as regular municipal waste at landfills. The operations of these landfills pose very high risk to public health and environmental pollution. Biomedical waste incinerators being used within the healthcare are not meeting the required air emission limits and hence a source of serious health effects to nearby communities.

In St. Vincent and the Grenadines the research by Dr. Martin Foote (Case studies on biomedical waste management in eastern Caribbean December 2007) revealed that there were no written guidelines with respect to segregation, collection, storage, and disposal of health care waste. Since 2001/2002, red bags have been used for biomedical waste and compliance is reported to be high (90-95%). Biomedical waste audits are not done regularly; the last one was conducted only as a result of a complaint being made. Both general and biomedical waste streams are effectively co-mingled and would be considered to be hazardous. There is an on-site incinerator that has not been used due to smoke emission problems since the second quarter of 2006. Workers with the job title of 'Grounds' men are the designated personnel assigned to collect and remove waste.

In Trinidad and Tobago biomedical waste is generated from private and public hospitals, clinics and laboratories. The predominant disposal method is landfill but in most cases treated by incineration before landfill. As with other Caribbean islands there have being very low compliance to existing environmental and occupational health regulations. Incinerators are generally not in compliance with regulatory emission limits and landfill is far below design and operating standards.

The Ministry of Health (MOH) within each Caribbean island provides operating standards and guidelines for the public healthcare sector. Specific management system for environmental health and safety management is lacking and the extend to which this is practiced is limited to individual regional health authorities in most counties.

3.4 Education, Training and Awareness

There is an apparent need for training of healthcare services professionals, maintenance workers, and landfill operators in order to lower the potential health risks associated with biomedical waste. There is also a greater need for a general public awareness of biomedical waste and its potential health hazard. Since the generation of biomedical waste now includes household solid waste streams and to control the spread of infections, home generated biomedical waste must be managed.

3.4 Healthcare Sector Structure and Functions:

In all three countries the Ministry of Health is responsible for the operations of all public hospitals, health centres and laboratories. In some Caribbean islands the operations of public healthcare facilities such as hospitals and health centres are managed under the umbrella of regional health authorities. These regional health authorities are managed directly by the respective Ministry of Health. There is also a division or department within the Ministry of Health that has specific responsibility for infection control and prevention. This division is managed by an Environmental Health Nurse or Officer in

most cases. The primary role of this division is to administer and manager the general immunization program and provide guidelines for a healthy and safe work environment. All public healthcare facilities provide primary and secondary healthcare services to the public at no costs or very minimal costs.

For the private healthcare services, there is a higher knowledge, awareness and standards for managing biomedical waste in these facilities. Improvements commonly noted include cleanliness, waste containers, and workers in required personal protective equipment. While there are no written government regulations, the private hospitals have developed operating guidelines and EHS policies and standards for the business. Healthcare services are provided at higher cost and hence will see persons who can afford this quality service.

CHAPTER 4.0: METHODOLOGY

4.1 Problem Restatement

The purpose of this project is to investigate and review the existing management practices of biomedical waste management at public hospitals within the Caribbean and its contribution to environmental health risks. The Caribbean region is known for its increasing high number of HIV/AIDS infections and seasons of potential risks for infectious disease. Biomedical waste is one source of spreading infection and contracting HIV. Most of the Caribbean islands have the basic infrastructures in place, a lack of sustaining industries and generally low knowledge and awareness to environmental health hazards and risks for the average citizen. The islands are popularly known for the natural beauty of land and sea and have a very strong tourism product and hence a great dependency on this industry. Policies are driven by the need for employment and development rather than environmentally friendly and safe developments. The healthcare industry is very critical to the health of the citizens of the region, but one that has not being given priority in the development and implementation of policies and regulations to ensure healthcare workers and public safety, health and environmental pollution prevention.

Effective management of biomedical waste can be an additional overhead cost that public hospitals does not have especially where healthcare services is provided at no and minimal cost. Where there is not a direct link to the hospital bottom line of operating within budget and providing quality, hospital CEOs, directors and Ministry of Health Minister's are reluctant to invest in environment health and safety initiatives.

There is lack of/poor documentation of any past assessment of the financial risks due to treatment of injuries, illnesses and liability cases within public hospitals.

4.2 Project Goal

The main goal of the project is to identify the main issues challenging effective management of biomedical waste at public hospitals within the Caribbean and propose a model to effect the necessary changes. The ultimate aim of this model is to significantly reduce the environmental health risk associated with biomedical waste disposal within the Caribbean. An initial assessment of environment health and safety risks and sustainability, quality and profitability of public healthcare services will be conducted.

4.3 Methodology Overview

The goal of the project was met through a detail investigation and review of biomedical waste management within three (3) Caribbean islands, and comparing the different systems, processes and practices in place. Information and data was collected from hospitals including the following:

- Distribution of questionnaires to key persons within the healthcare sector
- Conducting interviews by phone, in person and via emails
- Conducting an overview of the services provided by public healthcare sector
- Review of each country public health regulations and standards
- Review of each country medical waste regulations and standards

- Review of hospital and Ministry of Health EHS Policies
- Review of infection prevention and control programs in public hospitals
- Overview of hospital waste treatment and disposal methods
- Review of each country and hospital/ Ministry of Health Healthcare sector EHS management systems and programs
- Education and training
- EHS management costs.

