GUYANA
Support to Improve Maternal and Child Health
GY-L1058

DRAFT

ENVIRONMENTAL AND SOCIAL ANALYSIS REPORT

June 2016

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Acronyms

BNTF	Basic Needs Trust Fund
CDC	Civil Defence Commission
CEO	Chief Executive Officer
CIDA	Canadian International Development Agency
CMO	Chief Medical Officer
CO	Carbon Dioxide
DO	Dissolved Oxygen
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ESA	Environmental and Social Analysis
ESMP	Environmental and Social Management Plan
EU	European Union
GNBS	Guyana National Bureau of Standards
GOG	Government of Guyana
GPHC	Georgetown Public Hospital Corporation
GPL	Guyana Power and Light
GLSC	Guyana Lands and Surveys Commission
GT&T	Guyana Telephone & Telegraph
GTZ	German Technical Cooperation
GUYSUCO	Guyana Sugar Corporation Inc.
GWI	Guyana Water Incorporated
HSDU	Health Sector Development Unit
HSE	Health, Safety and Environmental
IDB	Inter-American Development Bank
IFC	International Financial Corporation
IPPS	Pollution Projection System
ITCZ	Inter Tropical Convergence Zone
MCD	Maternal and Child Health Department
MDG	Millennium Development Goal
MEA	multilateral Environmental Agreement
MHPRP	Multi-Hazard Disaster Preparedness and Response Plan
MISU	Management Information Systems Unit
MNR	Ministry of Natural Resources
MNRE	Ministry of Natural Resources & The Environment
MOPH	Ministry of Public Health
NDC	Neighbourhood Democratic Council
NDS	National Development Strategy
NEAP	National Environmental Action Plan
NGO	Non-Governmental Organisation
NIDRMP	National Integrated Disaster Risk Management Plan and Implementation Strategy
OH&S	Occupational Health and Safety
PAHO	Pan American Health Organization
PPE	Personal Protective Equipment
PRSP	Poverty Reduction Strategy Paper
PRS	Poverty Reduction Strategy
PSA	Public Service Announcement
PSM	Public Service Ministry
RDC	Regional Democratic Council

REO	Regional Executive Officer
RHA	Regional Health Authorities
RHO	Regional Health Officer
SDG	Sustainable Development Goals
STI	Sexually Transmitted Infection
TA	Technical Assistance
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund and United Nations Fund
USAID	United States Agency for International Development
USEPA	United State Environmental Protection Agency
WHO	World Health Organization

1. Introduction

1.1 Background

The Government of Guyana (GOG) and the Inter-American Development Bank (IDB) are in the process of finalizing a project to support the reduction of maternal, perinatal, and neonatal deaths in Guyana.

The project has been subjected to environmental safeguards and fiduciary screening and according to the safeguard policy filter report it has been given the classification "C." The report concluded that no issue or potential issues were identified and as such the operation does not require a social and environmental safeguard classification or environmental strategy.

Notwithstanding this, considering the potential infrastructure improvements and to inform the project on the current environmental management arrangements at the targeted health facilities, an Environmental and Social Analysis (ESA) including an Environmental and Social Management Plan (ESMP) has been prepared to guide the environmental and social management of the project.

1.2 Methodology

The preparation of the ESA and ESMP was undertaken by the consultant using the following approach and methodology.

Literature Review
A review of existing baseline information and literature material was undertaken. In addition, there was an examination of relevant national polices, strategies, plans, and legislation as well as IDB Safeguards Policies, and international guidelines and standards.

Stakeholder Engagements
Meetings and discussions were held with key personnel from the Ministry of Public Health (MoPH), Georgetown Public Hospital Corporation (GPHC), Diamond Hospital, CC Nicholson Hospital, health care professionals, and representatives from Neighbourhood Democratic Councils (NDCs) as outlined in Annex A. These discussions were very insightful in understanding the issues in general and those particular to the health facilities and have served as the basis for many of the measures contained in this ESA and ESMP.

Site Visits
Visits were made to the GPHC, Diamond Hospital and CC Nicholson Hospital in order to familiarize with the issues at these facilities and to collect baseline information.

Preparation of the ESA and ESMP
Preparation of the ESA and ESMP was done through the following:

- Collation of baseline data on the environmental conditions of the general area (region) where the targeted health facilities are located along with site specific baseline information;
- Identification of current environmental management systems and practices in the health sector and at the health facilities;
- Identification and analysis of potential environmental and social impacts from rehabilitation interventions by the project at these facilities; and
- Preparation of the environmental and social management plan including identifying requirements to be complied with and roles and responsibilities.

1.3 Organisation of the Environmental and Social Assessment

The ESA is arranged in a number of Chapters and these are summarized below:

Chapter 1: Introduction - This chapter provides the context to the project and the rationale for an ESA. The approach and methodology of the ESA and ESMP preparation is outlined along with the layout of the report.

Chapter 2: Project Description - This chapter details the project and it's various components and activities.

Chapter 3: Policy, Legislative and Institutional Framework - This chapter provides a summary of the IDB Safeguard policies as well as national policies, strategies and plans relevant to the project including specific plans, legislation and regulations and the regulatory bodies which will have oversight of the project's activities.

Chapter 4: Environmental and Social Baseline Conditions - This chapter provides a description of the project environment, including the physical, biological and socio-economic conditions.

Chapter 5: Description of Health Facilities - This chapter provides an overview of the health facilities being considered under the project and describes current environmental management systems and practices.

Chapter 6: Environmental and Social Impacts and Environmental and Social Management Plan - This chapter identifies the potential environmental and social impacts of the project during the planning, construction and operation phases and recommends measures to prevent and manage potential adverse impacts. The chapter also outlines considerations for the Contractors Environmental Management Plan (EMP).

Chapter 7: Monitoring Plan - This chapter outlines monitoring activities to be undertaken during project implementation to determine compliance with the environmental and safety requirements, as well as to determine the effectiveness of the mitigation and management measures being implemented.

Chapter 8: Public Participation - This chapter identifies the requirements for public participation and approaches which should be adopted by the project.

2. Project Description

The project, *Support to Improve Maternal and Child Health – GY-L1058* is an investment loan of approximately U.S$5 Million and the executing agency will be the MoPH through its Maternal and Child Health Department (MCD).

The objective of the project is to contribute to the reduction of maternal, perinatal, and neonatal deaths in Guyana. To meet this objective, the project has preliminarily identified the following components:

Component 1. Strengthening reproductive, maternal, and neonatal health services.

Sub-Component 1. Reproductive health services (US$1.0 million).
The objective of this sub-component is to increase access, use, and quality of health services for adolescents and women of reproductive age, through the following activities: (i) technical assistance (TA) to strengthen the community platform and the primary level of care for service delivery;21 (ii) TA to design an strategy to increase contraceptive methods prevalence; (iii) TA to design and implement a behavior change communication strategy, including messages targeted at adolescents; and (iv) procurement of equipment/supplies.

Sub-Component 2. Maternal and neonatal health services (US$2.5 million).
The objective of this sub-component is to increase access, use, and quality of antenatal, delivery, and postnatal care for mothers and newborns, through the following activities: (i) TA to assess and reorganize the health care and referral networks; (ii) TA to revise and adjust the portfolio of services and the roles of different cadres of health workers; (iii) TA to assess the distribution and operation of maternity waiting homes; (iv) infrastructure improvements and procurement of equipment/supplies; (v) TA to support the implementation of a quality improvement strategy, including the improvement of clinical and management practices and the promotion of patient-centered and culturally-appropriate care; and (vi) TA to develop individual and community plans to support women and newborns to access facilities for delivery and emergency care.

Component 2. Strengthening the healthcare delivery system (US$0.5 million).

The objective of this component is to increase the effectiveness and efficiency of essential support systems for service delivery, through the following activities: (i) TA to improve the supply chain for contraceptive methods, drugs, and blood products; (ii) TA to improve the quality of the information generated and used by the health system; and (iii) TA to analyze bottlenecks in the labour market and recommend actions to increase retention and performance.

Component 3. Administration, auditing, and evaluation (US$1.0 million).

This component will support execution monitoring, and evaluation activities. The latter will include an ex-post economic analysis and a before-after evaluation.

Under Component 1, Sub-Component 2 (iv) infrastructure improvements and procurement of equipment/supplies, consideration is being given to the following interventions:

- A remodeling of the Diamond Hospital on the East Bank of Demerara to include obstetric services or the construction of a second floor to the Hospital to include obstetric services.
- Minor renovations at the old ward of GPHC (for example, removal of a wall to increase the post-delivery ward).
- Minor renovations to Regional Hospitals including the C.C Nicholson Hospital.

- Financing of equipment and supplies for GPHC, Diamond Hospital, other Regional Hospitals and the C.C Nicholson Hospital.

Following a rapid health system diagnosis to be done by IDB, the project will be finalized for execution.

The facilities currently under consideration are the GPHC, the Diamond Hospital and the CC Nicholson Hospital. The locations of these facilities are shown in figures 1 and 2.

Figure 1: Locations of the Medical Facilities

Figure 2: Layout of the Medical Facilities

3. Policy, Legal and Institutional Framework

The project, *Support to Improve Maternal and Child Health – GY-L1058* is required to be in compliance with Guyana's national environment and health related policies, legislation, and institutional framework and the environmental and social safeguards of the IDB. This chapter provides an overview of the policies, legislation and institutions that form the enabling environment of the project.

3.1 Policy Framework

The Constitution of Guyana, National Strategies and International Agreements that Guyana has aligned with provide the broad foundation and guiding principles for Guyana's social, economic, environment, and health related policies and sustainable development decision making in general.

3.1.1 The Constitution of the Cooperative Republic of Guyana, 1980, and 2003 Reforms

The Constitution of Guyana is the highest governing legal document for the country. Chapter 2, specifically, Articles 24, 25, and 36 of the 1980 Constitution and 149 (J) of the 2003 amendments, outlines Guyana's health and environment related principles.

The right to health is guaranteed in Article 24 of the Constitution of Guyana, which states that "*Every citizen has the right to free medical attention and also to social care in case of old age and disability*." The definition of health used is consistent with that of the World Health Organization (WHO) which is defined as *"a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity"*[1].

The importance of protection and management of the environment is also well recognized and given particular attention. This is outlined as follows:

- Article 25: "*Every citizen has a duty to participate in activities to improve the environment and protect the health of the nation*."
- Article 36: "*The wellbeing for the nation depends upon preserving clean air, fertile soils, pure water and the rich diversity of plants, animals*."
- Article 149J: (1) "*Everyone has the right to an environment that is not harmful to his or her health or wellbeing*."
- Article 149(J): (2) "*The State shall protect the environment, for the benefit of present and future generations, through reasonable legislative and other measures designed to:*

    - *Prevent pollution and ecological degradation;*
    - *Promote conservation; And*
    - *Secure sustainable development and use of natural resources while promoting justifiable economic and social development*"

3.1.2 International Commitments: From the Millennium Development Goals (MDGs) to Sustainable Development Goals (SDGs)

At the international level, Guyana is a signatory and party to several key Conventions and Agreements[2] that are aimed at ensuring sustainable development.

[1] http://www.who.int/about/definition
[2] https://en.wikipedia.org/wiki/Category:Treaties_of_Guyana, and https://sustainabledevelopment.un.org.

The Millennium Development Goals (MDGs) were at the forefront of the global development agenda and represented the international community's commitment to eradicate poverty by 2015. Both health and environment featured prominently in the MDGs with Goals 1, 4, 5, and 6 addressing nutritional disorders, hunger and poverty, child morbidity and mortality, maternal health and women's health, and communicable diseases respectively. Goal 7 was dedicated to ensuring environmental sustainability.

According to basic 2014 data from the Pan American Health Organization (PAHO), over the last two decades, Guyana realised good progress in the health sector with success in decreasing the burden of communicable diseases such as HIV/AIDs, malaria, and tuberculosis, and increasing life expectancy from 62 years in 1991 to 67 years in 2015. The country made good strides in meeting the health related MDG goals and targets with positive impacts and outcomes, and made steady progress as well with regards to maternal health[3].

The MDGs was succeeded at the start of 2016 by an even more ambitious set of goals aimed at continuing the commitment and efforts of nations to eradicate social ills by 2030. These are referred to as the Sustainable Development Goals (SDGs). Goals 3- good health and well being, is most relevant to the project.

3.2 National Strategies and Plans

The importance of health to national development is given priority in Guyana's country development strategies. Both the National Development Strategy (NDS) and the Poverty Reduction Strategy (PRS), two main policy documents, have highlighted the contribution that health can make to poverty reduction and national development.

3.2.1 The National Development Strategy (NDS)

The NDS of Guyana (1996) outlined objectives and fundamental policy conditions for the country's development process. Volume 3, Chapters 18 and 19 set out the overarching national policy framework and priorities for environment and health respectively. The NDS has since been revised and updated for the period 2001-2010 and in 2016 remains relevant.

3.2.2 Guyana Poverty Reduction Strategy Paper (PRSP) 2011-2015

In 2001, Guyana set an ambitious agenda in its first Poverty Reduction Strategy Paper (PRSP) aimed at generating economic growth, improving its provision of social services (including health), enhancing governance structures and progressing in a timely manner towards the achievement of the MDGs by 2015. Since the 2001 PRSP, Guyana has prepared two PRSP progress reports, one in 2004 and the other in 2005; and in 2008 prepared a second Poverty Reduction Strategy. A third PRSP was prepared in 2011 spurred on by changing economic and political developments that required a shift in strategy. The health sector continued to be given prominence in the PRSP which identified a National Health Strategy with the objectives of:

- Improving quality of care;
- Ensuring access to health services for every citizen
- Expanding Family Health and Home-based care services, with special focus on Maternal and Child Health, Early Childhood Development and the care of the Elderly;
- Reducing chronic non-communicable disease;

[3] IDB Project profile- GYL1058. MDG Progress Report 2011, Chief Medical Officer Report 2014, and Health Vision 2020.

- Reducing communicable diseases: HIV, Sexually Transmitted Infections (STIs), tuberculosis and malaria;
  - Mental Health
  - People with Disabilities
  - Health Systems Strengthening

The PRSP 2011 stated that one of the main policies of the GOG is to provide equitable access to health care services. The 2011 PRSP also addressed the mainstreaming of environmental sustainability into national development planning and establishing links between poverty and environment (including climate change)[4].

3.2.3 Guyana National Health Sector Strategy 2013-2020 (Health Vision 2020)

Health Vision 2020 sets out the GOG's vision and plan for long term health and was informed by the lessons learnt from the National Health Plan of 2003-2007 and the National Health Strategy 2008-2012. The Strategy targets a three part goal: (i) advance the wellbeing of all peoples in Guyana; (ii) reduce health inequities and; (iii) improve the management and provision of evidence-based, people-responsive, quality health services. Thirteen components comprise the Strategy of which two are directly relevant to the project, Service Delivery and Environmental Health.

3.2.4 National Environmental Action Plan

A National Environmental Action Plan (NEAP) was first prepared in 1994 and a second prepared and adopted in 2001. The second NEAP set out the environmental management framework for Guyana for the period 2001-2005. Relevant to health and environment, the NEAP identified the following:

- National commitment to international multilateral agreements;
- Promotion of implementation tools including (i) environmental education and public awareness, (ii) human resources development, (iii) institutional capacity building, (iv) inter-agency collaboration, (v) public participation, (vi) information management and networking, (vii) acquisition of appropriate technology and (viii) environmental legislation;
- Focus on cross sectoral issues related to (i) land use, (ii) environmental health, (iii) integrated water resource management and waste management;
- Development of cross sectoral programs covering regulatory standards, controls and monitoring in relation to: i) environmental health; ii) environmental pollution; iii) integrated waste management; and iv) Pesticides and toxic chemicals; and
- Executing environmental assessments for proposed development activities that may significantly affect the environment.[5]

3.2.5 Disaster Risk Management

Several initiatives have been pursued by the GOG with regards to disaster risk management and response. Among these include the development of legislation, management plans, implementation strategies, procedures, guidelines, damage assessment and needs analysis system, early warning system, and coordination platforms. A Disaster Risk Management Bill, National Disaster Risk Management Policy and Early Warning System Framework document, National Flood Plan, Community Based Integrated

[4] Guyana Poverty Reduction Strategy Paper 2011-2015, July 2011, Pp.15 and 79.
[5] National Environmental Action Plan, 2001-2005, 2001.

Disaster Risk Management Plan, Integrated Disaster Risk Management Agriculture and Environment Plan, National Public Education Plan, among other instruments have been prepared. [6]

Through IDB support, the GoG, in 2013 prepared a 10 year National Integrated Disaster Risk Management Plan and Implementation Strategy (NIDRMP) with the intention to guide the implementation of projects and initiatives in Guyana – at national, regional and local levels – that are required in order to meet the NIDRMP's strategic objectives of risk identification, prevention/mitigation, financial protection/risk transfer, preparedness/response and recovery.