4.4 Case Studies

A case study in three (3) Caribbean Islands through interviews, surveys and reviews. The selection of the hospitals is based on geographical location in each country, country size, population and development. Public hospitals from the following countries will be investigated;

1. Jamaica,
2. St.Vincent and the Grenadines and
3. The Republic of Trinidad and Tobago.

Biomedical waste is one of many waste streams from a hospital and one that may not be recognize as requiring special management, due to the lack of regulations and risks impacts. Interviews were aimed at upper level managers, directors, administrators and nurses. One potential factor in a weak environment health and safety management program at public facilities is inadequate funds and hence an attempt to understand EHS costs was undertaken through the survey questionnaire and interviews.

4.5 Expected Results

The case studies revealed useful informative data that was used in performing comparisons in management systems, regulations and EHS costs of the selected hospitals. Opportunities for improvements in all aspects of the hospital EHS management programs and systems were identified and recommendations made based on cost effectiveness and potential health risks. Areas for best practices and opportunities for improvements was highlighted and used in the formulation of a proposed model for effective management of biomedical waste. The proposed model also included best practices from developed nations with such the United States of America and Europe.

4.6 Research Limitations

The results of the project may be limited to general information obtained by other means other than actual visiting each hospital. Information and data gathered was done within a selected time, rather than over extended period. Also only three Caribbean islands were reviewed and assessed.

4.7 Questionnaire for Hospital Waste Management

Survey being conducted as part of a case study on Hospital Waste Management Practices within the Caribbean.

COUNTRY:

NAME of HOSPITAL:

SIZE:

JOB POSITION/TITLE:

DATE:

Please provide an answer to each question below.

1. Does the hospital keep a record of the waste generated? YES NO.
2. Are hospital wastes separated by using separated collection containers? YES NO.
3. Waste generated by hospital is treated or disposed of onsite at the hospital? YES NO.
4. How are sharps disposed of at hospital? _____.
5. Does the hospital have an onsite waste incinerator? YES NO.
6. Is there a designated person who has responsibility for management of hospital waste? YES NO.
7. Is biomedical waste separated from other wastes such as garbage? YES NO.
8. Does the hospital dispose of hospital waste at external landfill? YES NO.
9. Are hospital waste managed by hospital staff only? YES NO.
10. Does the hospital have an environmental policy? YES NO.

11. Does the hospital tracks its environmental costs? YES NO.

12. What is the monthly cost for operating the onsite waste incinerator?

    _____.

13. What is the cost associated with using offsite waste incinerator? _____.

14. What is the monthly cost associated with disposal of waste to offsite landfills.

    _____.

15. Are there any current issues with medical waste?_____..

CHAPTER 5.0: RESULTS (Case Studies)

5.1 Case Studies Background

Eight (8) written survey questionnaires were completed for separate public hospitals in three Caribbean islands (Jamaica, Trinidad & Tobago and St. Vincent & The Grenadines) during the period September 5th and October 23, 2009. Interviews were conducted by phone, in person and follow-up emails with hospital contacts and consultants.

The information provided from questionnaires, interviews, review of governmental laws and regulations, code of practices and literature review chapter provided the foundation of each case study.

Public health care service is provided free of cost to the public. There is a national health insurance policy and program that offers reduction on cost of prescription for specific chronic diseases/condition such as hypertension, diabetes and high cholesterol.

5.2 Jamaica Case Study Background (population of 2.6 million)

There are 23 public hospitals, 350 government health centres and numerous medical laboratories. All public hospitals and health centres are managed by regional health authorities, namely:

- South Eastern Regional Health Authority
- Southern Regional Health Authority

- Western Regional Health Authority
- North Eastern Regional Health Authority.

Table 2. Overview of Regional Health Authorities and Public Hospitals in Jamaica.

REGIONS	PUBLIC HOSPITALS	HEALTH CENTRES
Southern Regional Health Authority	5	94
Western Regional Health Authority	4	82
North Eastern Regional Health Authority	4	82
South Eastern Regional Health Authority	9	90

Each regional health authority is responsible for the operations of all public hospitals and health centres within the region. The Ministry of Health directly manages all regional health authorities. Private hospitals are licensed by the Ministry of Health and are primarily located in the South Eastern and Western regions.

There is a documented operating standard and guideline manual governing public hospitals and health centres. This manual has limited instructions and procedures for the management of biomedical/medical waste, personnel training and personal

protective equipment. There is also insufficient healthcare workers to effective deploy and manage this manual within the affected public hospitals.