In addition, the Civil Defence Commission (CDC), with support from the United Nations Development Programme developed a Multi-Hazard Disaster Preparedness and Response Plan (MHPRP) in 2013. The MHPRP sought to detail arrangements to cope with the effects of natural and/or man-made disasters occurring in Guyana and to assign responsibilities and to provide coordination of emergency activities connected with major disasters, in general and specific ways.

The health sector features prominently, both in terms of vulnerability as well as being part of response mechanisms. The sector is particularly vulnerable to flooding and there is a high risk of infectious disease outbreak as well as high risk of fire. With support from PAHO/WHO, a health sector self-assessment tool for disaster risk reduction was developed for the purposes of determining the status of key aspects of disaster risk management in Guyana with focus on mitigation and preparedness. The application of the self-assessment tool indicated that there are gaps in both mitigation and preparedness. However, disaster risk management planning is developing within the health sector e.g hospital contingency plan developed for GPHC, though resources remain inadequate. As it regards health facilities in general, vulnerability and risk assessments are not done; there is limited building codes/regulation and/or provisions specific to health sector facilities; the health sector resilience improvement programme does not include all priority facilities; and there is limited financing for evaluating structural/nonstructural vulnerability of health sector facilities or retrofitting. [7]

The RDC of Administrative Region 4 is currently taking the initiative to prepare a Disaster Management Action Plan to cover facilities under its purview.

3.3 Legal Framework

Several laws guide the health and environment sectors in Guyana. These include the Ministry of Health Act 2005; Regional Health Authority Act 2005; Health Facilities Licensing Act, 2007; Health Facilities Regulations, 2008; Occupational Health and Safety Act 1997; Environmental Protection Act, 1996; and Environmental Protection Regulations 2000. This body of legislation offers a robust legal framework for the management of the health and environment sectors.

3.3.1 Ministry of Health Act, 2005

The Act sets out the functions of the Minister of Health and the Ministry (now Ministry of Public Health). Among the responsibilities conferred to the Ministry by the Act include oversight of health care services including mental health; provide advice to Government and establish policies on health; develop and ensure the implementation of the National Health Plan and other action plans and directives including human and all other resource requirements; enter into service agreement with the Regional Health Authorities (RHA) and review and approve their health plans and budgets; and facilitate the regulation of

[6] CDC, 2013, Multi-Hazard Disaster Preparedness and Response Plan. Pg. 9
[7] Dr. Shamdeo Persaud, CMO, undated, Health Sector Disaster Risk Reduction Self Assessment.

the health care professionals of hospitals and other health facilities in the public and private sectors including accreditation.

3.3.2 Regional Health Authority Act, 2005

The Regional Health Authority Act establishes RHA with responsibility for providing for the delivery of and administering health services and health programmes in specified geographic areas and for matters incidental thereto or connected therewith. Section 25 (I) of the Act sets out the jurisdiction and functions of the RHA.

3.3.3 Health Facilities Licensing Act, 2007

Under the provisions of the Health Facilities Licensing Act, all health facilities require being licensed by the Minister of Health. The Act also provides for inspectors who are authorized to enter any facility and conduct inspections. Offenses are outlined with fines and imprisonment upon summary conviction. Importantly, the Act also provides for the Minister to make Regulations related to licenses, renewals, standards for health facilities, record keeping, prescribing and governing the construction, establishment, location, equipment, maintenance and repair of, additions and alterations to, and operations of health facilities.

3.3.3.1 Health Facilities Regulations, 2008

The Health Facilities Regulations, enacted under the Health Facilities Licensing Act, 2007 provide specific guidance on areas of compliance by health facilities. These Regulations apply to the health facilities which are prescribed as health facilities under Section 2 of the Act and are specifically identified as:

- Blood Banks;
- Diagnostic Imaging Facilities;
- Dialysis Centres or Dialysis Clinic;
- Health Centres;
- Hospitals;
- Human Tissue Banks;
- Maternity Wards;
- Medical Laboratories;
- Nursing Homes;
- Oncology Clinics with Radiation Therapy;
- Pathology and Clinical Laboratory; and
- Surgical Centres.

Sections 14, 15, 19, 20, 32, and 33 of the Regulations refer to patient care arrangements, equipment and supplies, sanitation and safety, disposal of infectious and radioactive wastes, infection control, water, and occupational safety and health; these being the most relevant to this project. The full text of these sections of the Regulations is outlined in Annex B.

3.3.4 Occupational Health and Safety Act, 1997

The provisions for registration and regulation of industrial and other establishments for occupational health and safety of persons at work are enshrined in the Occupational Safety and Health Act 1997. The

Act covers areas such as administration, safety and health, hazardous chemicals, physical and biological agents, notifications of accidents and occupational diseases, offenses, penalties, and procedures.

3.3.5 Environmental Protection Act, 1996

The Environmental Protection Act provides for the management, conservation, protection and improvement of the environment, the prevention or control of pollution, the assessment of the impact of economic development on the environment and the sustainable use of natural resources. The Act established the Environmental Protection Agency (EPA) that is mandated with key core functions which relate to environmental assessment and described as follows:

- To take such steps as are necessary for the effective management of the natural environment so as to ensure conservation, protection and sustainable use of natural resources;
- To promote the participation of members of the public in the process of integrating environmental concerns in planning for development on a sustainable basis;
- To ensure that any development activity which may cause an adverse effect on the natural environment be assessed before such activity is commenced and that such adverse effect is taken into account in deciding whether or not such activity should be authorized. The authorization/permitting process and requirements are outlined in Part 4 sections 10-18 of the Act (a simplified flow chart of the process is presented in Annex D); and
- To prevent or control pollution. Part 5 of the Act set out the requirement for preventing and controlling pollution and the penalties for the breach of these Regulations.

3.3.5.1 Environmental Protection Regulations, 2000

The Environmental Protection Act, 1996 comprises several subsidiary Environmental Protection Regulations. These are:

- The Environmental Protection Authorizations Regulations 2000
- The Environmental Protection Air Quality Regulations 2000
- The Environmental Protection Water Quality Regulations 2000
- The Environmental Protection Noise Management Regulations 2000
- The Environmental Protection Hazardous Wastes Management Regulations 2000
- The Environmental Protection (Litter Enforcement) Regulations 2013
- The Environmental Protection (Expanded Polystyrene Ban) Regulations 2016

These Regulations were developed to regulate and control the activities of development projects during construction and operation. The EPA has the responsibility to ensure the compliance of all new and existing activities to these Regulations by issuing the required authorizations and monitoring their operations.

Table 1: Regulations under the Environmental Protection Act

Environmental Protection (Authorizations) Regulations 2000	The Regulations require development activities/facilities pertaining to industry (e.g. manufacturing, processing, handling, transport, storage, disposal) to be authorized by EPA, with specified conditions to avoid, minimise, and mitigate environmental impacts. It also provides for Environmental Impact Assessments (EIAs) where necessary (Section 3 of the Act). The EPA determined the types/categories of development that requires environmental authorization, and

	projects related to development and operation of hospitals and related infrastructure are subjected to authorization[8]. Currently, this is not aggressively enforced by the Agency primarily due to other operational and strategic focus and resource constraints. The authorization process for both new and existing facilities including variances are outlined in these Regulations, Part 3, Section 17 and 20.
Environmental Protection (Air Quality) Regulations 2000	In accordance with these Regulations anyone who emits any air contaminant in the construction, installation, operation, modification or extension of any facility related to industry, commerce, agriculture or any institution shall apply to the EPA for an environmental authorization at least ninety days before the date on which the emission is to commence. In accordance with the Regulations the EPA shall establish the desirable air pollution limits. Currently, there are no nationally determined or established Air Quality standards, however the Agency is guided by and utilizes the WHO and United State Environmental Protection Agency (USEPA) allowable limits (refer to Annex C).
Environmental Protection (Hazardous Waste Management) Regulations 2000	These Regulations outline the rules and procedures for transport, storage, treatment and disposal of hazardous wastes and are intended to ensure, through the environmental authorization process, that all operations that generate, transport, treat, store and dispose of hazardous wastes are managed in a manner that protects human health and the environment. The Regulations allow for the provision of information on the types of facilities and quantity of hazardous waste generated, treatment standards and efforts to reduce the waste generated. An Emergency Preparedness Plan is required for anyone who operates a hazardous waste facility. These Regulations also address clinical waste from medical care in hospitals, medical centers and clinics.
Environmental Protection (Water Quality) Regulations 2000	These Regulations require an environmental authorization for construction, installation, operation, modification/extension of facilities that discharge effluents. Requirements and guidelines on the discharge of effluents and disposal of sludge are provided. The EPA and Guyana National Bureau of Standards (GNBS) developed Interim Guidelines for Industrial Effluent Discharges into the Environment and these are currently being used by the EPA (refer to Annex E). The EPA also adopts the WHO and USEPA standards for surface and potable water when applicable. These standards have also been adopted by the Ministry of Public Health for its monitoring and surveillance programs. Draft Water Quality Guidelines have also been developed by the EPA.
Environmental Protection (Noise Management) Regulations 2000	Under these Regulations operations that emit noise in the execution of various activities such as construction, transport, industry, commerce and any institution are required to apply to the Agency for an environmental authorization. The EPA is responsible for the establishment of standards for permissible noise levels in industry, construction and other areas. The EPA may grant authorization for noise emission unconditionally or subject to conditions and may require environmental audit procedures. The GNBS and the EPA together with other relevant agencies developed standards for noise emissions into the environment. Residential, Institutional, and Educational daytime and night-time decibel limits are 75 and 60 respectively. Industrial and transportation limits are

[8] List of Projects Requiring Environmental Authorization EPA-EMPD2014L1R0. This list gives the categories of projects for which an Environmental Authorization/Permit is required from the EPA. This list is not exhaustive, some of the projects not listed may require an Environmental Authorisation. In addition, some of the projects listed may also require an Environmental Impact Assessment (EIA) or an Environmental Management Plan (EMP); this decision is made by the Agency, through Screening, once an Application has been submitted.

	set at 100 and 80 dB, Commercial at 80 and 65, Construction at 90 and 75, and Recreational at 100 (between 18:00-01:00hrs), and 75(01:00-08:00hrs).
Environmental Protection (Litter Enforcement) Regulations 2013	These Regulations provide for the enforcement against litter offences. It is an offence under these regulations to (a) place litter in a public place; (b) permit or cause another person to litter a public place or; (c) have litter on private premises that pose a health risk. The fine for an individual found littering in a public place is $50,000, while for body corporate it is $100,000. A fixed penalty of fifteen thousand dollars ($15,000) is offered to offenders who accept liability for the offence committed. Under the Litter Prevention Regulations, the NDCs and RDCs are to provide receptacles in public places. Further, every Council shall make appropriate provision for the prompt, efficient and regular emptying of the contents of the receptacles and for the removal and disposal of those contents.
Environmental Protection (Expanded Polystyrene Ban) Regulations 2016	The EPA in 2016 established a ban on extended polystyrene (styrofoam) food service containers. The Regulations prohibit the importation, manufacture and sale of expanded polystyrene food service products. Persons or businesses that breach these regulations shall be liable upon summary conviction to a fine of no less than $50,000. The EPA currently enforces the importation and manufacture of styrofoam food service containers. It will later in the year enforce the sale as well.

3.4 Guidelines

3.4.1 EPA Guidelines

The EPA has prepared several Environmental Management Guidelines for varying activities in keeping with the Environmental Protection Regulations of 2000. The Guidelines relevant to this project are outlined below.

3.4.1.1 EPA Environmental Impact Assessment Guidelines, Volume 1, Rules and Procedures for Conducting and Reviewing EIAs, 2004

The intention of these guidelines is to provide to the EPA, Environmental Assessment Board (EAB), sector agencies, private sector, Non-Governmental Organisations (NGOs), members of the public and consultants a set of approved guidelines for the conduct and review of Environmental Impact Assessments (EIA) in Guyana[9]. The EPA's permitting process varies depending on the type of project, its dimension and potential environmental impacts or whether it is new or existing. For new development projects there are two processes: (i) Environmental Impact Assessment (EIA) not required and (ii) EIA required (see Annex D). The process to obtain the final environmental permit can take from 2 to 6 months, sometime longer especially for EIA required projects. After the EIA/ESMP approval, EPA will issue an Environmental Permit with stipulated conditions.

The environmental permitting process is outlined in Annex D. The environmental permit process is initiated by an application through a prescribed authorization application form[10]. The Form outlines specific and general information required by the EPA for screening of the project. For rehabilitation works as contemplated under the project, an application for "Operation Permit for Existing/Registered Operations" is needed.

[9] EPA Environmental Impact Assessment Guidelines, Volume 1, Rules and Procedures for Conducting and Reviewing EIAs, 2004.

[10] Available for download from http://www.epaguyana.org.

3.4.1.2 Environmental Protection Agency Guidelines for Transportation, Storage and Occupational Handling of Chemical/Industrial Hazardous Waste, 2011

The purpose of these Guidelines is to provide information to persons on the correct procedures for the transport, storage and occupational handling of chemical/ industrial hazardous waste. These Guidelines apply to any person who operates a company, business or facility that transports, generates, stores, treats and disposes of chemical/industrial hazardous waste. It contains information on procedures and requirements for the transportation, storage and occupational handling of chemical/ industrial hazardous waste. Hazardous waste is defined in this guideline document as "*a waste or combination of wastes which because of its quantity, concentration or physical, chemical, infectious characteristics, may pose a substantial hazard to human health or the environment*."

3.4.1.3 Environmental Protection Agency Guidelines for Storage, Transportation & Occupational Handling of Biomedical Waste, 2011

The objective of these Guidelines is to provide general information on the proper storage, transportation and handling of biomedical waste. These Guidelines are for any person who operates a business or facility that generates, stores, and transports biomedical waste. It contains information on storage, transportation and occupational handling methods as well as guidelines on various treatment methods that are applicable to Guyana. Biomedical waste is defined in this guideline document as "*discarded biological material from teaching, clinical and research laboratories and operations.*" These Guidelines are provided in Annex F.

3.4.2 Guyana National Bureau of Standards Guidelines

GNBS develops and promotes standards for economic development and consumer protection. The GNBS provides a set of guiding standards relevant to health facilities. Those relevant to the project are outlined below.

3.4.2.1 GYS 265: 2013 Medical Laboratories – Requirements for Quality (Second Revision) and Competence. ISO 15189:2012

This international standard specifies requirements for quality and competence in medical laboratories. It can be used by medical laboratories in developing their quality management systems and assessing their own competence. It can also be used for confirming or recognizing the competence of medical laboratories by laboratory customers, regulating authorities and accreditation bodies.

3.4.2.2 GYS 259:2004 Occupational, Health and Safety Management Systems – Specification with Guidance for Use.

This standard specifies the requirements for an Occupational, Health and Safety (OH&S) management system to enable an organization to formulate policies and objectives. This takes into account legislative requirements and information regarding significant hazards and risks which the organization can control and over which it can be expected to have an influence to protect its employees and others whose health and safety may be affected by the activities of the organization.

In addition to the above Guidelines, the GNBS also provides Standard Building Codes related to fire safety, use and occupancy, plumbing, concrete and masonry, Guyanese hardwoods etc[11].

[11] Guyana Bureau of Standards, Standards Catalogue 2013/2015.

3.5 IDB and Other Policies and Guidelines

3.5.1 IDB Policies

The IDB has identified that environmental and social safeguards be applied during all project execution. Safeguards are applied to ensure that project funds are engaged in a manner consistent with the Bank's institutional policies with respect to social and environmental protection and management.

According to the Project Profile, the project has triggered the Environment and Safeguards Compliance Policy (OP 703) which requires that all bank financed operations shall be screened and classified according to their potential environmental impacts. This project has been classified as *Category C: Operations that are likely to cause minimal or no negative environmental and associated social impacts*[12].

3.5.2 International Guidelines for Health Facilities

Several international organisations have developed guidelines for environment, health and safety for health care facilities. Prominent among these are the International Financial Corporation (IFC) which are applied to projects supported by the World Bank Group. The IFC Guidelines are outlined in Annex G.

3.6 Institutional Framework

3.6.1 The Ministry of Public Health

MoPH is the leading institution in the health sector. It is headed by a Minister of Public Health who has overall responsibility for sectoral management and regulation. The Minister is assisted by a Permanent Secretary who has responsibility for management, administration and policy analysis and a Chief Medical Officer who oversees all technical functions pertaining to the health sector.