Biomedical Waste Management Laws and Regulations:

There is no governmental regulation for the management of biomedical waste and health and safety regulations or standards for hospitals in Jamaica. There is a documented Ministry of Health standard/procedure manual on Infection Control and Management. This manual has a section that briefly describe how hospital waste is to be managed. This manual is used by the special division within each regional health authorities called the Infection Control Division. This division is responsible for monitoring work practices and the prevention of infections at public hospitals and health centres. The Ministry of Environment regulation (NRCA ACT 1991) requires waste generators to obtain an environmental permit and licenses for the management of hospital wastes. None of the hospitals surveyed has an environmental permit or license for management of hospital waste that is generated. All public hospitals in Jamaica were already in operation prior to this environmental regulation and enforcement for existing hospitals is not taking place.

The Ministry of Labour and Social Security has a draft Occupational Safety and Health Regulations for workplace; however this regulation does not specifically address hospitals and other healthcare facilities.

Environment Health and Safety Management System

There are written Ministry of Health environmental policy and mission statement that is used by each public hospital. There is a major focus of this policy and mission statement on quality of service and patient care, however no such statement on workplace safety and health for employees.

A formal environment health and safety management system for the public health sector does not exist. Within each regional health authorities the Human Resources department and the Maintenance Manager /Director share the environment health and safety responsible for the hospital. Issues related to training and workplace hazards are managed through the Human Resources and Legal departments. Workplace sanitation and waste management is managed by the Maintenance department.

There are many labour union groups and association that represent healthcare sector workers including nurses and medical doctors. The major groups representing the industry workers are, Medical Association of Jamaica, Nurses Association of Jamaica, The Junior Doctor Association and many other trade union groups. These unions and associated are responsible for representing workers rights for salary, benefits, working conditions and training, during labour agreement discussion with the government ministries (Finance, Social Security and Health).

Some maintenance services activities within the public healthcare sector are done through contracted services. There are no governmental requirements for safety and health management of contractor workforce in Jamaica.

Biomedical Waste Management

The management of biomedical waste within public hospitals is not properly documented. The Infection Control Division provides guidelines for collection and storage of hospital waste. Biomedical waste is collected on each hospital ward, patient care area, laboratories and theatres. Hospital waste containers are generally plastic and metal bins with lined red plastic bags. Waste is placed inside containers by hospital staff as it is generated. The collection bins are emptied daily by sanitation workers. Waste is transported to main storage area onsite. Hospital workers are provided with hand sanitizers.

A shortage of designated hospital waste collection bins results in hospital waste collected in other containers. Sharps are not always collected in sharp containers as these are often not available for use.

Biomedical waste generation within hospitals are not generally measured and tracked. All five surveys and interviews with hospital personnel revealed that biomedical waste management within hospitals across the country is similar. In all regions there are reported cases of improper segregation of biomedical waste from general garbage and other types of waste, resulting in the mixing of biomedical and other solid waste. This eventually leads to inappropriate disposal as some biomedical waste in landfills. The collection and removal of biomedical waste from generation points to temporary storage areas is done by maintenance support staff, Janitorial staff and maintenance support contractors. Waste collection is done on a daily basis and base on disposal option (onsite or offsite) waste is stored in designated area prior to disposal.

At two hospitals the temporary storage facility is not secured or protected from dogs and other stray animals. In all hospitals biomedical waste collection containers are generally colour coded (RED) for easy identification; however there are challenges with availability of required quantity of waste containers. As a result of inadequate biomedical waste containers, biomedical waste is stored in regular waste containers. Contaminated municipal waste is not strictly managed as biomedical waste. Regular waste contaminated by body fluids and human parts are generally not managed as biomedical waste.

Lack of adequate financial resources is severely affecting the operations and effectiveness of public hospitals and hence the management of health hazard and environmental risks.

Biomedical waste is incinerated either onsite or offsite. Not all public hospitals have a functional biomedical waste incinerator and hence the waste from those hospitals without an incinerator is transported to another hospital for incineration. This extended storage period, additional handling and transportation increase waste handlers to health hazard and risk associated with biomedical waste.

The main challenges associated with biomedical waste management in public hospitals are:

- lack of a formal standard for managing hospital waste
- inadequate financial resources, equipment, materials, supplies and personnel. Costs of service are very minimal and service is often used by

the lower income earning groups, that is poor and some middle class citizens.

- lack of training for hospital staff and waste handlers and
- there is a high number of healthcare workers and maintenance personnel that are contractors and there is a lack of EHS regulations for contract services and their workers within the public health sector.

There is no formal process in place for measuring and tracking of biomedical waste management costs. The costs associated with waste management are considered as apart of the hospital maintenance costs.

There is no formal training program in place for hospital staff in the safe handling and storage of biomedical waste. Health care professionals are aware of potential health hazard and risk associated with biomedical waste base on professional training, however other operational staff and maintenance support workers lacks this knowledge.

All hospital surveyed and from hospital personnel interviewed stated that there is no environment health and safety management system for public hospitals in Jamaica. Some of the hospital personnel interviewed is of the opinion that an environment health and safety system is necessary within hospitals as it will help in eliminating some of the current environmental and safety challenges. Roles and responsibilities for environment health and safety management within hospitals are shared between the Human Resources and Maintenance departments. Hospital personnel also believed that this must be a requirement from the government and enforced by the Ministry of Health or Ministry responsible for workers health and safety within the workplace.

Lesson Learned and Areas for Improvements:

1. Lack of a formal Ministry of Health standard and regulations for management of biomedical waste at generating facilities such as hospitals, clinics and laboratories
2. Lack structured environment health and safety system within public hospitals
3. Inadequate financial resources to support effective operations of public hospitals
4. Potential high health hazard risk exists amongst waste handlers due to lack of safety and health training
5. Source of environmental pollution due to improper disposal of biomedical waste at landfills
6. Inadequate management structure and system to manage biomedical waste at generating facilities
7. Potential environmental pollution due to improper waste incineration practices/ operations.
8. Costs associated with environment health and safety management is not tracked
9. Lack of assessment of potential and actual health risks and its impacts associated with poor management of biomedical waste and unsafe working conditions in public hospitals.
10. Lack of occupational health and safety regulations for the healthcare industry
11. Lower quality services and higher risks in public hospitals compared to the opposite in private hospitals.

Summary and Conclusion:

Jamaica public hospital waste management practices is below international standard and has potential health hazard and risks for infectious disease.

There is a significant lack of required hospital waste containers, personal protective equipment and training of staff in public hospitals. The present draft Occupational Safety and Health regulations do not address health and safety hazards and risk within the healthcare sector. The government standards and guidelines for hospital waste management are weak and need improvements and full deployment. The disposal of biomedical waste is a potential major source of environmental pollution. The lack of resources (financial, equipment, materials, supplies, personnel) is the main challenge to effectively managed biomedical waste within public hospitals. There is an inadequate government budget allocation and low to no cost inflow from fees and service charges within the public health sector. Lack of formal risks assessments and impact evaluation due to the lack of EHS standards and regulations within the public healthcare sector.

5.3 St Vincent and the Grenadines Case Study Background (population of 111,000 thousand)

One (1) written survey questionnaires was completed for the only public general hospital in St. Vincent (Kingstown General Hospital - 209 beds) over the period September 5th and October 23, 2009. There is two small hospitals is Grenadines namely; Bequita District Hospital and Mesopotamia District Hospital. There thirty eight (38) health centres in 9 districts, all providing primary health care services.

There an Environmental Health Officer at each district health centre with specific responsibilities for diseases prevention and control.

The government has a national health insurance program that provides access to health care services at very minimal costs.

Biomedical Waste Management Laws and Regulations:

There is a written standards and code of practice for the management of hospital waste within health care facilities in St. Vincent and the Grenadines. The Solid Waste Management Act (2000) and Regulations (2006) are in place however these do not address biomedical waste. There is no written workplace health and safety Act and regulations. There is no specific regulation, policy or standards for the management of biomedical waste within public hospitals. There are no written regional environmental policy and mission statements regarding quality of service and patient care, or environment safety and health.

The Ministry of Health owned and operated all healthcare facilities and sets standards and practices for the healthcare sector. The Ministry of Health through the Chief Medical Officer is responsible for the operations of private health care facilities. All medical doctors are accredited and registered to practice, while nurses are registered by the General Nursing Council. The Medical Association of St. Vincent and the Grenadines represent all professionals within the healthcare sector.

Biomedical Waste Management:

Base on survey report, there is a standard practice for the collection, storage and disposal of biomedical waste. Biomedical waste is collected in designated colour coded (red bags) containers labeled “Biomedical Waste” at and close to the waste generating point. Biomedical waste is removed from collection points to disposal areas, which varies from landfill, burial to open burning.

There is no government inspection of facility to ensure workplace safety and health standards and employees in public hospitals. Environmental Health Officers are included in the hospital sector to assist with performing primary health care services. These persons are not trained in biomedical waste management.

There is no documented environment health and safety management system in place at public hospitals. The current organizational structure shows responsibilities for environment health and safety management is with the Chief Medical Officer. There is no single point accountable person for environment health and safety management. Environment health and safety management is not an area of major concern due to the lack of regulations. Base on interviews with nurses and hospital workers there is a lack of knowledge of potential health hazard and risk associated with biomedical waste management.

Environment health and safety management in public health care facilities is limited to waste collection, storage and disposal of waste. Services for waste management collection and disposal is provided by the Central Water and Sewage Authority;

a government agency. Safety and health incidents are not documented and tracked and many such incidents are either not reported or never investigated and reports generated. Costs associated with legal issues such as lawsuits are not properly documented and a management system to reduce these costs by addressing root cause is not in place. There are infrequent incidents of community complaints against hospitals and specifically regarding hospital waste disposal. There is no system for tracking and reporting of expenses and costs associated with environment health and safety management at the hospital and health centres. All costs associated with environment health and safety management is considered with the hospital operating and maintenance costs as a hidden cost. Audits are not included in the current management system and is done base on incidents of complaints and allegations of negative impacts.

There is no standard policy or statement of training requirements for health care workers within the healthcare sector. Training for hospital staff is limited to professional course of study and on the job orientation provided through a Public Health Nurse at each healthcare facility. Local colleges and regional universities provide a broad overview of health and safety hazards and risks associated with healthcare professionals and within the healthcare sector. There is no formal human resources management system for tracking and monitoring employee training. Nurses and doctors are mandated to have professional registration and accreditation respectively. The Medical Associated of St. Vincent and the Grenadines overseas the programs and systems within the Ministry of Health.