3.6.2 The National Health Policy Committee (NHPC)

The NHPC is the leading policymaking body within the health sector. The NHPC's main objective is to oversee the implementation of the Guyana National Health Sector Strategy (NHSS) and the supporting frameworks and strategies. It is mandated to advise the Cabinet on health policy, mobilizing resources, and supporting the development and implementation of national policies. NHPC members include the Minister of Public Health, the Minister within the MoPH, the Permanent Secretary of the MoPH, the Chief Medical Officer (CMO) of the MoPH, the Executive Director of the Health Sector Development Unit (HSDU), and the Director of the Management Information Systems Unit (MISU).

3.6.3 Central Board of Health

The purpose of the Central Board of Health is to promote, protect and advocate for optimal public health for all Guyanese through consistent, quality services extended to all communities throughout the country. Among the responsibilities include framing regulations and providing advice to the Minister on all matters concerning health. The Board consists of the CMO, who is the Chairman, and representatives from key agencies and regional/municipal authorities.

[12] http://www.iadb.org/en/topics/sustainability/project-categories,8736.html

3.6.4 Regional Agencies and Parastatal Bodies

Since 1986, the responsibility for the delivery of health services lies with the Regional Democratic Councils (RDCs). Funding was through the Ministry of Local Government. The Ministry of Public Health (formerly Ministry of Health) retained responsibility for vertical health programmes, and provision of human and technological resources to the RDCs. The Regional Health Officer (RHO) has oversight of all primary health care facilities and the district/regional hospitals. The national and regional hospitals in Regions 4 and 10 are directly administered by the MoPH or are independent entities. In Region 4, four national hospitals, including the GPHC are self-managed or under the MoPH and not under the remit of the RDC. In Region 10, Linden and Kwakwani Hospitals are under the direct purview of the MoPH as well. Those health facilities at the regional level, their budget and expenditures are done by the Regional Executive Officer (REO). Additionally, all human resources decisions must be initiated at the regional level by the REO and go through the Public Service Ministry (PSM) process[13]. Figure 3 below presents the regional to national institutional structure in existence since 1986.

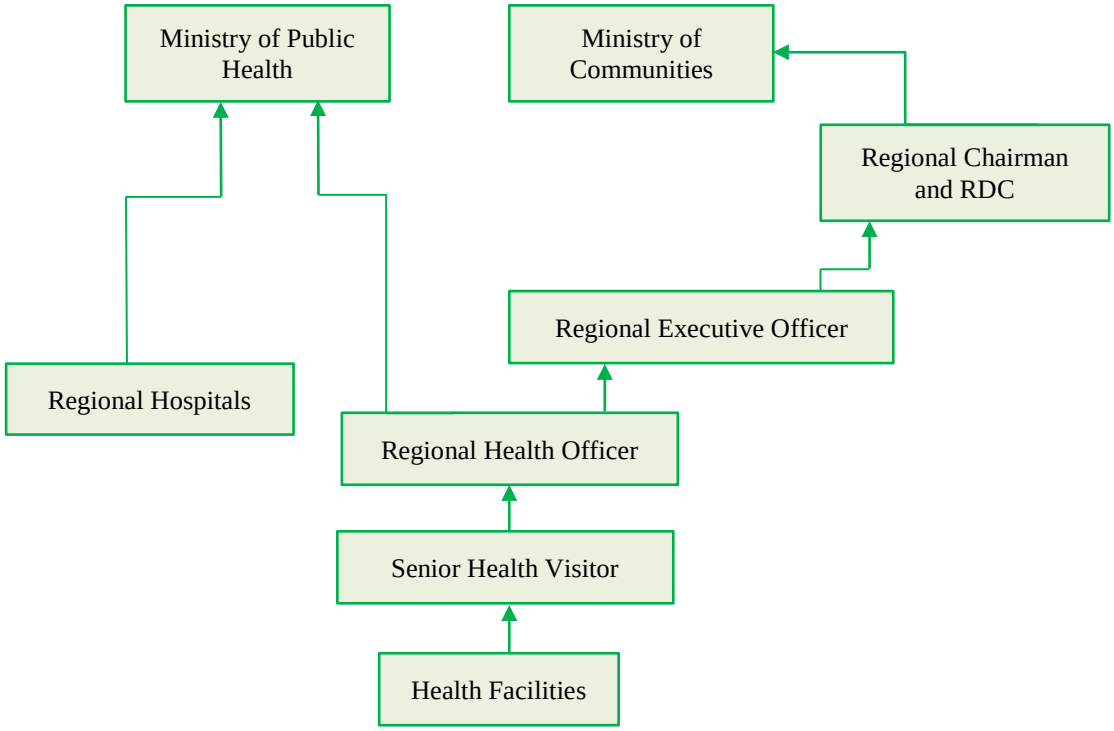

Figure 3: Regional to National Health Administration Reporting Structure
Source: Guyana Health Systems Assessment 2010

The Regional Health Authorities Act 2005 gave the Minister of Health authority to create RHAs, a move away from the existing RHO structure, and being autonomous from the RDC in terms of strategic direction and financing, and under the oversight of a board of directors (with representation from the MOPH, the RDC, business groups, and provider organizations). It was envisioned that the RHA would be managed by an appointed Chief Executive Officer (CEO) and have control over its budget, expenditures, human resources, and administrative decisions. In return, it would sign a service agreement with the MOH that bounds it to certain targets. The RHA Board, as the signatory to the service agreement, would

[13] Health Systems 20/20 and the Guyana Ministry of Health. October 2011. Guyana Health System Assessment 2010. Bethesda, MD: Health Systems 20/20, Abt Associates Inc.

be accountable to the Ministry of Health for achieving specific performance indicators, with targets as laid out in the service agreement[14].

Health care is also provided by some parastatal organizations. The main company which does this is the Guyana Sugar Corporation Inc. (GUYSUCO) which maintains clinics and diagnostic services for its staff and their dependents. A focus is also placed on Primary Health Care including health education[15].

3.6.5 Georgetown Public Hospital Corporation (GPHC)

GPHC is Guyana's national referral hospital. It operates independently, preparing its own budgets, managing human resources, and directing procurement. It has its own board of directors that oversees the operation of the hospital. The board includes representation from a wide range of stakeholders including unions and line ministries. Through its operational independence and CEO approval, the GPHC has developed innovative practices such as creating new health worker positions, developing incentive programs, and improved efficiency in hiring employees, other than through PSM process[16].

3.6.6 Private Sector

According to the Health Sector Analysis Report by PAHO (2003) the private sector and private companies in the health sector include approximately 10 hospitals as well as diagnostic facilities, clinics and dispensaries. The private health services have expanded rapidly and provide about half of all curative services. Most of these services are provided in Georgetown and other urban centres. The principal sources of financing in the private sector are through fees from individual patients. Several non-governmental organizations including religious organizations provide services on a not for profit basis.

3.6.7 Professional Regulatory Bodies

The regulatory bodies for professionals in the public and private systems include the Guyana Nursing Council, the Guyana Medical Council, the Guyana Dental Council and the Pharmacy and Poisons Board. These bodies address issues of registration and licensing of health professionals.

3.6.8 Ministry of Natural Resources

In 2012, the Ministry of Natural Resources and the Environment (MNRE) was established in pursuit of significant improvement of environmental governance. The Ministry was given the responsibility to oversee and coordinate the functioning of the EPA, the Guyana Forestry Commission, the Guyana Geology and Mines Commission, the Guyana Gold Board, the Guyana Lands and Surveys Commission, Guyana Wildlife, the National Parks Commission and the Protected Areas Commission. In 2016, the Ministry was renamed Ministry of Natural Resources (MNR), with oversight of the above mentioned Agencies, the exception being the Guyana Lands and Surveys Commission.

3.6.9 Environmental Protection Agency (EPA)

The work of the EPA is conducted by four technical Divisions, namely, the Environmental Management Permitting Division with responsibility for authorizations; the Environmental Management Compliance and Enforcement Division with responsibility for monitoring and to ensure compliance and enforcing the Act and Regulations; the Biodiversity Management Division responsible for coordinating conservation

[14] Guyana Health Systems Assessment, 2010
[15] Health Sector Analysis, Guyana, PAHO, 2003
[16] Guyana Health Systems Assessment, 2010

related multilateral Environmental Agreements (MEAs) and projects; and the Education and Information and Training responsible for education and awareness.

The Agency is represented on the Central Board of Health. As part of its authorization programme the EPA has been engaged with several health facilities including the GPHC Infectious Waste Sterilization Facility, Linden Hospital, Lethem Hospital, and more recently the Dr. Balwant Singh Hospital[17]. EMPS were prepared for the Linden and Lethem Hospitals. The Hazardous Waste and Air Quality Unit of the Agency has been working with health facilities particularly in developing and disseminating environmental management guidelines and providing guidance to contractors regarding removal of asbestos[18].

The Compliance and Enforcement Division proactively addresses reports from the public concerning improper waste management and noise nuisances at private health facilities. This intervention also involves monitoring implementation of recommendations to mitigate the reported nuisances. The EPA plans to strengthen its compliance and enforcement interventions in the health and health related sector[19].

3.6.10 International Organizations

The International and regional donors and technical cooperation agencies are also important actors in the health and environment sector. The main actors are the IDB, PAHO, the United Nations Children's Fund and United Nations Fund (UNICEF), United Nations Development Programme (UNDP), United States Agency for International Development (USAID), European Union (EU), Canadian International Development Agency (CIDA), Basic Needs Trust Fund (BNTF) and German Technical Cooperation (GTZ).

[17] Linden and Lethem Hospitals did not complete the authorization process. Dr. Balwant Singh Hospital is currently undergoing the process. GPHC has received its permit for Infectious Waste Sterilization Facility.
[18] Roofs sheets of some older constructed buildings in Georgetown are of asbestos.
[19] Director, Compliance and Enforcement Division, pers. comm.

4. Environmental and Social Baseline Conditions

This chapter provides a description of the environmental and social baseline conditions within Administrative Region # 4 since the health facilities currently under consideration are all located within this Region.

4.1 Physical Environment

Landforms in Guyana appear to be the surface manifestation of its underlying geology and the country is divided in to four geomorphological regions: the Coastal Plain, the Sandy Rolling Land, the Pakaraima Mountain Region and the Pre-Cambrian Lowlands. The geomorphological regions are shown in figure 4. The targeted health facilities are all located within the Coastal Plain. The boundaries of these geomorphological regions closely follow the boundaries of its geological formation (Daniel, 1984).

4.1.1 Geomorphology and Soils

The Coastal Plain is a narrow belt ranging between 8 and 65km in width with a length of 440km stretching from the Corentyne River in the east to Waini Point in the west. The Coastal Plain can be subdivided into a younger and older coastal plain. The younger Coastal Plain is underlain by the Demerara formation of the holocene age, and the older Coastal Plain by the coropina formation, Pleistocene (Daniel 2001). Coastal units recognized are Recent (Peat, Shell, Sand, Mud, and Cheniers), Demerara formation (Holocene), Coropina formation (Clay), and the Berbice Formation (White Sands). The coastal area of Guyana is a result of its underlying geology, subsequent weathering processes and the transport of those products of weathering. East of the Essequibo River the plain consists of recent and old sediments with recent deltaic and fluvio-marine clays and silts occurring on the coast with silty clays and sands inland. West of the Essequibo River the coastal plain narrows with extensive organic wetland 'pegasse' deposits inland. While these are most extensive in the west of the country, (Regions 1 & 2) they also occur scattered between the Essequibo, Demerara and Berbice Rivers. East of the Berbice River the pegasse area is small and the coastal 'frontland' and 'riverain' clays relatively wide.

The soils of the area are a combination of clays, silt, and pegasse. Since the health facilities are located on the Coastal Plain of Guyana where soils are characterised by four different types of clays, it is expected that a combination of the following clays can be found at the sites: Mara Clay, Brickery Clay, Tuschen Clay and Lama Muck. These clays have the following characteristics:

- **Mara Clay**: Poorly drained soil developed from relatively old marine sediments. It occurs in depressions and is characterized by a shallow peat deposit over thick dark grey clay underlain by a greenish grey clay subsoil
- **Brickery Clay:** Poorly drained soil developed in river alluvium. The alluvium may have been deposited over fluviomarine sediments. It is characterized by a thin dark grey clay surface over a grey clay subsoil mottled with brownish yellow, yellowish red, and brown. The substratum is soft greenish grey clay, which may contain numerous bits of partially decomposed organic matter. The soil is strongly acid, slowly permeable and has a moderate level of fertility.
- **Tuschen Clay:** Poorly drained soil developed in river alluvium. It is characterized by a thin dark grey clay surface over a grey to greenish grey clay subsoil with mottles of brownish yellow, yellowish red and brown. The soil is strongly acid, slowly permeable and has a moderate level of fertility.
- **Lama Muck:** Poorly drained organic soil occurring in depressional areas. The soil consists of well-decomposed muck underlain by dark reddish brown peat. The substratum is greenish grey soft clay. The area is approximately 1.5 m above mean sea level.

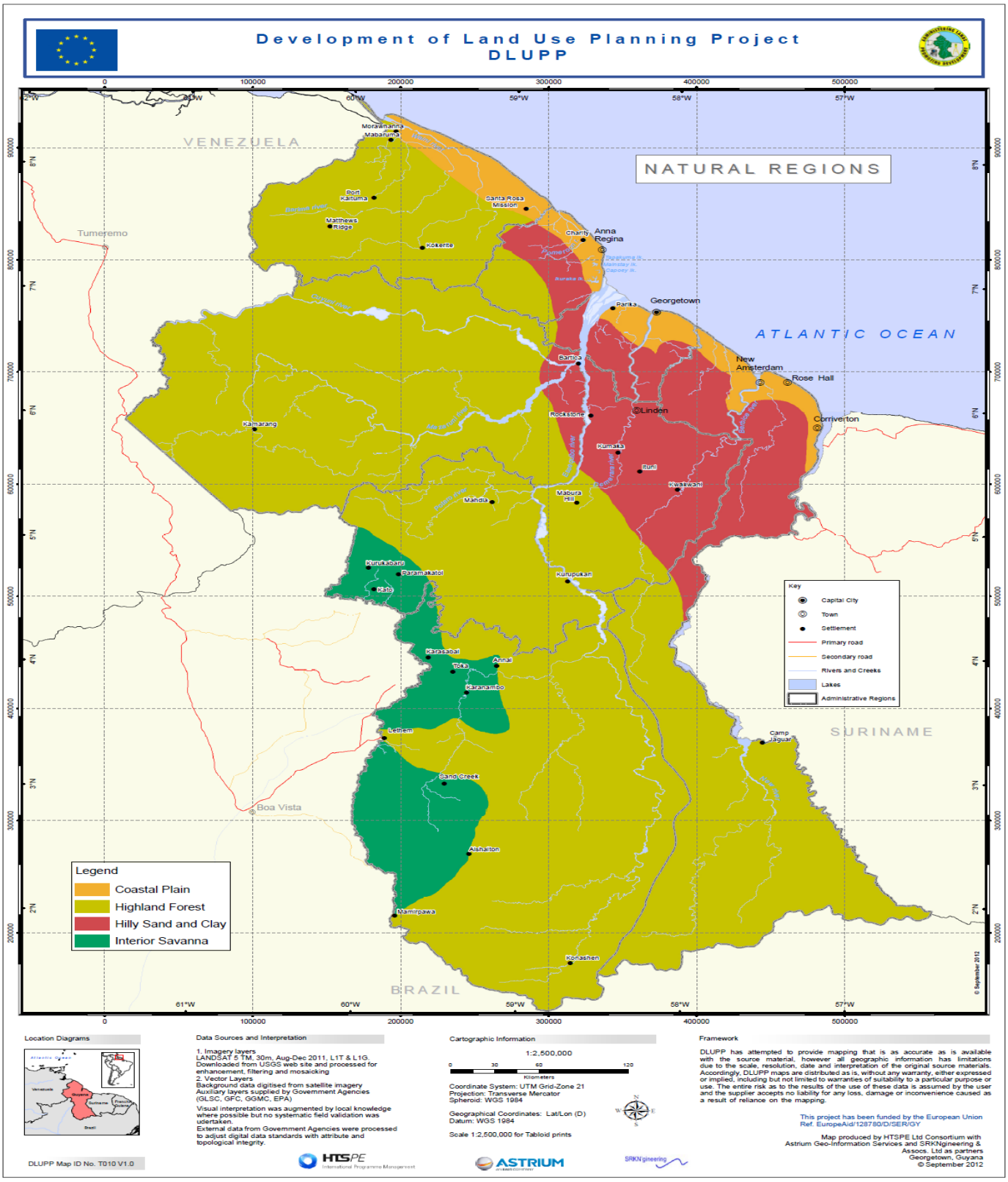

Figure 4: Natural Regions of Guyana[20]

[20] Source: Guyana National Land Use Plan (2013)

4.1.2 Topography

The topography of the area is typically low–lying and flat. The recent plain occurs at elevations of 2m below to 3m above sea level with sandy old beach ridges forming higher ground. The older coastal plain lies at an altitude of about 3-9 m above sea level. The normal tidal range is approximately 3m with resultant flooding (particularly sea invasion) especially during the wet seasons from April to August and November to January and during high tides. Many areas of the coastal plain are below sea level while other areas are man-made and built-up to raise them above the surrounding land level. An elaborate system of sea defences, along with irrigation and drainage canals, is required to protect the area from flooding.