Inadequate government financial support to the public health sector has contributed is a significant way to the weaknesses in the management of biomedical waste.

Lesson Learned and Areas for Improvements:

1. There is a lack of a formal Ministry of Health standard for management of infectious/biomedical waste at generating facilities such as hospitals, clinics and laboratories
2. No formal environment health and safety system for the healthcare sector
3. Inadequate financial resources to support public health sector improvements and effectiveness
4. No system for management of raw materials and supplies used and their impact on the overall business and the environment.
5. There are cases of environmental pollution due to improper collection, storage and disposal of biomedical waste
6. Inadequate biomedical waste collection containers
7. There is a potential environmental pollution due to improper waste incineration practices/ operations.
8. Lack of health hazard risks and impact assessment due to poor management of biomedical waste.

Summary and Conclusion:

The lack of a formal environment health and safety system for healthcare sector is driven mainly by inadequate financial resources, a lack of government EHS regulations and standards for the healthcare sector. Public hospital and health centres are not income generating business and their sustainability does not depend on their EHS performance, social responsibilities or economics. Services are provided at minimal cost that is used to assist in maintaining the facility.

Potential health hazard and risk associated with the healthcare sector is not properly documented and shared with affected workers. Workplace hazards and risks are not properly and effectively addressed by workers union bodies and top management. There was never a study done to assess healthcare workers health, injuries or illnesses to establish relatedness to job hazards.

5.4 Trinidad and Tobago Case Study Background (population of 1.3million)

Two (2) written survey questionnaires were completed for separate public hospitals during the period September 5th and October 23, 2009. There are sixteen (16) public hospitals, 96 government health centres and numerous medical laboratories.

All public hospitals and health centres are managed by regional health authorities, namely:

- North West Regional Health Authority

- South West Regional Health Authority
- North Central Regional Health Authority
- Eastern Regional Health Authority.
- Tobago Regional Health Authority

Table 3. Overview of Regional Health Authorities and Public Hospitals in Trinidad & Tobago

REGIONS	PUBLIC HOSPITALS	HEALTH CENTRES
South West Regional Health Authority	4	13
North West Regional Health Authority	3	17
North Central Regional Health Authority	6	13
Eastern Regional Health Authority	2	15
Tobago Regional Health Authority	1	18

Each regional health authority is responsible for the operation of public hospitals and health centres in the region. All regional health authorities are directly managed by the Ministry of Health. Each regional health authority is responsible for

management of all public hospitals within the region in accordance with the Ministry of Health regulations, Acts and code of practices, environmental regulations and occupational health and safety regulations. Hospital employees are directly employed to the regional health authorities and not the Ministry of Health. There is a government health care insurance program that assists in proving health care services at minimal costs.

Biomedical Waste Management Laws and Regulations:

There is written standard and code of practice for the management of hospital waste within healthcare facilities. The Environmental Management Action 2000 has regulated requirements for clinical and related waste and requires generators to be certified. The occupational health and safety regulations 2004 stipulate requirements for a safe workplace and protection of workers at the workplace. There is no specific regulation or standard for the management of biomedical waste within public hospitals. There are written regional environmental policy and mission statements regarding quality of service and patient care, however no such statement on workplace safety and health for employees and contractors.

Biomedical Waste Management:

Base on survey reports, there is a standard practice for the collection, storage and disposal of biomedical waste. Biomedical waste is collected in designated colour coded (red bags and sharp bottles) containers labeled “Biomedical Waste” at and close to the waste generating point. Biomedical waste is removed from collection points to

temporary storage areas on a daily basis. Hospital waste containers are located on each ward, patient care areas, laboratories and theatres. The waste is then collected by sanitation workers to storage areas for disposal. Sharps are disposed of in designated sharp containers. Interviews revealed that there are instances when there is a lack of designated containers and other containers are used. Biomedical waste is disposed of by incineration and landfill.

There is no government inspection of facility to ensure workplace safety and health standards are maintained. Issues are managed through labour agreements with hospital management and workers union. Public health inspectors conduct general inspection of critical areas such as waste storage, incinerators and sanitation facilities.

There is no documented environment health and safety management system in place at public hospitals. The current organizational structure shows responsibilities for environment health and safety management is shared between the Human Resources department and the Regional Maintenance Administrator. There is no single point accountable person for environment health and safety management for each region or hospital. According to one administrator there is a need for such person within the organization in order to drive an effective management system at each hospital, the lack of resources and budgetary constraints result in this gap. Environment health and safety management is not an area of major concern due to the lack of regulatory regulations and weak enforcement. Base on interviews with nurses, administrator and hospital sanitation workers there is a general knowledge of potential health hazard and risk associated with

biomedical waste management, however the required action to address these hazards and risk is to be taken at top management levels including the Ministry of Health.

Environment health and safety management is limited to waste collection, storage and disposal. Main wastes are sewage, garbage, biomedical waste, yard waste, scrap materials and empty containers. Services for waste management are provided by contractors and janitorial & maintenance staff. Safety and health incidents are not documented and tracked and many such incidents are either not reported or never investigated and reports generated. Incidents associated with workers injury or patient care is managed through the regional authority and the Ministry of Health legal group which is apart of the Human Resources department. While the costs associated with legal issues such as lawsuits are documented a management system to reduce these costs by addressing root cause is not in place. There are infrequent incidents of community complaints against hospitals and specifically regarding incinerator operations. There is no system for tracking and reporting of expenses and costs associated with environment health and safety management at hospitals. All costs associated with environment health and safety management is considered with the hospital operating and maintenance costs as a hidden cost.

There is no standard policy or statement of training requirements for health care workers within the healthcare sector. Training for hospital staff is limited to professional course of study and on the job orientation provided through Human Resources department. Local university and colleges provide a broad overview of health and safety hazards and risks associated with healthcare professionals and within the healthcare

sector. According to healthcare professionals interviewed, on a non –routine basis hospitals provide leaflets and staff notices on potential health hazards and risk within the hospitals. These are generally done after an incident or there is a general awareness in that area driven either by nationwide, regional or international influence. Healthcare workers are represented by different workers union groups such as Nurses Association, Medical Doctor Association, Practical Nurses Association and others by one or more workers union groups. It is through these workers union bodies that work place conditions, personal protective equipment and training is reviewed and agreed on by management and workers representatives. Personal protective equipment is provided by hospitals for employees. Healthcare sector workers are required to be immunized against infection diseases such as hepatitis. There is no formal human resources management system for tracking and monitoring employee training. Nurses and doctors are mandated to have annual renewal of professional certification. Selected senior healthcare professionals and administrators are normally in attendance at government and private sector sponsored workshops for the healthcare industry. There is at least one annual regional healthcare sector workshop. Training for contractors and their workers is not provided by the hospital or any local agency.

Governmental financial support is fairly adequate and generally provides for available resources such as personnel, equipment, materials and supplies for biomedical waste management. Base on interviews with hospital staff, there is a general view that instances of unavailability of materials, supplies and equipment is due to management weaknesses rather than a lack of funding.

Lesson Learned and Areas for Improvements:

1. There is a lack of a formal Ministry of Health standard for management of infectious/biomedical waste at generating facilities such as hospitals, clinics and laboratories
2. No formal environment health and safety system for hospitals
3. Low perception on potential health hazard and risk amongst healthcare professionals
4. Potential high health hazard risk exists amongst waste handlers due to inadequate training
5. No system for management of raw materials and supplies used and their impact on the overall business and the environment.
6. There are isolated cases of environmental pollution due to improper collection, storage and disposal of biomedical waste
7. Inadequate biomedical waste collection containers in some hospitals
8. There is a potential environmental pollution due to improper waste incineration practices/ operations.
9. No formal records on EHS risks and impacts associated with the management of biomedical waste in public hospitals.

Summary and Conclusion:

The lack of a formal environment health and safety system for healthcare sector is driven mainly by a lack of government EHS regulations and standards for the industry. Public hospitals are not income generating business and their sustainability does not

depend on their EHS performance, social responsibilities or economics. Services are provided at minimal cost that is used to assist in maintaining the facility. The quality of service provided by public healthcare facilities is below that of private healthcare facilities and this difference is directly linked to cost of healthcare service.

Potential health hazard and risk and impacts associated with the healthcare sector is not properly documented and shared with affected workers. Workplace hazards and risks are not properly and effectively addressed by workers union bodies and top management. There was never a study done to assess healthcare workers health /sickness to establish relatedness to job hazards.

CHAPTER 6.0: DISCUSSION OF FINDINGS

6.1 Project Importance

In recent years, the spreading of infectious diseases within the developing nations of the world has increased and widespread cases of contagious infections have increased. The Caribbean nations from a large group of this group of developing nations (third world). Due to a lack of infrastructural development some of the Caribbean islands healthcare sector faces challenges of being a source for infectious disease. The management of hospital waste (biomedical waste) is one such potential source that poses health hazard and risks to hospital staff and waste handlers.

The Caribbean islands are major attractions for overseas vacationers due its natural beauty, warm weather and beautiful sea shores. The tourism industry of most Caribbean island is the main foreign exchange earners for the country and its sustainability will depend on a healthy people, safety and environmentally friendly public services.

The Caribbean region is ranked among the top three regions with leading cases of HIV/AIDs infection. With this statistics, the Caribbean Health Institute and Pan American Health Organization has reported that the control of infectious disease within the Caribbean region is crucial and the management of biomedical waste is most important for the Caribbean.

6.2 Analysis of Findings:

The major findings from the project can be broadly classified as listed below:

- Access to public health services within the Caribbean is either free or at a minimal costs
- Lack of formal records on EHS risks and impacts associated with biomedical waste management within public hospitals
- Government provides a general health insurance program to assist in the delivery of healthcare services within the public sector
- Private hospitals providing healthcare service at higher quality and lower EHS risks
- Public hospitals used generally by lower and some middle class citizens base on their inability to afford private healthcare services.
- Inadequate and lack of government capital and operation budgets to improve and manage biomedical waste in the public healthcare sector.
- Infectious disease prevention is managed through a division within the Ministry of Health in the smaller islands and by regional health authorities in the larger islands. The program is administered by an Environmental Health Nurse or Officer. The program for infection control and prevention is not fully deployed and effective in all public hospitals. Provision of immunization against infectious disease is the major focus of this division, along with training of hospital staff.