4.1.3 Climate and Weather[21]

Guyana's climate is influenced primarily by the seasonal shifts of the Inter Tropical Convergence Zone (ITCZ) and the seasons and climate are determined mainly by the variation in rainfall patterns. Guyana has a tropical climate characterised by a high but variable rainfall, high humidity and a relatively small temperature range with two wet and two dry seasons.

The coastal plain is characterized by two wet seasons from April to July, and November to January and two dry seasons in between. There is a rainfall average of 200 days a year, with 50% of the average rainfall occurring from mid-April to mid-August. Annual averages on the coast are 2,500 millimetres near the Venezuelan border and 2,300 millimetres in Georgetown. Rainfall data obtained for the Botanical Gardens Weather Station[22] from the Hydrometeorological Department is presented in table 2 and figure 5 below. The data from this Weather Station is relevant to all three of the proposed health facilities since they are located in generally close proximity to the Weather Station. The data covers the period 2004 to 2014 and shows that the annual rainfall for the general area ranges between 2000-2500 mm. It should be noted that when the ITCZ is strong (late April to early July), copious rainfall is experienced but when it is weak rainfall may be absent. El Niño and La Niña events can also affect the rainfall pattern and sometimes result in drought and flood conditions respectively.

Mean air temperature ranges between 25 to 27.5°C throughout the year in most regions except the upland regions in the interior/west of the country, where mean temperatures are cooler and range between 20 to 23°C.

Guyana's coast is subject to the north-easterly trade winds with speeds of about 6 meters per second. This moderates the hot and humid conditions. However, between July and August, stronger westerly winds, which influence the prevailing wave climate, are experienced. Wind speeds also vary seasonally. During the dry season, the strongest winds are experienced between January and April when the northeast Trade Winds dominate. Wind speeds range, on average, between 9 km/h (wet season) and 12 km/h (dry season).

The overall relative humidity in Guyana is generally above 70%. Relative humidity is high averaging about 70% in the Savannahs, 80% on the coast and 88% in the rainforest.

As a result of Guyana's proximity to the equator there is little variation in the hours of daylight. It varies from a minimum of 11.6 hours per day in December to a maximum of 12.5 hours per day in June. Bright sunshine is influenced by rainfall and during the rainy season the coast can experience an average of 6 hours per day.

[21] Information for this section was sourced from the Hydrometerological Department of the Ministry of Agriculture.
[22] Botanical Gardens Weather Station is the closest weather station to the site.

The coast is situated in the tradewinds, but tropical storms or cyclones do not occur in this area. Guyana lies south of the path of Caribbean hurricanes and therefore does not experience tropical storms or hurricanes.

Table 2: Rainfall Data (mm) for Georgetown from 2004 to 2014

Years	Months											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2004	162.30	124.00	54.00	320.40	407.40	255.60	377.20	117.00	110.60	61.80	26.40	404.60
2005	1108.20	203.70	78.50	219.60	296.00	102.80	380.50	57.30	55.40	67.30	229.50	516.70
2006	571.30	73.20	43.80	93.40	477.60	440.80	224.60	116.50	185.70	137.70	209.60	253.70
2007	156.50	26.30	121.80	111.70	433.40	398.10	297.60	375.50	154.10	53.10	179.90	633.70
2008	203.60	365.00	210.20	145.50	311.10	298.30	406.70	228.00		59.00	155.70	919.60
2009	515.00	151.60	65.80	316.30	58.30	295.00	213.40	59.90	71.60	79.30	63.10	97.50
2010	20.60	24.70	41.00	299.00	401.90	246.70	469.10	154.20	159.00	99.40	352.00	319.40
2011	136.6	413.9	500.70	34.00	269.90	170.40	182.90	118.30	30.80	194.40	167.40	233.60
2012	387.40	347.00	32.20	110.70	307.20	238.60	367.80	136.70	31.70	26.90	194.20	309.30
2013	82.70	116.30	27.70	129.20	347.00	282.20	418.90	289.10	117.90	117.20	336.20	283.50
2014	275.30	147.60	61.20	67.50	125.10	224.10	148.90	194.00	21.60	49.30	374.20	127.30

Source: Hydrometeorological Department

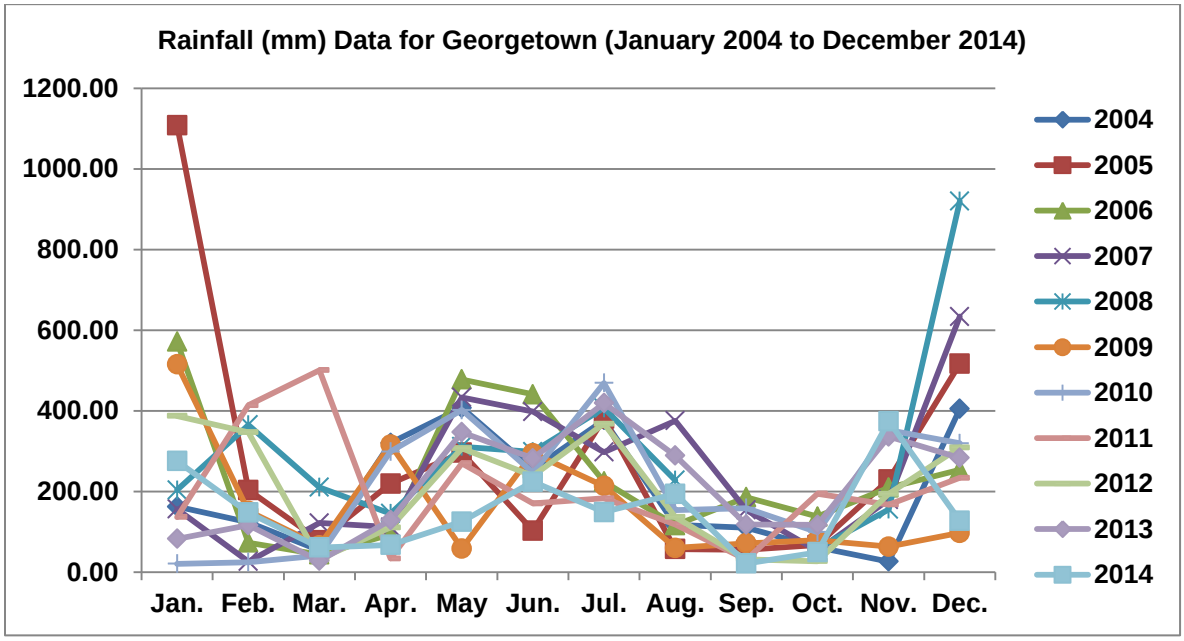

Figure 5: Rainfall pattern for Georgetown from 2004 to 2014

4.1.4 Surface Hydrology and Drainage

The hydrology of the general area in which the targeted health facilities are is largely controlled by its situation in the low Coastal Plain. The soils within the general area are clay rich, with poor internal drainage. In addition, the area is below sea level. In this regard, the control of water along the Coastal Plain is critical and can be a difficult task. Coastal lands need to be protected from flooding by the sea during high tides, as well as flooding caused by water streaming down from the inland areas during the

heavy rainy seasons. At the same time a supply of freshwater is required for agricultural lands. In an effort to maintain these characteristics a system known as empoldering was introduced by the early Dutch Colonist, during the 17th Century, as a mean for utilizing the rich and fertile coastal soils for agriculture, particularly the sugar cane industry. This system of drainage comprises several constructed polders. These polders played a major role in the land reclamation process, settlement pattern and Guyana's agriculture patterns and practices. This system has since provided the foundation for the existing drainage and irrigation infrastructure and facilities along the general project area and throughout Guyana's inhabited coastal areas.

Drainage and irrigation along the general project area are therefore consistent and exhibit an integrated system of man-made structures and natural occurrences, through the development of polders, hence the empoldering process. Masonry walls called 'seawalls' are built facing the sea, so as to protect the land from flooding during high tides and raised water levels. At the rear end is a long facade dam called the 'backdam' which holds back freshwater coming down to the coast from inland areas during the rainy season. In the case of the general project area, the 'backdam' creates a large conservancy known as the East Demerara Water Conservancy, which provides the coast with freshwater for irrigation and domestic purposes.

A series of parallel drainage and irrigation canals are used to link the 'backdams' with the seawalls or river defence. These canals are generally perpendicular to the conservancy dam. Sluice gates called 'kokers' are used to regulate the flow of flood-waters, from the polder to the sea, as well as controlling the supply of freshwater from the conservancy behind the 'backdams' into the polder for irrigation purposes. During flood conditions when there is need to discharge water during the high tides pumps are utilized. The sides of polders, in some areas along the general project area, are also protected by what is known as 'sideline dams'. Some researchers have described the coastal drainage and irrigation system as consisting of a series of 'parallel dykes'.

The general project area is comprises highly developed residential, industrial and commercial areas and as such there is a network of drainage facilities. This network consists of a series of small, interconnected community drains. Along the East Bank Demerara area where the Diamond Hospital is located drainage is done by canal and trenches which discharge into the Demerara River. The Georgetown area where the GPHC is located is drained by both drains into the Demerara River and pumps into the Atlantic Ocean. The Nabaclis area where the CC Nicholson hospital is located is drained by both drains and pumps into the Atlantic Ocean. All three facilities have internal drains which are connected to the area (village and city) drainage.

The East Demerara area is protected from flooding from the Atlantic Ocean by a sea defense system. Naturally occurring mangroves and an engineered sea defence system protect the seacoast. The wider area is drained by the Demerara River and the Atlantic Ocean.

4.1.5 Groundwater Hydrology and Quality[23]

Guyana has abundant ground water supply which is relied upon for water supply requirements. Heavy amounts of precipitation provide high amounts ground water recharge. Most of the domestic water supply comes from ground water resources. The coastal aquifer system is the source of most of the country's ground water resources.

[23] The information presented in this section is taken from the Water Resources Assessment of Guyana conducted by the US Army Engineering Corp in 1998.

The most important aquifers are in the unconsolidated, poorly sorted deltaic sands that underlie the coastal lowlands. The remaining aquifers are primarily in the igneous and metamorphic rocks of the Guyana Shield, which is mostly composed of Precambrian rocks. Other important aquifers are in unconsolidated sands and in other volcanic deposits. The coastal aquifer system, a series of three separate but hydrogeologically connected aquifers, has been providing water for the coastal inhabitants of the country for the last century. A relatively small area in the northwestern corner of the country contains brackish to saline water, and saltwater intrusion is becoming a concern in the eastern coastal lowlands. Ground water is locally plentiful from scattered sedimentary and volcanic deposits in the southern and western regions. Fresh ground water is scarce to lacking in the central mountainous area known as the Guyana Shield, where only fractures and small alluvial deposits produce water

At the coast large quantities of fresh water are available from the coastal aquifer system. This system occupies a subsurface area of about 20,000 square kilometers, extending about 250 kilometers along the Atlantic coast and 40 to 150 kilometers inland. Sediments reach a thickness of 1,800 meters onshore and become progressively thicker offshore and toward the east. The coastal aquifer system is composed of three connected but hydrogeologically distinct aquifers. Overlying layers of clays confine the lower two aquifers, protecting them from contamination by overlying sources. The three aquifers are named, from upper to lower, the Upper Sands, the A Sand, and the B Sand, with each capable of yielding large amounts of water.

The Upper Sands aquifer is 30 to 60 meters deep and ranges in thickness from 15 to 120 meters; it is the shallowest of the three aquifers of the coastal aquifer system. In Georgetown in 1831, this was the initial aquifer developed for water supply. However, due to a high iron content (greater than 5 milligrams per liter) and brackish water (total dissolved solids greater than 1,200 milligrams per liter), the aquifer was never fully exploited and withdrawals ceased in 1913. The water from this aquifer becomes more saline toward the coast. The aquifer is composed of quartz grains, which represent former beach dune deposits. Within 15 kilometers of the coast, ground water in this formation is confined by the Demerara Clay, a marine clay. From 15 to 35 kilometers inland to the outcrop of the White Sands Formation, the older Coropina Formation, also a marine clay, acts as the confining unit. These confining clays have an average thickness of 45 meters. Thickness of the Upper Sands unit ranges from about 15 meters in the Georgetown area to 90 meters near the Corentyne River in the east. This unit crops out and is recharged through the White Sands Formation, 35 kilometers south of Georgetown.

The A Sand aquifer was first developed in 1913 and is now considered the principal water source for Georgetown and the coastal lowlands region. The Intermediate Clay Formation, which is about 90 meters thick and composed of clay and shale, acts as an impermeable barrier between the Upper Sands and the A Sand aquifers. The A Sand aquifer is composed of quartz sand and fine gravel, and ranges from 150 to 215 meters deep and 12 to 27 meters thick. In general, the aquifer increases in thickness and depth southeastward from East Coast of Demerara to Berbice. From Berbice to the Corentyne River, the A Sand aquifer decreases in thickness and depth. This aquifer yields between 4,000 and 40,000 liters per minute year-round. The quality of water withdrawn from this aquifer is good with a low chloride content; however, its high carbon dioxide and iron content can corrode ferrous and cement-based materials, with the excessive iron requiring treatment.

The B Sand aquifer lies below the Upper Sands and the A Sand aquifers at depths of 350 to 800 meters and varies in thickness from 15 to 60 meters. The 65- to 130-meter-thick Alternating Clay and Sand Formation separate the A Sand and B Sand aquifers. While the B Sand is not exploited to the extent of the A Sand aquifer, it has yields of 4,000 to 40,000 liters per minute year-round. The water is fresh with no elevated levels of iron or chloride; however, it has a trace of hydrogen sulfide with temperatures up to 40.5 degrees Celsius. This aquifer, which was first used for domestic water in 1962, is composed of angular quartz sand and shale with gravel. From the Georgetown area, this aquifer thins toward the east in

the central part of the coastal lowlands where it becomes almost undetectable. Due to the lack of data, no recharge area has been definitively determined for the B Sand, but most studies indicate that the B Sand may be recharged by infiltration of precipitation in the White Sands Formation.

4.1.6 Surface Water Quality

The major natural waterways surrounding the general project area are the Demerara River to the west and the Atlantic Ocean to the north. Despite not having extensive information on the water quality within these waterways there is a good understanding of what the quality consists of. The EPA in 2006, in preparing the State of the Environment Report for the Demerara Watershed[24] conducted water quality testing along the course of the Demerara River. The section of the River relevant to the project sites consists of brackish/estuarine water.

In in brackish waters pH averaged 6.2 due to the mixing of freshwaters with ocean waters, which is at pH 8.0 or higher. Dissolved oxygen (DO) averaged 5.0 mg/L throughout. At the time of the survey, water temperatures ranged from a low of 26^{o}C to a maximum of. Conductivity levels averaged 620 µS/cm. Average salinity for brackish water, measured after slack tide was 0.4% (Ocean water is 3.5%). In brackish waters, turbidity ranged from 2.0 to 82.0 NTU indicating the presence of algae, sediments, suspended solids and domestic and industrial wastes. Alkalinity averaged 34.7 mg/L ($CaCO_3$). Carbon dioxide (CO_2) was 5.8 mg/L in brackish waters. Hardness averaged 0.5 mg/L. Total ammonia was 0.2 mg/L in the brackish section. Anomalies with high ammonia values were measured at many stations, tributaries and point sources. Such values were all due to anthropogenic inputs (from non-point sources and point sources), which were run-off from agricultural fields, and municipal and industrial discharges along the river. Total ammonia concentrations in these cases were likely beyond what is considered acceptable for the protection of aquatic life. Phosphate averaged 0.0 mg/L (i.e. non-detectable with the test method utilized) while silica averaged 3.0 mg/L throughout the Demerara.[25]

In the Atlantic Ocean the waters off Guyana's coast are influenced, particularly during the rainy season, by the heavy sediment load from the Amazon River and rivers of Guyana. The sediments are carried by the Guiana Current or South Equatorial Current that flows in a northwesterly direction parallel to the coastline. The discharge of fresh water from the Amazon, Essequibo, and Orinoco Rivers affects the coastal salinity, particularly during the long rainy season.

4.1.7 Air Quality

There is a general lack of air quality testing and air quality monitoring in Guyana. The EPA is now pursuing obtaining this type of data. However, the EPA in 2006, in preparing the State of the Environment Report for the Demerara Watershed, utilized the Pollution Projection System (IPPS) software to estimate emission levels[26]. The report indicated that generally air quality in the Demerara Watershed is good except for the areas immediately around industry. This was because most industrial operations did not have controls and did not practice pollution abatement. The industries of most concern were wood processing (sawmills and plywood factories) and power generation (frequent use of small to medium-sized generators). A third major source of pollution is frequent uncontrolled open burning of

[24] All three of the health facilities under consideration are located within the Demerara River Watershed.