- Immunization against specific infectious diseases such as yellow fever, hepatitis, rubella, etc is provided at healthcare centres. It is a requirement that workers within the healthcare sector be immunized against infectious diseases.
- Lack of biomedical waste collection containers is widespread across the islands surveyed
- Lack of personal protective equipment for hospital waste handlers result in high risk for infection due to contact with hospital waste.
- Lack of training in infection control and prevention is common amongst all hospitals surveyed.
- Biomedical waste is often mixed with other waste due to a lack of biohazard collection containers
- Costs associated with hospital waste management and infection control and prevention not tracked and managed
- Costs associated with health and environmental risks and liabilities not measured and tracked
- Environment health and safety management is not integrated into the overall business management for public hospitals
- Caribbean islands do not have specific environment health and safety regulations for the healthcare industry.
- Contractor workforce does are not necessary required to meet similar training and skills as direct employees in healthcare industry.

The Ministry of Health in each island has a formal documented on Infection Control and Prevention. The detail of each program is based on the scale of the healthcare sector and population. This program is not fully deployed across all public hospitals and health centres and lacks adequate resources to ensure its effectiveness. Key weaknesses of the program are:

- Lack of adequate staff for environmental health control
- Inadequate staff to manage the infection control and prevention program and specifically the immunization aspect of the program for healthcare workers
- Unavailability of required immunization at health centres
- Lack of adequate biomedical waste containers
- Lack of personal protective equipment for persons handling biomedical waste
- Lack of training for hospital staff and waste handlers.

Costs associated with health care services are either free or minimal. Due to weak governmental economic programs, governmental allocations to the Health Sector is not enough to ensure provision of suppliers, materials, staff and training for effectiveness. This strain for cash by Ministry of Health has resulted in less than desirable services being provided and lack of basic tools, materials, supplier and equipment.

The lack of government environment, health and safety standards and regulations for the management of the healthcare sector is one of the main barrier for the poor management of biomedical waste. A strong regulatory framework for the healthcare sector is the main reason for an effective environmental health and safety management system that can result in improved performance and reduce health hazard and risks.

The development and implementation of environment health and safety regulations by the government is not priority due to the weak economic programs of the islands. Governments are focused on seeking opportunities for employment and development to meet the basic needs for the population.

The lack of an environmental health and safety management system within the public health care sector is a significant contributor to potential health hazard and risk associated with biomedical waste. Healthcare sector sustainability is not linked to its present environment health and safety hazards, aspects and risks. Litigation cases associated with inappropriate handling of biomedical waste is not managed by hospitals. It is unknown whether the costs associated with legal fees and case settlements affect the hospital overall operating costs.

The training of hospital staff in the prevention of infectious disease at the workplace is critical issue that does not require a large cash flow to implement. The lack of this system within the public healthcare sector seems to due mainly to the lack of a proper health and safety management system for hazard and risk identification and evaluation as the basis for implementing controls. There is no documented evidence on history of workplace injury and illnesses amongst hospital workers. This issue is common amongst all Caribbean islands surveyed suggesting that this is a major barrier to effect changes in behaviour and lifestyle.

CHAPTER 7.0: CONCLUSION

7.1 Project Conclusion

There are common challenges faced by Caribbean islands in effective management of biomedical waste within the public health sector. For smaller islands (less than 1,000,000 populations) the challenges are greater due to less infrastructural development and weaker economy and hence less financial support from government for the public healthcare sector. Healthcare services are provided free of cost and in others instances at minimal costs and hence lead to unavailability of required suppliers for effective infection control and prevention program. This lack of and inadequacy of financial resources has resulted in poor quality services and lack of effective management system for medical waste. Without adequate funding it is very difficult to provide quality healthcare service (personnel, equipment, supplies) and management of health, safety and environmental risks associated with healthcare services.

Secondly, the lack of government/regional, laws, regulations and comprehensive operating standards for the healthcare industry and is another barrier to the effective biomedical waste management.

The third barrier is the lack of a comprehensive environment health and safety management system that drives the disease prevention and infection prevention control program within the region. Poor infrastructure and provision of general public utilities has contributed to health and environmental risks of biomedical waste management.

Fourthly, there is a lack of formal EHS risks and impact assessment and evaluations for biomedical waste management within the public healthcare sector. There is inadequate data to track and measure injuries and illnesses for healthcare workers due to poor and lack of EHS management systems.

7.2 Program Design and Implementation

The proposed model program for improvements can be categorized in three main areas as follows: lack of detail and comprehensive risks and impacts associated with the management of biomedical waste, a comprehensive EHS Management System that drives a comprehensive Disease Prevention and Infection Control Plan, EHS laws and regulations for the healthcare industry and infrastructural development in Caribbean islands.