[25] The information presented in this paragraph was gathered from pages ES- and ES-2 of the State of the Environment Report for the Demerara River Watershed.

[26] The IPPS was developed to exploit the fact that that industrial pollution is heavily affected by the scale of industrial activity, its sectoral composition, and the process technologies which are employed in production. This is particularly useful in most developing countries since they have little or no industrial pollution data but usually have relatively detailed industry survey information on employment, value added or output. The IPPS converts this information into emissions per unit of activity.

agricultural wastes. The report also indicated that SO_2 is estimated to be the largest emission in both the Demerara Watershed and Guyana as a whole. Also, emissions from the Demerara Watershed accounted for 5% of SO_2, 24% of NO_2, 7% of CO, 30% of VOCs 10% of PM_{10} and 15% of particulates of Guyana's emissions.

4.1.8 Noise

Noise measurements were taken at each of the health facilities being considered to determine the average noise levels within the facility area. One off noise measurements were taken at a selected area within the site by recording the decibel levels (see figure 6). These measurements were conducted on June 14, 2016. The levels recorded are outlined in table 3. All the measurements were conducted during daytime hours. It should be noted that, for noise generation, the decibel limits prescribed by the EPA for residential/institutional areas is 75dB during the day and 60dB during the night and for commercial areas it is 80dB during the day and 65dB during the night.

Table 3: Noise Level Readings

Sample Location	Site	Category	Time of Recording	Decibel Level Recorded
N1	Georgetown Public Hospital	Commercial/ Residential	16:10 hrs	58-63
N2	CC Nicholson Hospital - Nabaclis	Residential	17:35 hrs	41-52
N3	Diamond Hospital	Commercial/ Residential	14:30 hrs	52-80[27]

[27] Decibel level fluctuated and was influenced mainly by traffic traversing the East Bank Demerara Public Roadway.

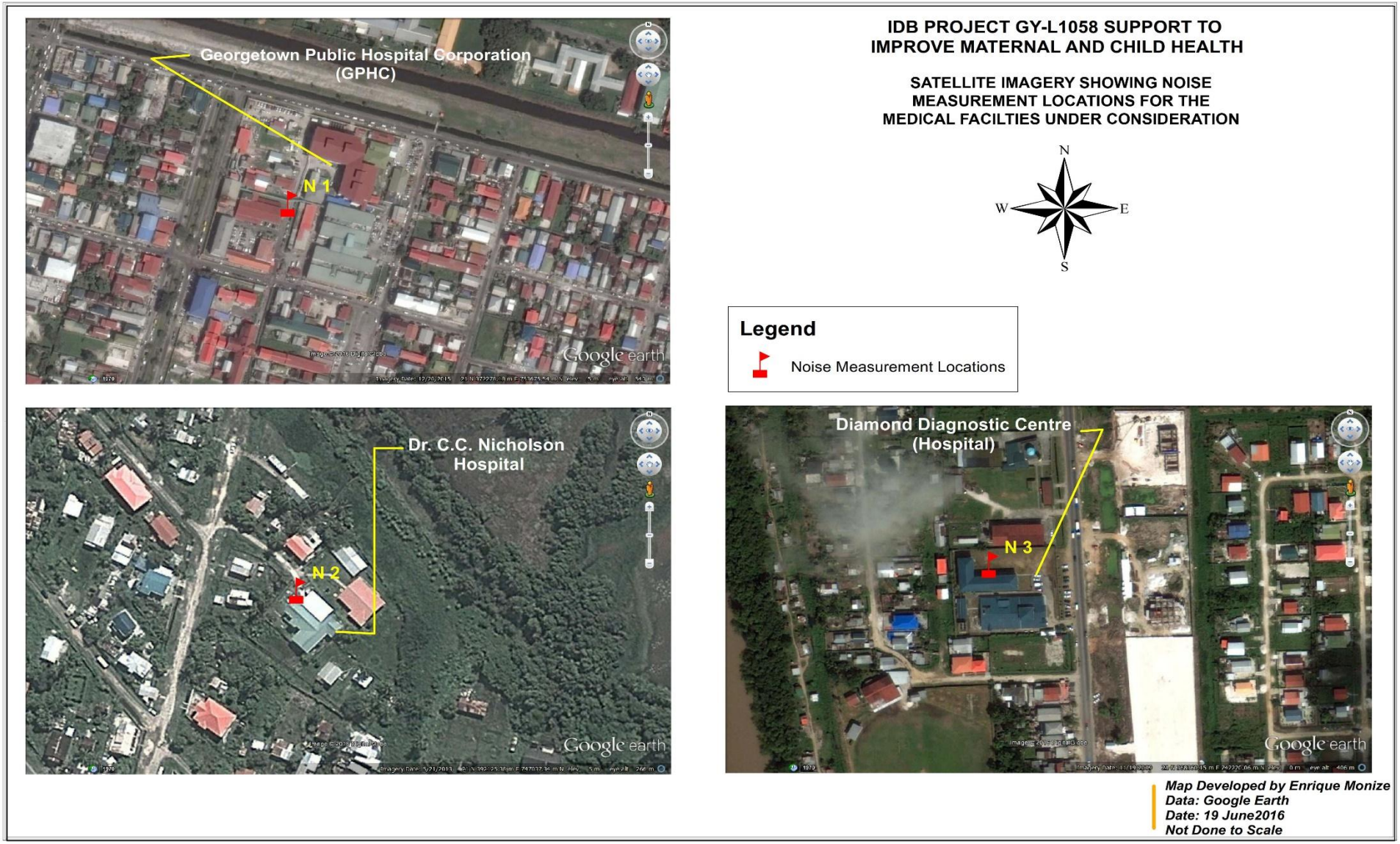

Figure 6: Noise Measurements Taken at the Medical Facilities

4.2 Ecological Environment

Generally, Guyana is considered a country endowed with relatively rich biodiversity and high endemism, due to four main factors: (i) the country's location at the edge of the species rich Amazon Basin; (ii) its overlying position on the Guiana Shield[28]; (iii) its strategic location on the Atlantic seaboard of South America that accounts for the marine and coastal environment; and (iv) the country's history of low incidents and intensity of conversion of natural habitats. A significant part of the Guyana's biodiversity exists on the coastal zone, though most of it is located within the forest and savannah provinces. However, within the general project area there is limited biodiversity due to human interactions and development activities over the last few centuries.

4.2.1 Ecosystem

The Coastal Plain is made up of largely alluvial mud, swept out to sea by the Amazon River, carried north by ocean currents, and deposited on the shores of Guyana. This has resulted in a rich and fertile clay, that overlays the white sands and clays of the Demerara and Coropina formations, formed from the erosion of the interior bedrock, and carried seaward by the rivers of Guyana. Extending from the vegetation line are mudflats, shallow brown water and sand bars. Five major wetland systems are distinguished in the coastal plain: the marine ecosystem of the seacoast, the estuarine ecosystem of the tidal wetlands of the river mouths, and the riverine, palustrine and lacustrine ecosystems.

The entire coast was once fringed by a belt of mangrove vegetation behind which lay swamps and savannahs occupied by sedges and numerous aquatic plants (Hussain 1990). Approximately 90% of the population of the country lives on the coastal plain. This coupled with extensive agriculture, major fishery and livestock production, industries and commercial centers, and the introduction of invasive and ornamental species leaves little original vegetation on the coast. Original vegetation is mainly seen in the Northwest district where there is a good representation of mangrove forest and coastal swamp forest.

4.2.2 Flora and Fauna at Sites

The sites of the health facilities are entirely cleared of the original vegetation. In the wider project area most of the vegetation was cleared to facilitate development, which includes housing, agriculture and commercial activities. There are some secondary vegetation along very small sections of the roadway comprising of secondary disturbed vegetation, primarily shrubs, herbaceous plants and several species of grasses. The dominant species include: razor grass (*Paspalum virgatum*), antidesma (*Antidesma ghaesambilla*), carrion crow bush (*Senna alata*), morning glory *(Ipomoea hederifolia)*, moko moko (*Montrichardia arborescence)* and tanner grass (*Brachiaria radicans*). These are all arable weeds and are quite common.

Aquatic vegetation in the drainage canals include: alligator eye (*Salvinia auriculata*), water lettuce (*Pistia stratiotes*), alligator spoon *(Eichhornia crassipes*), water poppy (*Hydrocleys nymphoides*), and the water grasses, *Paspalum repens* and *Luziola subintegra.*

Fauna such as crickets (*Gryllus spp*.), butterflies, wasps, flies, beetles, and birds such as cattle egret (*Bubulcus ibis*), kiskadee (*Pitangus sulphuratus*), and yellow plantain *(Icterus nigrogularis)* are present in

[28] The Guiana Shield region covers 2.5 million km^2. It extends from Colombia in the west to the Brazilian state of Amapá in the east, including the Venezuelan states of Delta Amacuro, Bolívar and Amazonas, all of Guyana, Suriname and French Guiana, and continuing into the Brazilian States of Pará, Roraima and Amazonas. The region contains 10-15% of the world's fresh water reserves and an extremely rich diversity of plants and animals, most of which are unique to this region. (www.guianashield.org)

the general area. The drainage canals contain fishes such as hassar *(Hassar orestis)* and patwa (*Cichlasoma bimaculatum)*.

There are no threatened or endangered species on the project sites and no protected area is located in close proximity. However, a mangrove reserve is located in close proximity to the Nabaclis area at the foreshore of the adjoining village of Golden Grove.

4.3 Socio-Economic Environment[29]

Human habitation and its accompanied economic activities along the project area and throughout Guyana's coast began during the 17th Century. This resulted from an ingenious engineering alteration of the natural environment through the empoldering process, as described in Section 4.1.4. In the mid-1700s, Europeans settled on the coast where they created plantations which were worked by African slaves. The main crops were coffee, cotton, and sugar, the last of which soon became the main crop. It was during this era of Dutch and British occupation that large blocks of lands were given to proprietors as plantation lands. The development of these plantations is perhaps the triggering force of the evolution of coastal settlements in Guyana, which took shape after the abolition of slavery in 1834 into a more village like setting. It was during this period of emancipation that saw the introduction of what is known as the 'Village Movement', whereby groups of ex-slaves pooled their saved earnings and purchased plantations from European owners. Under the village movement, front lands were sub-divided for residential purposes.

After the village movement, land settlement along the project areas and throughout Guyana's coast advanced as a means encouraging the growth of agricultural communities. Land settlement schemes were developed and lands were offered to indentured Indian labourers who had completed their period of service in Guyana instead of a return passage to India. Moreover, some plantations were also bought by individuals and became private estates. Other estates remained as sugar plantations under the ownership of Bookers and, after the nationalization during the 1970's, Bookers land came under the ownership or GUYSUCO. Today, the settlement pattern along the project area and throughout Guyana's coast is considered to be a mixture of linear or ribbon settlements and nucleated settlements. However, the areas to be served by the proposed project can be considered nucleated.

4.3.1 Administration and Governance

Administrative Region # 4 consists of the capital city Georgetown, suburban settlements and rural villages. Georgetown is governed by an elected Mayor and City Council. The suburban settlements are grouped with the neighboring villages into its fifteen NDCs which then constitute the RDC. The NDCs along with the Georgetown Municipality can be observed in figure 7. The RDC of Region # 4 is governed by a Regional Chairman who reports to the Ministry of Communities. The RDC also administers health care and local governmental functions at the village level.

The headquarters of the Guyana Police Force is located in Georgetown and there are nine Police Stations and seven Police Outposts responsible for maintaining law and order in addition to a Guyana Defense Force Headquarters at Base Camp Ayanganna and multiple Fire Stations including the Guyana Fire Service Headquarters. Region # 4 also houses a major prison in Georgetown holding short term and minor offenders of the law.

[29] Data extracted from Population & Household Census 2002.

Region # 4 has one Amerindian Village: St Cuthbert's Mission that is located in the white sand region approximately 30 kilometer away from the proposed road alignment. This village is governed by a village council.

The administration of the lands in the project area falls directly under the jurisdiction of the Guyana Lands and Surveys Commission (GLSC).

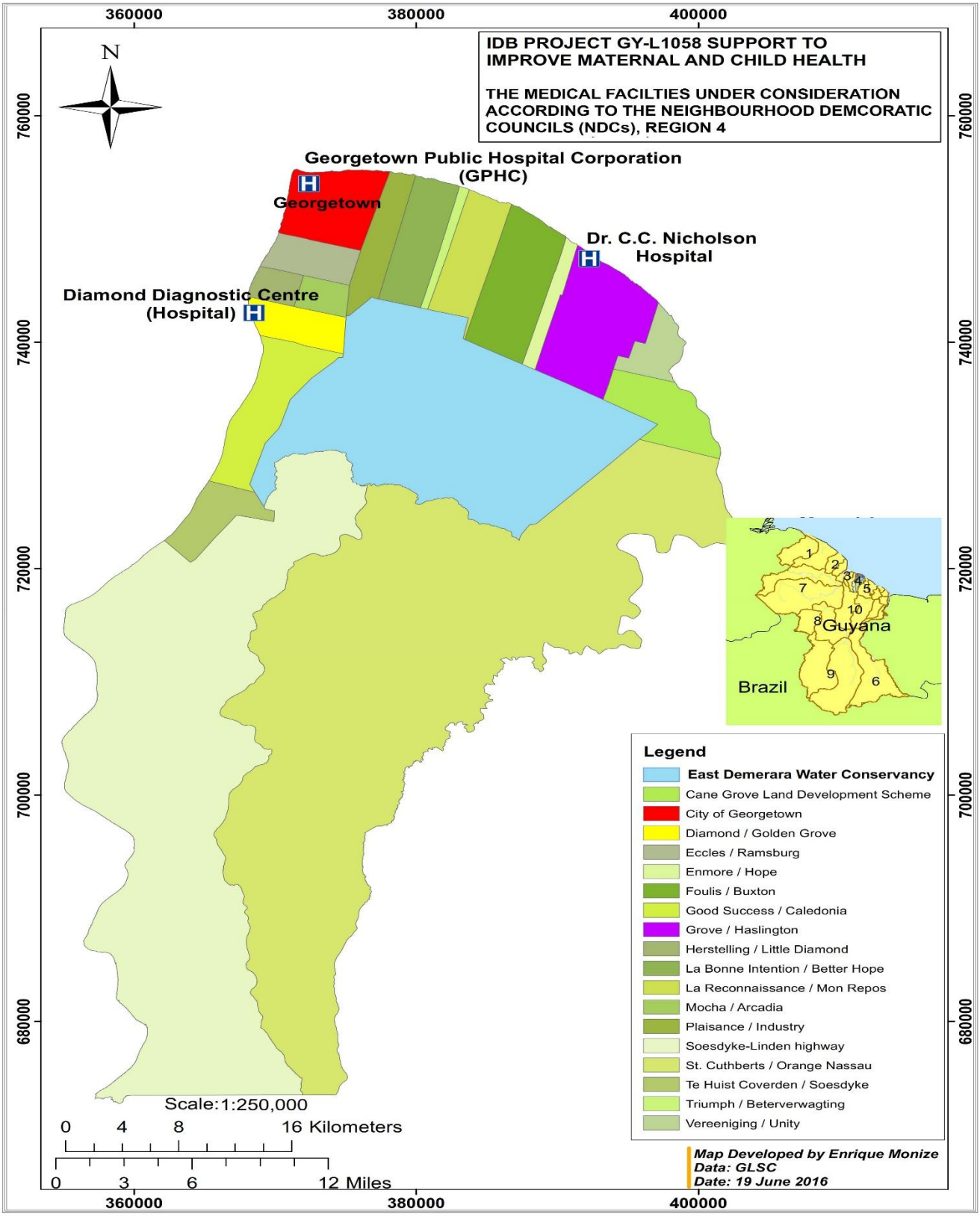

Figure 7: Neighbourhood Democratic Councils in Region 4

4.3.2 Land Use

Most activities within Guyana are concentrated on the coast where approximately 90 percent of the country's population lives and which comprises only approximately 7.5 percent of the country's total land area. The coastal area serves as the political, administrative and commercial centre of Guyana. The main coastal economic activity is agriculture.

The coastlands have 590 km of paved roads linking areas from Crabwood Creek on the Corentyne Coast to Charity on the Essequibo Coast. A large portion of these roads are in Region Four where most of the roads are paved. Navigable waterways extend to 1,077 km including the Demerara which is in close proximity to the project areas, and the Berbice and Essequibo Rivers. Historically Georgetown was the main shipment center and remains the main port today. There is one international airport the Cheddi Jagan International Airport at Timehri and one regional airport at Ogle.

The wider project area consists of the main populated areas of the country, including the Capital City Georgetown, and communities along the East Coast and East Bank Demerara. The area is also the center for administration and governance of the country and consists of the main industrial and commercial activities. The land use pattern of the wider project area can be observed in figure 8.

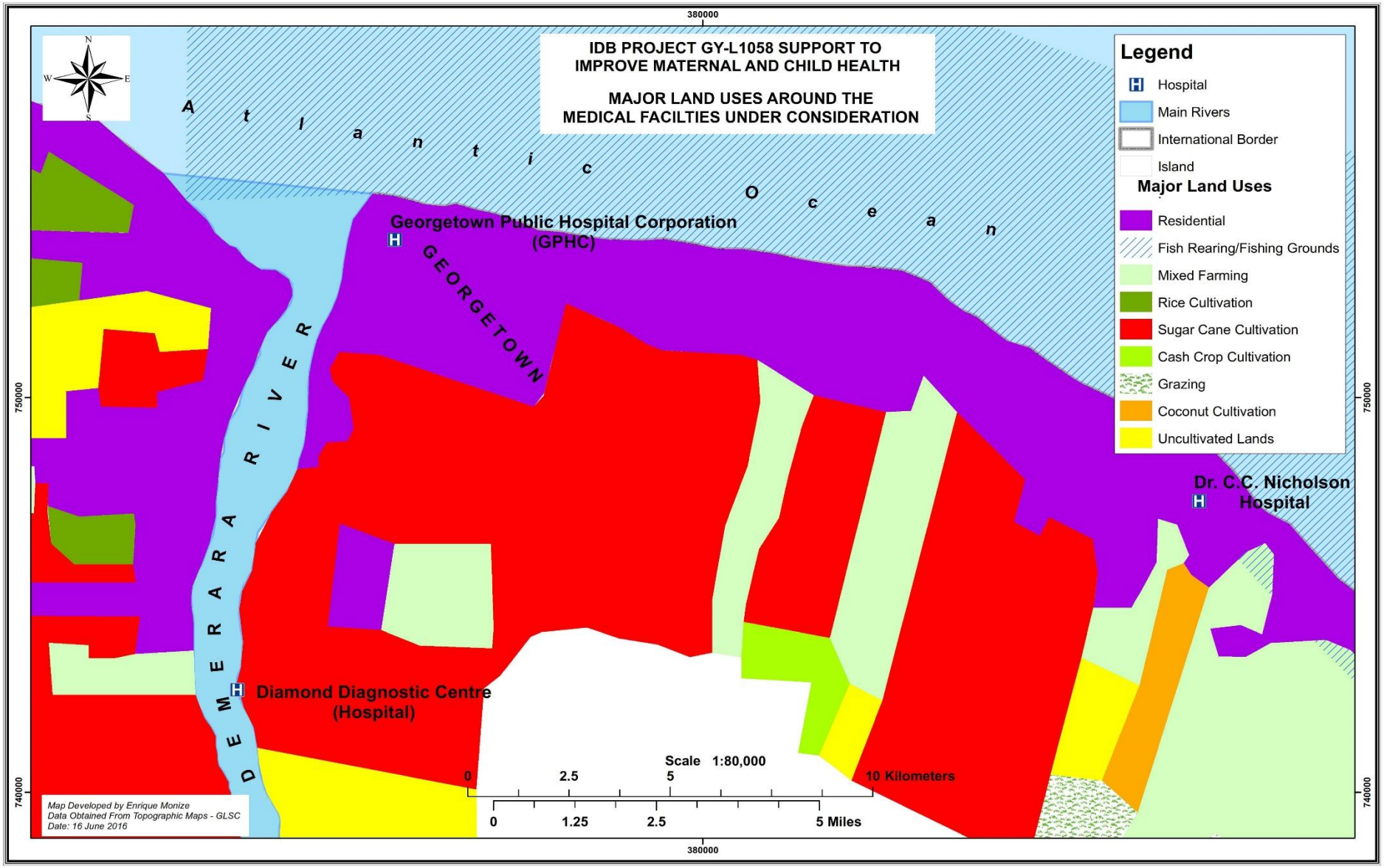

Figure 8: Major Land Uses around the Medical Facilities

4.3.3 Population/Demography

The population of Guyana in 2012 as released by the Preliminary Report of the Guyana Population and Household Census 2012 is 747,884 persons. The reported population is 3,339 persons less than the 2002 census, a decrease by 0.4%. Region # 4 recorded a population of 313,429 or 41.9% of the total population with a population density of 140.4 persons per square kilometre. This vastly outnumbered the other administrative regions in terms of persons per square kilometer. The population of Georgetown in 2012 was 134,497, decreasing by 12% from 2002. The decrease on population can be based on two main factors, emigration and rural migration to the new housing areas being developed within the region. It is therefore not surprising that although Georgetown had a population decrease of 12% from 2002 Region # 4 experienced a growth of 1% over the same period mainly due to rural to urban migration and migration to the suburban housing schemes. The population distribution along the wider project area can be observed in figure 9.

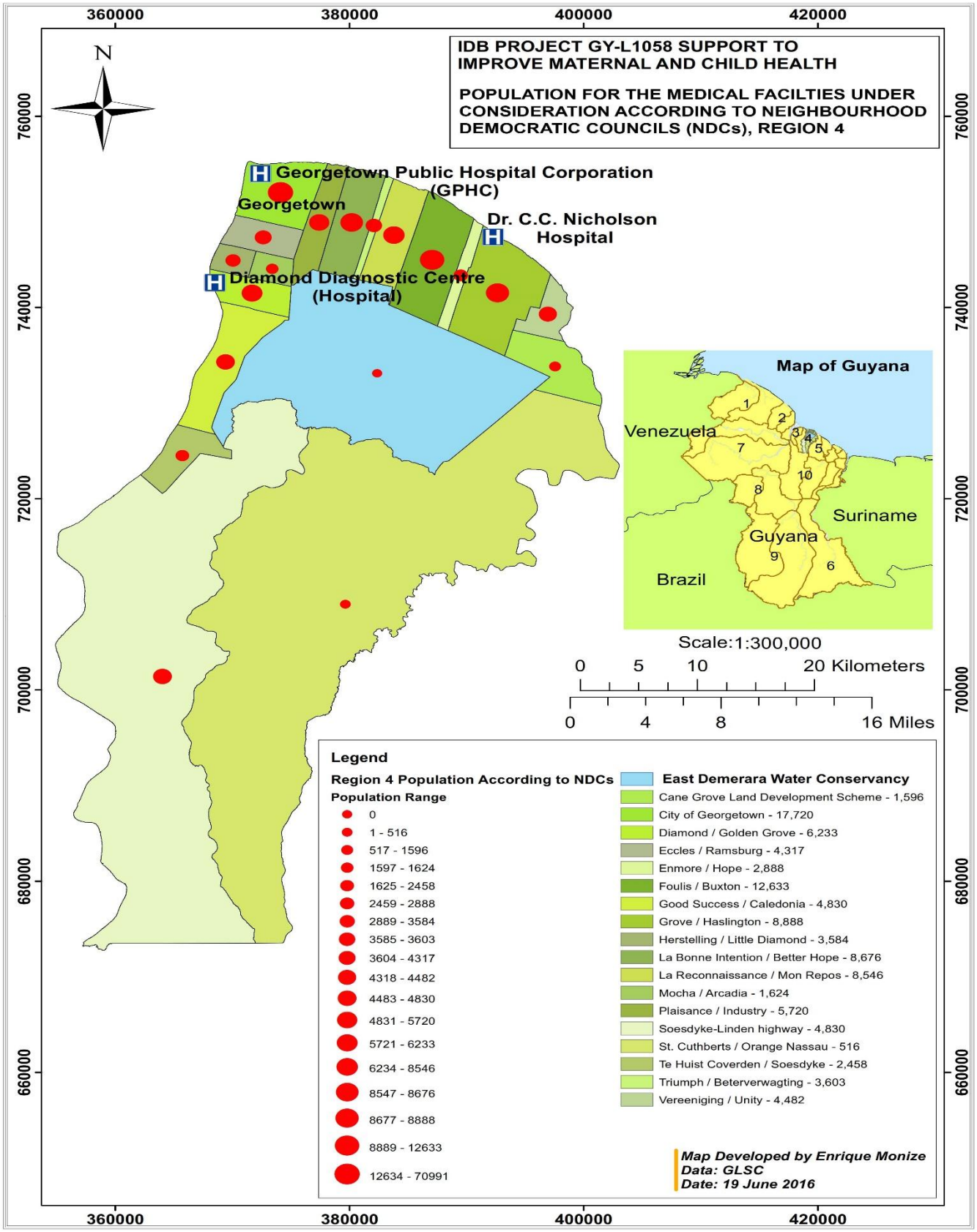

Figure 9: Population around the Medical Facilities

4.3.4 Health Care

Guyana has enhanced the health status of its population over the last 20 years by improving infant mortality rate and life expectancy. World Bank data suggest the following: life expectancy for males at birth was 59 years in 1992 and 63 years in 2011, for females it was 66 years in 1992 and 69 years in 2011; the crude death rate was 10 per 1,000 persons in 1992 and 7 per 1,000 persons in 2011; infant mortality per 1,000 live births was 29 in 2011 and 44 in 1992[30].

Within Region # 4 are most of the health care institutions in the country and the types are shown in table 4. In 2009, there were sixteen hospitals and a Rehabilitation Centre in this region increasing from ten in 2007. Medical supplies are provided at the Government health centres for various maladies. The Private Hospitals have their own clinic that provides a wide variety of drugs. Privately owned pharmacies are numerous in Georgetown and throughout the NDCs providing drugs at competitive prices. In addition to pharmaceuticals there is a rich cultural heritage of folk medicine known as "bush medicine" practiced in the rural villages.

Table 4: Health Institutions in Region 4

Health Institutions	2007	2009
Health Posts	12	8
Health Centers	38	40
District Hospitals	0	1
Regional Hospitals	0	1
Specialist Hospitals	1	0
Private Hospitals	7	6
National Hospitals	1	8
Company Hospitals	0	0
Rehabilitation Centers	1	1
Geriatric Hospitals	1	1
Hospital Beds	560	638

Source: Statistical Bulletin Volume 21 No. 1, 2014 & Volume 19 No. 2, 2010

4.3.5 Education

Education levels are generally high in Region # 4, corresponding to the number of educational institutions existing in the region and the relative ease of access to these institutions. In 2012, the Region had 64 nursery, 54 primary, 35 secondary and 4 technical/special schools for a total of 160 educational institutions. The region is also home to the national university: the University of Guyana. There are also three other universities offering undergraduate and graduate programs in the region. The level of education has increased with each generation with the current generation set to complete secondary education with a greater percent completing tertiary education.

4.3.6 Employment

Employment in Region # 4was distributed over the ten major industries in 2002. The manufacturing industry accounted for the most employees while electricity, gas & water accounted for the least. Manufacturing was the next highest employer. Followed by construction and agriculture. It was expected

[30] Sourced from article by Prem Misir on Health Care in Guyana published in Social Medicine, Volume 9, Number 1, February 2015.

that the industrial base of the region will reflect a higher portion of workers in that category as opposed to agriculture dominating for most of the country.

4.3.7 Utilities

The health facilities areas are well serviced through the provision of the necessary utilities and other services. Specifically the following are provided:

- Electricity (Guyana Power and Light - GPL)
- Water (Guyana Water Incorporated - GWI)
- Phones (Guyana Telephone & Telegraph - GT&T & Digicel)
- Internet (GTT and other private providers)
- Roads (the NDC is responsible for repairing all internal streets & roads while the Ministry of Public Infrastructure is responsible for the East Bank and East Coast Demerara Public Road as well as some streets in Georgetown while the City Council has responsibilities for select roads)

4.3.8 Cultural and Anthropological Environment

Administrative Region # 4 is believed to be rich in archeological history due to inhabitation by various indigenous groups and by Europeans. The Region was inhabited by the Amerindians, followed by the Dutch settlers and then by the English with labour from African slaves. Migrant populations including the Portuguese, Chinese and Indians later settled after working on the sugar plantations for periods of indentureship, establishing business and pools of labour for various estates in Demerara. However, there are no known archaeological sites or artifact discoveries in proximity to the targeted health facilities. All of the areas are also disturbed by previous or recent human activities, including infrastructure, agriculture activities, commercial activities and human settlements.

5. Description of Environmental Management at Health Facilities

This chapter provides an overview of the health facilities being considered under the project and describes current environmental management systems and practices. The facilities currently under consideration are the GPHC, the Diamond Hospital and the CC Nicholson Hospital.

5.1 Georgetown Public Hospital Corporation

Figure 10: Georgetown Public Hospital Corporation

The Georgetown Public Hospital Corporation is Guyana's largest hospital and is located at New Market Street, Georgetown within a commercial/residential district. The GPHC has instituted some measures to regarding environmental management and health and safety at the facility. These measures are described below.

Health, Safety and Environmental Administration
The GPHC has in place two Occupational Health and Safety (OH&S) Officers who oversees health, safety and environmental (HSE) compliance. The OH&S Officer falls under the Quality Control Department. Inspections are done throughout the facility on a monthly basis, including both clinical and non-clinical areas. A checklist is utilized to guide monitoring and areas monitored include fire safety, waste management, use of personal protective equipment and gear (PPE), ventilation, etc. A monthly inspection report is also prepared after each monitoring exercise and this is shared with management.

Orientation is done for all staff. There is a standard presentation for regular staff and a more details one for doctors and nurses. This is not depending on needs and as requested.

While monitoring is being done, specialized monitoring equipment such as air quality testing meter are lacking. The OH&S Department may require strengthening by adding to the complement of staff as the current OH&S personnel is responsible for serving approximately 2,000 GPHC staff. More training, on a continuous basis for GPHC staff was recognized as a need as well as capacity building for OH&S personnel.

Waste Management
Waste collection is segregated at the GPHC in terms of non-infectious waste and infectious waste and these waste types are managed separately. Non-infectious waste is collected in bins (Annex H-1) from which it is transferred to a waste collection skip (Annex H-2). It is then taken to a waste compacter where

it is shredded and compacted. This waste is then collected by a private contractor for disposal on a daily basis.

Infectious waste consisting of sharps and biomedical waste are managed separately. Sharps are collected in specialized sharp containers, shown in Annex H-3. However, it was observed that the containers are not always utilized as is prescribed, with some containers filled beyond capacity (Annex H-4). Other bio-hazard wastes are collected in red bags. All infectious waste are collected and stored at a waste holding area (Annex H-5). The waste holding area is enclosed and equipped with air conditioning to ensure waste is stored in a proper manner. All infectious waste are treated and shredded by a hydroclave (Annex H-6) located at the GPHC. Medical waste from other health facilities within Administrative Region 4 is also treated by the GPHC hydroclave and collected from these facilities by the GPHC Biohazard truck (Annex H-7). After treatment the remaining material is disposed of as non-infectious waste. Body parts are stored at the mortuary and are transported to be buried at the Hope Cemetery.

Wastewater
There is no treatment of wastewater at the GPHC. All wastewater, including sewage, is disposed of into the Georgetown Sewage System.

Sewage
Sewage from GPHC facilities are linked into the Georgetown Sewage System.

Ventilation
There is adequate ventilation within the GPHC facilities. There is in place a built-in central air system which is equipped with extractor fans to provide ventilation.

Noise
Power generators are the major source of noise at the GPHC. There are three large and two small generators at the north block of the hospital and two other generators at the south block. These generators are for back-up power since power is sourced from the Guyana Power and Light Company (GPL). The three large generators (Annex H-8) are older and are not equipped with the required sound proofing and when operational they generate a significant amount of noise. However, a newer generator (Annex H-9) is currently being installed which is equipped with the necessary noise abatement measures. Once this is operational it is planned to rehabilitate the existing generators, including installation of noise abatement measures.

Fuel Management
Fuel for the generators is stored within a main tank and a few smaller tanks. Approximately 40,000 liters is stored onsite. The main tank is housed within a contained impervious area (Annex H-10). However, the smaller tanks are not within containment. In addition, minor fuel spills (Annex H-11) were observed outside the containment area, with the likely cause being either improper handling or leakage in the pipes.

Protective Gears
Workers are usually outfitted with the required protective gears, especially those persons involved in the handling of waste. Gears provided include respirators, gloves, overalls, boots (puncture proof), etc. However it was reported that adequate safety gears are not always readily available.

Disaster Risk
The GPHC compound is at risk of flooding, depending on the situation of the external drains. Flooding occurred in the past due to the external drains being clogged. However measures have been put in place such as floor raising and curb walls in vulnerable buildings. Since the external drainage system was

cleared there has been no flooding. Vector control is usually done in the drainage system within and around the compound.