A critical review of current operating strategies regarding cost for services and increase allocation of government capital budget to improve healthcare facilities is necessary. Sourcing low interest funds and using specifically for healthcare improvements must be given priority by Caribbean leaders. The review, revision and re-deployment of a comprehensive Disease Prevention and Infection Control program in each island is an important aspect of the program that must be addressed. Benchmarking other country's (eg USA) Infection Control and Prevention Program for the healthcare sector is recommended. Generally however all islands need to develop and implement and enforce environmental health and safety regulations for the healthcare sector.

Development of a specific EHS management system by the government (Ministry of Health) and established accountabilities though the hospital leadership will provide a framework for environment health and safety risk and hazard management. The framework for the EHS management system is the ISO 14001 standard series. The management system will focus heavily on hospital management leading the program and establishing roles and responsibilities. These improvements can be addressed through a Caribbean agency representing all islands through the umbrella of Caribbean Community (CARRICOM). This will be more effective as some of the smaller islands do not have the necessary resources to support this research.

Timeline for the full implementation of the program is three years. This will allow for sourcing necessary funding for improvement projects, drafting of improvements in design, work to be completed in the development of regulations and drafting of EHS management system for review and then approval by respective heads of government.

7.3 Area for Further Research:

This thesis focuses on barriers to effective management of biomedical waste as a source of infectious disease. Some areas for further research in this area are:

- Study on risks and impacts of a lack of EHS management standards and regulations for healthcare industry
- Effectiveness of a free costs structure in healthcare sectors in the Caribbean
- Assessment of public versus private healthcare services regarding EHS management systems
- Learning more about the general immunization program in the Caribbean

- Number and types of injuries and illnesses amongst healthcare workers
- Benefits and risks associated with use of contracted workforce within the public health sector

WORKS CITED

Cleaning up after an injury or accident in your home; "improving the quality of your life", Environmental Health Division, Florida Department of Health.

Lt Col SKM Rao*, Wg Cdr RK Ranyal+, Lt Col SS Bhatia#, Lt Col VR Sharma; India. Biomedical Waste Management: An Infrastructural Survey of Hospitals. MJAFI, Vol. 60, No. 4, 2004

Biomedical Waste Operating Plan. Environmental Health Division, Florida Department of Health.

Biomedical Waste M management in the Caribbean. The Caribbean Environmental Health Institute, 2007.

Forde, a WINDREF Research Fellow and Professor within the Department of Public Health & Preventive Medicine at St. George's University. Biomedical Waste Management in the Organization of Eastern Caribbean States (OECS) Report. Pan American Health and Education Foundation.

Trinidad Daily Newspaper. March 12, 2009. Medical waste gets intervention.

Environmental Management Authority Case Studies. A National Inventory Study for the Generation of Hazardous Wastes in Trinidad and Tobago. Conducted by the Caribbean Environmental Health Institute. March 2006.

Ianthe Smith, Environmental and Engineering Managers Ltd.
Draft Medical Waste Management Policy for Jamaica. October 29, 2004.

EPA Guidelines. Medical waste - storage, transport and disposal
Re–issued September 2003.

Washington State Department of Ecology, October 2005. Best Management Practices for Hospital Waste.

Hospital Waste Journals, Volume 10 Issue 3. Helping Hospitals Manage Waste.

Hem Chandra, Environews- News Letter of India. An Environmental Hazard and Its Management. Hospital Waste Vol. 5 No. 3 - July 1999.

Environment Canada, Ontario Region, Canadian Centre for Pollution Prevention: Pollution Prevention in the Health Sector.

Srishti (Anu G Agrawal, Megha Kela Rathi, Ratna Singh, Ravi Agarwal) Hospital Waste Time to Act: Srishti's factsheets on 14 priority areas. India June, 2002.

E-LAW Impactor Jamaica Environment Trust. Managing Hospital Waste in Jamaica. 2004.

Jackie Hunt Christensen, Health Care Without Harm. c/o Institute for Agriculture and Trade Policy Medical Waste Treatment Technologies: Evaluating Non-Incineration Alternatives. Minneapolis, MN 55404.USA

C.L. Environmental Co. Ltd. Environmental Impact Assessment. Southeast Regional Medical (infectious) Waste Treatment Facilities. Kingston Jamaica September 2003.

Jamaica Sunday Gleaner Newspaper April 5, 2009. Inside the city of Riverton Published: Sunday | April 5, 2009.

"Jamaica" Wikipedia: The Free Encyclopedia December 2008. Bureau of Western Hemisphere Affairs. <http://en.wikipedia.org/wiki/Jamaica.

"Trinidad and Tobago" Wikipedia: The Free Encyclopedia December 2008. Bureau of Western Hemisphere Affairs. <http://en.wikipedia.org/wiki/Trinidad and Tobago.

"St Vincent and the Grenadines" Wikipedia: The Free Encyclopedia December 2008. Bureau of Western Hemisphere Affairs. <http://en.wikipedia.org/wiki/St. Vincent and the Grenadines.