Emergency Response
The GPHC has a response mechanism in place to respond to fire. Fire safety training is usually conducted departmentally in collaboration with the Guyana Fire Service though none has be done for 2016 as yet. Fire drills are also conducted but are limited to non-clinical areas. Fire extinguishers (Annex H-12) are in place at fire points throughout the facility. These are checked/serviced annually. Fire hydrants (Annex H-13) are located within the compound and were recently restored and are now operational. Fire alarms are also installed within the newer buildings.

Facility Maintenance and Management including Sanitation
The Facilities Management Department of the GPHC is responsible for general maintenance and which includes carpentry, plumbing, electrical. There is a dedicated sanitation team which is responsible for weeding, cleaning of drains including perimeter drains and who work with a monthly schedule and as needs arise. Generally, the facilities including the buildings and compound are in good sanitary conditions.

HSE Signage
There are limited signs relating to HSE onsite. Additional signage could be installed focusing on littering, flammable material storage, biohazard waste storage, etc.

5.2 Diamond Hospital

Figure 11: Diamond Hospital

The Diamond Hospital is located at Plantation Diamond, East Bank Demerara, within a commercial/residential area. It was commissioned in 2007 to provide health care for the growing population along the East Bank Demerara corridor. The safety and environmental situation at the Diamond Hospital is described below.

Health, Safety and Environmental Administration
There is no person employed to address occupational safety or environmental management at the Diamond Hospital. However, the Medical Superintendent normally oversees this responsibility. There is an infectious disease nurse on staff who assists in certain aspects such as overseeing waste management.

There is no established protocol for the training of staff on HSE matters. Some training is conducted on an ad-hoc basis, for example training on the cleaning of the hospital.

Waste Management
Waste collection at the Diamond Hospital is segregated in terms of non-infectious waste and infectious waste and these waste types are managed separately. Non-infectious waste is collected in bins (Annex H-15) from which it is transferred to a waste collection skip (Annex H-16). It is then collected by a private contractor for disposal every two days.

Infectious waste consisting of sharps and biomedical waste are managed separately. Sharps are collected in specialized sharp containers, shown in Annex H-17. However, it was observed that the containers are not always utilized as is prescribed, with some containers filled with other waste types (Annex H-18), resulting in the mixing of wastes. Other biomedical wastes are collected in red bags (Annex H -19). However, currently, due to a shortage of garbage bags it was observed that red bags are also being utilized to collect regular garbage, as is shown in Annex H-14. This situation could result in the mixing of waste as has happened in some instances. All infectious waste are collected and stored at a waste holding area (Annex H-20 and Annex H-21). While the waste holding area is secured it is not fully enclosed and the necessary warning signs are not in place. All infectious waste are collected every two weeks by the GPHC biohazard collection truck and sent to be treated and shredded by the hydroclave at the GPHC. Medical waste from other health facilities within the region is also stored at the Diamond Hospital. However, no waste register is maintained and there may be the need for more frequent pick up of this waste. Expired pharmaceuticals are limited but are returned to the Materials Management Unit of the Ministry of Health for disposal.

Wastewater
There is no system in place for the treatment of wastewater at Diamond Hospital. All wastewater is discharged into the drainage system.

Sewage
Septic tanks are provided for the collection of sewage and these are emptied by a private contractor when filled.

Ventilation
There is the need for improvement in ventilation at the Diamond Hospital. The air conditioning systems are not functioning effectively with many non-working ACs. In addition, there are no extractor fans or air vents in the laboratories.
Noise
There is only one small power generator (50 kVa) at the hospital which is the major source of noise. However, this generator (Annex H-22) is used for back up purposes only and does not generate significant noise levels. The hospital plans to acquire a larger generator (350 kVa) in the near future.

Protective Gear
While workers are usually outfitted with the some protective gear adequate gears are not always available for those persons involved in the handling of waste.

Disaster Risk
There was no severe flooding event at the hospital since its establishment. However, there is water accumulation within the compound during excess rainfall, as is shown in Annex H-23. Water accumulation also occurs in some rooms within the hospital (Annex H-24). Improvement in the drainage system and other measures (floor raising, curb walls etc) within the facility itself may be necessary to prevent this situation.

Emergency Response
At the Diamond Hospital there is no Emergency Response Plan and training is not conducted in this regard, including fire drills. The Diamond Fire Station is located in close proximity but onsite there are no fire alarms or smoke detectors. A few fire extinguishers (Annex H-25) are in place at designated fire points. However, these are not inspected or serviced regularly, as can be seen in Annex H-26.

Facility Maintenance and Management including Sanitation
The NDC assists with sanitation, including weeding of the compound. A handy man is also on staff who addresses sanitation on a daily basis. However, there is need for improvement of sanitation within the building and compound at Diamond Hospital.

Within the building there are moulds growing on the walls due to moisture created by the air condition system line network within the walls. This situation is prevalent in several areas within the building and can be observed in Annex H 27. Also, it was reported that the toilet system also backs up constantly (Annex H-28) and which could be related to a design issue. In addition, there are risks posed by unstable voltage, faulty ACs as well as exposed electrical wiring from non-working lights as shown in Annex H-29 & 30. Maintenance of the facility is done by the RDC of Region 4. However, there is no fixed schedule. There is need for urgent intervention regarding the maintenance of the facility especially regarding the electrical, plumbing and air conditioning systems.

In the compound evidence of littering was observed, as is shown in Annex H-31. Also there are many old and derelict equipment scattered around the compound as well as old construction materials, vegetation, etc. which require clearing. This situation can be observed in Annex H-32.

HSE Signage
There are some signs relating to HSE installed onsite as is shown in Annex H-33. However, these need to be improved and additional signage should be installed in areas such as the waste holding shed, etc.

5.3 CC Nicholson Hospital

Figure 12: CC Nicholson Hospital

The CC Nicholson is a much smaller hospital located at Nabaclis, East Coast Demerara. The hospital was established in 1994 by the London-based Cyril Charles Nicholson Foundation, and was upgraded by the GOG in 2003 to provide residents of nearby communities an alternative to travelling to Georgetown for

medical treatment. The hospital, which is located within a residential area, was previously a 24 hours facility but is currently opened 7 days per week from 08:00 hrs to 21:00 hrs. Efforts are being made to recommence 24 hours operation. Services currently offered include treatment in chronic disease, maternity, minor surgery, clinical and ambulance services. Plans are in place to install a maternity centre, trauma room and a small laboratory and x-ray facility. The hospital currently treats an average of 400 patients per month. HSE practices at the CC Nicholson Hospital are described below.

Health, Safety and Environmental Administration
There is no person employed to address occupational safety or environmental management at the CC Nicholson Hospital. However, a nurse on staff is assigned the responsibility for sanitation. There is no established protocol for the training of staff on HSE matters.

Waste Management
Waste collection at the CC Nicholson Hospital is segregated in terms of non-infectious waste and infectious waste and these waste types are managed separately. Non-infectious waste is collected in bins (Annex H-34) from which it is transferred to a waste collection skips (Annex H-35). It is then collected by the Neighbourhood Democratic Council for disposal. However, collection is not as frequent as is required.

Infectious waste consisting of sharps and medical waste are managed separately. Sharps are collected in specialized sharp containers, shown in Annex H-36. Filled containers are stored onsite (Annex H-37) until a significant quantity is accumulated. It is then transported to the Diamond Hospital after which it is taken to the GHPC for treatment and shredding at the hydroclave.

Other medical waste is collected in red bags and were previously burnt in a makeshift incinerator onsite (Annex H -38). However, this practice has since been reduced due to the complaints of nearby residents. The waste is still being burnt but in smaller quantities. It was recognized that this practice needs to be discontinued and that such waste also be disposed of at the GPHC hydroclave. Expired pharmaceuticals are stored onsite (Annex H-39) and once a significant quantity is accumulated these are taken to the Food and Drugs Analyst Department for disposal.

Wastewater
Wastewater is discharged into a soak away system (Annex H-40) at the CCH Nicholson Hospital. The compound drains into the neighbourhood drainage system.

Sewage
Two septic tanks (Annex H-41) are provided for the collection of sewage and these are emptied by a private contractor when filled.

Ventilation
There is adequate ventilation within the buildings at the hospital.

Protective Gears
While workers are usually outfitted with protective gears adequate gears are not always readily available.

Noise
There is no noise generating equipment at the site. Currently there is no back-up power generator.

Disaster Risk
There is generally good drainage within the compound and the site and surrounding areas rarely floods. However, there may be the potential for flooding from major or extreme flooding events.

Emergency Response

At the CC Nicholson Hospital there is no Emergency Response Plan and training is not conducted in this regard, including fire drills. A few fire extinguishers (Annex H-42) are in place at designated fire points. However, these are not inspected or serviced regularly.

Facility Maintenance and Management including Sanitation

The RDC for Region 4 has overall responsibility for the maintenance of the facility. A nurse on staff is assigned the responsibility for sanitation. Good sanitation practices were observed with both the building and the compound being well kept.

HSE Signage

There are some signs relating to HSE installed onsite as is shown in Annex H-43. However, additional signage could be installed.

6. Environmental and Social Impacts and Environmental and Social Management Plan

6.1 Introduction

The project, according to IDB classification, is Category C and likely to cause minimal or no negative environmental and associated social impacts. Notwithstanding this, the IDB has requested that an ESA and ESMP be done to assess the potential negative environmental and social impacts associated with the infrastructure rehabilitation interventions and to identify measures of prevention and mitigation actions.

The ESA and ESMP are essentially safeguard instruments with the principal objectives to:

- Prevent or minimise potential adverse environmental and social impacts due to the project activities and components;
- Minimize human risk during the construction and rehabilitation works;
- Ensure environment, health and safety measures are implemented throughout the project's construction activities; and
- Enhance environmental management at the health facilities.

At this stage, final determinations on the scope of the project are still to be made. However, for the purposes of the ESA and ESMP, the project's activities relating to infrastructure improvement and equipment are considered as follows:

- A remodeling of the Diamond Hospital on the East Bank of Demerara to include obstetric services or the construction of a second floor to the Hospital to include obstetric services.
- Minor renovations at the old ward of GPHC (for example, removal of a wall to increase the post-delivery ward).
- Minor renovations to Regional Hospitals including the CC Nicholson Hospital.
- Financing of equipment and supplies for GPHC, Diamond Hospital, other Regional Hospitals and the CC Nicholson Hospital.

6.2 Environmental and Social Impacts

This section describes the potential impacts on the bio-physical and social environment of the health facilities being considered, and recommends mitigation measures to avoid, minimize or mitigate the potential negative impacts.

The impact assessment identifies and describes project's impacts at the design and construction phases. Consideration is also given to impacts associated with the operation of the health facilities. Impact identification and evaluation was conducted by adopting a systematic approach and included:

- Characterizing the baseline conditions of the health facilities to establish and assess the most likely environmental effects of the project;
- Identifying the source of impacts and the impacts themselves that are likely to be generated by the project. This was achieved through professional judgment, field work, desk top analysis and review of relevant literature consultations with project stakeholders;
- Rating impacts to determine impact significance; and
- Recommending appropriate mitigation and enhancement measures.

The significance of impacts was assess and rated using a simple impact rating matrix system that is based on the severity of impact and the likelihood of the impact occurring. This is outlined as follows:

Loc – Localised	Ex – Extensive	ST – Short Term
LT – Long Term	Av. – Avoidable	Un – Unavoidable
Sig. – Significant	Insig. – Insignificant	M. – Mitigable
UM – Unmitigable		

The following are the major environmental and social impacts that could result from the rehabilitation/refurbishment component of the project and the operation of the facilities.

6.2.1 Planning Phase

Physical Restrictions on Building Space and Area

The physical space available for remodeling and expansion could be restrictive depending on the interventions planned. This is particularly applicable for the Diamond Hospital.

6.2.2 Construction Phase

The impacts described herein would apply mainly the facilities where the remodeling and rehabilitation works are expected to be significant and which is likely to be at the Diamond Hospital.

Physical Environment

Soil Erosion and Degradation
There is the risk of soil erosion and degradation from vegetation clearing, soil compaction, increased runoff during rainy periods and accidental discharge of hazardous materials such as fuel, oils or lubricants. While it may be localized, if not addressed it could lead to environmental degradation.

Fuel, Lubricants and Chemicals Contamination
During construction there is the potential risk to human health and the environment from the transportation, handling and storage of fuel, lubricants and chemicals such as paint etc.

Improper Waste Management
The rehabilitation activities will generate waste which, if not managed properly, can result in soil and water contamination, contribute to ill health, and affect the aesthetics of the area. Waste likely to be generated includes garbage which usually consists of a mix of bottles, bags, cans, boxes, styrofoam, plant residues, excess food and paper. Liquid waste will also be generated including sewage waste and wastewater from sanitary facilities and work areas. Hazardous waste likely to be generated includes used batteries, waste oil, filters, oil containers and contaminated soils. Construction wastes could include excavated soils and cement bags, paint tins, aggregate and concrete rubble, metal, broken glass, timber waste and debris.

Waste piles often present an eye sore and can affect the aesthetic of any environment. The improper disposal of waste can result in mal-odour and attraction of vermin and disease vectors. In addition, improper storage and disposal of waste can also lead to water and soil contamination.

Noise
Significant noise and vibration can be caused by machines, site vehicles, pneumatic drills etc. The impact of this can be exacerbated due to the presence of close-by receptors (health facility staff, patients and visitors) as well as nearby residents.

Ambient Air Quality deterioration due to Dust
Air quality could be impacted by emissions from vehicles, earthmoving equipment and released particulate matters. Demolition to modify the existing building could also lead to considerable levels of dust. Poor air quality could affect asthmatic patients as well as health facility workers and visitors and with the risk of either minor or severe health impact depending on the level and duration of exposure. This may be particularly applicable to the Diamond Hospital.

Water Pollution and Impeded Drainage
Contamination and impeding of the internal and external drainage can result from construction activities and the way waste is disposed and construction materials stored. Also contributing to this could be discharges from sewage facility and rainwater run-off.

Social Environment

Disruption of Utilities Services
Construction activities could cause temporary disruptions of utility services such as electricity, communication and water to the health facilities and wider area including nearby residents.

Temporary Disruption of Healthcare Services
Since the health facilities under renovation will not be closed, they could experience shortages of working space. This may necessitate moving patients or equipment from one area or room to another and could lead to temporary disruption of health care services. Depending on the extent of the rehabilitation activities, it could necessitate temporary closure of the health facilities and relocation of patients and staff e.g construction of a second floor at the Diamond Hospital.

Increased Risk of Traffic Accidents
Construction activities could result in increased traffic and congestion around the health facilities and within the nearby communities. In some areas, heavy trucks in small access roads and storage of construction materials by the roadside could increase the risk of accidents.

Temporary Visual Intrusions
Construction materials, work zones and contractors work areas could be visually intrusive especially since the health facilities will continue to be accessed by the public.

Occupational Health and Safety Risks to Construction Workers
The health and safety of construction workers could be at risk during construction activities. The movement of trucks, operation of equipment and machinery, and construction activities could impact the health and safety of workers by increasing risk to accidents and injuries.

Risk to Patients, Health Facilities Workers and Visitors from Construction Activities
Refurbishment work undertaken in the same or nearby buildings with patients has potential to cause inconvenience or even injuries to the patients, health facility workers and visitors to the facility. Potential hazards could include falling or tripping on materials, injury from falling or flying debris during demolition, and dust nuisance.

Social Misdemeanor by Construction Workers
Undesirable behaviour could occur by construction workers and aimed at health facility personnel and visitors. Additional issues such as inappropriate disposal of solid waste and use of alcohol could take place on-site.

6.2.3 Operation Phase

The impacts identified herein are related to the operation of the health facilities and current practices.

Physical Environment

Air Pollution from Onsite Incinerators
Incineration of increased amounts of waste from health facilities which utilize open incinerators would result into localized pollution of air. Also, emissions could degrade air quality for nearby residents. This occurrence is very likely if health facilities expand operations and increase activities while continuing current waste disposal practices of open burning e.g at CC Nicholson Hospital.

Water Pollution from Wastewater
There is currently no treatment of wastewater generated by health facilities. Continuation of this practice can result in contamination of receiving water bodies where there is no central sewage system as in the case of the GPHC.

Social Environment

Risks from the Handling and Management of Biomedical Waste
While there are systems in place to collect and manage biomedical waste there is room for improvement which would reduce risks to patients, health facilities personnel and the public in general.

Occupational Health and Safety Systems
Across the health facilities the basic protocols and procedures are in place in keeping with international guidelines (WHO, PAHO etc.) and are generally observed. The key issue is the extent to which compliance is monitored and enforced. In some instances the risks are enhanced where there are insufficient materials and PPE and where the responsibility of OH&S is given to an already busy individual who has other responsibilities and is unable to focus on this key area. In other instances the OH&S personnel alone is not sufficient based on the large number of staff at the facility.

Weak Fire Safety and Emergency Response System
Fire extinguishers and firefighting equipment are either not serviced or non-existent in most of the health facilities. This increases the risk in the event of a fire and which could have disastrous consequences.

Noise from Electricity back-up Systems
The majority of health facilities have in place back-up power supply through generators. However, these generators are not suitably housed with the requisite noise attenuation in place. This could lead to noise nuisance to persons at the facilities as well as nearby residents.

Security Risk at Health Facilities
While all facilities have security presence, there is concern from health facilities personnel to have this improved due to recent incidents of unruly behaviour towards health facilities personnel by both patients and visitors. There is also a need for internal monitoring of activities and patients within the facilities for which surveillance is needed.

Insufficient Disaster Management Arrangements
The principal disaster risk facing health facilities in coastal Guyana is that of flooding and fire. The risk level varies depending on location and facility layout and design. Even though there has not been thus far any reported major flooding incidents or fires, the threat remains and most facilities have not undertaken a disaster risk assessment or developed and adopted formal response mechanisms.

6.3 Environmental and Social Management Plan

The Environmental and Social Management Plan as outlined in Table 5, describes recommended mitigation actions to address the environmental and social impacts identified. The mitigation actions for construction will apply particularly where significant remodeling and rehabilitation works will be done and which is likely to be at the Diamond Hospital.

Table 5: Environmental and Social Impacts and Mitigation Measures

Impact Description	Impact Significance	Mitigation/Enhancement Measures	Responsibility
ENVIRONMENTAL IMPACTS			
Planning Phase			
Physical Restrictions on Building Space and Area	Loc; LT; Un; Sig; M	▪ For GPHC and CC Nicholson where only minor internal adjustments are being considered. No mitigation is required. ▪ However, for the Diamond Hospital consideration could be given to utilizing the existing building being used for accommodating doctors and to seek alternative accommodation within close proximity to the hospital. Alternatively, a new structure can be accommodated within the compound.	MoPH
Construction Phase			
Soil Erosion and Degradation	Loc; ST; Av; Sig; M	▪ Soil disturbance should be limited to areas only where it is absolutely necessary ▪ Adequate drains should be installed in temporary work areas to prevent water accumulation ▪ Areas of exposed soil should be monitored during periods of heavy rainfall ▪ Movement of heavy-duty equipment over open areas should be restricted and controlled and damage to these areas should be repaired as soon as possible ▪ Appropriate heavy-duty equipment should be utilised for all works ▪ Soil erosion control measures (e.g. re-vegetation, reseeding of grasses, land preparation etc.).	Contractors
Fuel, Lubricants and Chemicals Contamination	Loc; ST; Av; Sig; M	▪ Fuel should be transported to the construction areas as needed or in small quantities. Small quantities of fuel onsite will minimize the possibility of spillages to occur, and also minimize the impacts if spillages do occur, especially since the construction activities would be temporary and it would not be feasible to construct a facility for fuel storage. ▪ Fuel which will require storage onsite should be placed at a safe distance from the area drains, downwind of the health facility and work areas and should be placed higher than ground level to detect any leaks. ▪ Ensure necessary preventative measures such as adequate signage, fire extinguishers and/or sand buckets are placed in and around the fuel storage area. The type of fuel stored in containers should be indicated and the signage should include 'No Smoking' and Highly Flammable'; ▪ When handling fuel, care should be taken to prevent spillage and leaks, especially during off- loading and refueling. All nozzles and hoses should be properly secured and stored away to avoid spills and/or accidents; ▪ During the filling/refilling process drip pans should be placed under the fuel/equipment to prevent any possible contamination and subsequent run off of fuel due to leaks;	Contractors

Impact Description	Impact Significance	Mitigation/Enhancement Measures	Responsibility
		▪ Spill kits should be available in the event of spillages. The kits should be placed in strategic locations that are accessible to key personnel who should be trained in the proper use of these kits through the executions of drills. ▪ Ensure waste oil is collected and properly disposed. Waste oil drained from equipment and machinery should be collected by pans and transferred to storage containers located in a designated area; ▪ Construction workers should be trained on the proper use of spill kits, as well as in the safe handling of fuel and lubricants. A mock spill exercise should be conducted prior to construction activities.	
Improper Waste Management	Loc; ST; Av; Sig; M	<u>Liquid Waste</u> ▪ Sewage will be generated from work sites associated with the construction phase of the project. This sewage should be stored in portable toilets and disposed of by the Contractors securing the services of a sewage waste disposal service. <u>Solid Waste</u> ▪ All solid waste should be disposed of at an approved landfill. Garbage should not be allowed to accumulate onsite and should be disposed of at least twice weekly. ▪ Waste such as paper and cardboard from the work sites, empty plastic bottles, cans, etc. will be generated by construction workers. The waste should be collected in bins placed at strategic points around the working area to be used by workers. The bins should be emptied on a regular basis, or once filled. <u>Hazardous Waste</u> ▪ Waste oil from servicing or oil change of machinery and vehicles should be collected and reused/disposed in a safe and acceptable manner. Currently, in Guyana, there is no facility to recycle waste oil. The Contractors should therefore collect this waste oil and take off-site to EPA recommended entity to be utilized. ▪ Used batteries should be collected and returned to the suppliers to be shipped for recycling. <u>Construction Waste</u> ▪ A designated area should be cordoned off for construction waste. ▪ Such waste should be removed regularly and not allowed to build up. This should be the responsibility of the Contractors. Waste should be disposed of at the Hagues Bosch facility.	Contractors
Noise	Loc; ST; Av; Sig; M	▪ Compliance with the GNBS Standard limits for construction activities of 90dB during the day and 75dB during the night ▪ Ensure noise attenuation devices are installed on all heavy duty equipment. ▪ Heavy duty equipment usage to be minimized. ▪ Ensure that machinery and equipment are working efficiently. ▪ Schedule construction activities to periods when impacts will be less.	Contractors
Ambient Air Quality	Loc; ST; Av; Sig; M	▪ Require the use of dust screens or nets in windows, doorways and ventilators of	Contractors and

Impact Description	Impact Significance	Mitigation/Enhancement Measures	Responsibility
deterioration due to Dust		rooms where demolition or other dusty construction activities are occurring. ▪ Some operations of the health facilities should be relocated and the area handed over to the contractors. This would require removal of patients, personnel, and equipment. ▪ Dry materials for construction such as sand and cement should not be stockpiled for long periods, and should also be covered to prevent particles from becoming airborne; ▪ All vehicles transporting loose materials should be covered to minimize dust emissions; and ▪ There should be no burning of waste onsite.	Health Facility Administrator/ Superintendent
Water Pollution and Impeded Drainage	Loc; ST; Av; Sig; M	▪ Ensure proper supervision of earthworks, controlled and guided maintenance of machinery and use of proper equipment. ▪ Ensure fuel and lubricants are managed and stored as recommended and there is regular monitoring of the fuel storage area. ▪ Install proper portable sanitary facilities for construction workers and to ensure such facilities are maintained and kept in good order. ▪ No dumping of solid waste into internal drains should be allowed. All waste should be managed in accordance with the Contractors Waste Management Plan. ▪ Stock piles of granular construction materials such as sand should be located away from area drains. ▪ Equipment/machinery cleaning and maintenance areas should be located away from drains.	Contractors
Disruption of Utilities Services	Loc; ST; Av; Sig; M	▪ Every effort must be made by Contractors to avoid such disruptions. ▪ For any service disruption that occurs, the utility should be urgently contacted in accordance with the Contractors Emergency Response Plan. ▪ Contractors should have alternative means of such service and not be utlising the facility's utilities e.g contractors having own generator and water tanks.	Contractors and Health Facility Administrator/ Superintendent
Temporary Disruption of Healthcare Services	Loc; ST; Av; Sig; M	▪ Plan pre-construction activities early to identify suitable rooms or adjoining buildings into which to relocate patients or service areas with minimal inconvenience, especially to patients under intensive care. ▪ Contractors shall advise facilities management well in advance concerning access closures, rerouting of pedestrian traffic and interruptions in water, electricity and sewerage services. ▪ Refurbishment should be done in phases so that the entire facility is not disrupted at once. ▪ Where construction is likely to disrupt the entire facility's operation there would be the need to close the facility and relocation patients and staff e.g constructing a 2nd floor at the Diamond Hospital	Contractors and Health Facility Administrator/ Superintendent

Impact Description	Impact Significance	Mitigation/Enhancement Measures	Responsibility
Increased Risk of Traffic Accidents	Loc; ST; Av; Sig; M	▪ Ensure drivers delivering construction materials respect speed limits and avoid parking and blocking roadways. ▪ Construction materials should at no time be stored on the roadside. ▪ Employ safe traffic control measures, including temporary traffic signs and flag persons to warn road users especially when moving equipment in and out of the facility compound.	Contractors
Temporary Visual Intrusions	Loc; ST; Av; Sig; M	▪ Storage areas for construction materials should be cordoned off and materials such as aggregate and sand covered. ▪ Work areas should be screened off and kept tidy and cleared at the end of each work day.	Contractors
Occupational Health and Safety risks to construction workers	Loc; ST; Av; Sig; M	▪ Contractors should comply with all existing national laws and regulations related to health and safety. ▪ Contractors should designate someone with the responsibility of occupational safety, health and environmental management. ▪ Construction workers should be properly oriented to the safety and health rules and guidelines. ▪ Well-equipped first aid kits should be provided at all work sites. ▪ Machines should be operated by competent, licensed and authorized personnel only, and in a manner that does not endanger other workers, staff and visitors at the health facilities. ▪ The Contractor's Emergency Response Plan should be made available to all relevant contractors personnel. ▪ Potable water for contractors workers should be provided. ▪ Portable toilets should be installed on-site. ▪ Appropriate PPE should be provided to employees and should be worn at all times during operation. Gear to be provided should include safety vests, hard hats, respirators, gloves and safety boots where necessary. Rain coats should also be provided and ear muffs where noise exceeds 60dB. ▪ Contractors workers are required to wear safety equipment and protective clothing provided by the Contractors in all working areas and monitoring should be done by contractor's environmental personnel to ensure workers utilise the gears provided. ▪ Safety rules and guidelines should be posted at strategic locations. ▪ Safe access and thoroughfare must be provided on site at all times. Dangerous areas shall be clearly identified with appropriate signs. ▪ Legible warning signs, barriers and signals shall be placed at strategic locations ▪ especially in hazardous areas	Contractors .
Risk to patients, health facilities workers and	Loc; ST; Av; Sig; M	▪ Cordon off areas under construction. ▪ Ensure good housekeeping and clean on a daily basis operational areas to	Contractors

Impact Description	Impact Significance	Mitigation/Enhancement Measures	Responsibility
visitors from construction activities		remove rubble and construction wastes. ▪ Contractor workers to adhere to silent zone requirements and limit verbal noise or other forms of noise during renovation works inside the health facilities. ▪ Employ the use of screens or nets to avoid flying debris and dust.	
Social Misdemeanor by Construction Workers	Loc; ST; Av; Insig; M	▪ As a contractual obligation, contractors will be required to prepare an EMP to implement during project execution and which should outline rules and responsibilities of Contractor personnel.	Contractors
Operation Phase			
Air pollution from onsite incinerators	Loc; ST; Av; Sig; M	▪ Burning of waste should not be done at health facilities. ▪ Consideration should be given for appropriately sized hydroclaves or PAHO approved incinerators for health facilities. ▪ A collection and transportation arrangement should be implemented to take waste from health facilities to the GPHC hydroclave.	MoPH, Health Facility Administrator/ Superintendent
Water contamination from discharge of untreated wastewater	Loc; LT; Av; Sig; M	▪ Consider the treatment or filtering of wastewater prior to discharge.	Health Facility Administrator/ Superintendent.
Risks from the handling and management of medical waste	Loc; LT; Av; Sig; M	▪ Seek to achieve compliance with existing requirements for health facilities management of medical waste as set out in legislation, regulations and guidelines ▪ Ensure health facilities have adequate receptacles (bags, boxes, containers) for storing biomedical waste and sharps. ▪ Sourcing and installation of appropriately sized hydroclaves for health facilities or establish a coordinated and scheduled arrangement for the uplifting of medical waste from these facilities and transport to a central location for treatment and disposal (GPHC). ▪ Improve the facilities for the storage of medical waste at health facilities to ensure it is in keeping with the existing laws and guidelines. ▪ Ensure health facility personnel handling medical waste undergo training and undergo regular orientation. ▪ Ensure PPE are readily available and utilized.	MoPH and Health Facility Administrator/ Superintendent.
Occupational Health and Safety Systems	Loc; LT; Av; Sig; M	▪ Health facilities should have personnel dedicated to OH&S. ▪ Expand the OH&S team based on the number of health facility staff and provide opportunity for training and capacity development of OH&S personnel. ▪ Ensure regular M&E and reporting is done by OH&S personnel. ▪ Ensure appropriate PPE is always available and utilised. ▪ Ensure there is systematic awareness raising, training and orientation of health facility staff on OH&S.	Health Facility Administrator/ Superintendent
Weak Fire Safety and Emergency Response System	Loc; LT; Av; Sig; M	▪ Train staff on fire management. ▪ Monitor and maintain fire extinguishers and other firefighting equipment. ▪ Conduct fire drills on a regular basis.	Health Facility Administrator/ Superintendent

Impact Description	Impact Significance	Mitigation/Enhancement Measures	Responsibility
		▪ Install fire alarms and or smoke detectors. ▪ Develop emergency response procedure and orient staff.	
Noise from electricity back-up systems	Loc; ST; Av; Sig; M	▪ Ensure as much as possible generators are sited downwind of the health facilities. ▪ Generators should be placed in an enclosure which allows for sound attenuation. ▪ Generators should have noise attenuation devices installed.	Health Facility Administrator/ Superintendent
Security Risk at Health Facilities	Loc; LT; Av; Sig; M	▪ Increase the number of security personnel at health facilities and revamp security procedures. ▪ Install cameras within the health facilities which are to be monitored by the Administrator or Superintendent.	Health Facility Administrator/ Superintendent
Insufficient Disaster Management Arrangements	Loc; LT; Av; Sig; M	▪ Disaster Risk Assessments should be done for health facilities. ▪ Disaster Management Arrangements to be instituted based on risk levels and in particular for flooding.	MoPH and Health Facility Administrator/ Superintendent.
Irregular Maintenance of health facilities	Loc; LT; Av; Sig; M	▪ Maintenance teams should be dedicated to or stationed at the health facilities. ▪ Alternatively there should be scheduled or regular monitoring and inspections. ▪ There should be regular maintenance of electrical systems, air-conditioning, sewage systems, plumbing, drainage, potable water supply and water treatment and maintaining the aesthetics of the facilities.	MoPH, MoC/RDC Health Facility Administrator/ Superintendent.

Key – Impact Rating Parameters

Loc – Localised **Ex – Extensive**
ST – Short Term **LT – Long Term**
Av. – Avoidable **Un – Unavoidable**
Sig. – Significant **Insig. – Insignificant**
M. – Mitigable **UM – Unmitigable**

6.4 Contractors Environmental Management Plan

6.4.1 Introduction

The Contractors will be responsible for environmental management at the construction sites and will be required to prepare an Environmental Management Plan (EMP) to identify practical measures to ensure that construction activities do not negatively affect the environment and to ensure that health and safety is not compromised. The EMP will outlined measures to address noise, dust, hazardous materials management, etc. In addition, as part of the EMP, specific Plans will be included to address the following:

6.4.2 Health and Safety Plan

This Plan will outline measures to be adopted by the Contractors to adhere to the national laws and requirements regarding occupational health and safety and will include provisions for the use of PPE, orientation of construction workers, adequate signage within work zones, and code of conduct for construction workers.

6.4.3 Waste Management Plan

This Plan would identify category of waste and the handling, storage and disposal methods along with the disposal frequency for each waste type.

6.4.4 Post Construction Restoration Plan

This Plan would identify the approach to restoration where construction or rehabilitation works at the health facilities has resulted in disturbances to natural sites and areas. In such instances these areas are to be restored and re-vegetated. This also includes materials stockpiles and excavation areas. The approach to restoration should be to allow natural re-vegetation with native species and without the application of pesticides or agro-chemicals.

6.4.5 Emergency Response and Contingency Plan

The Emergency Response and Contingency Plan will include a description of possible emergency situations and the necessary response procedure and contingencies. Situations to be covered in this Plan include accidents and injuries; fuel spills, fires; flooding; disruption to utilities; and structural collapse. Such a Plan should include:

- Emergency Contact Details;
- Emergency Procedures;
- Authority of Control;
- Roles and Responsibilities;
- Emergency Response Equipment;
- Scenario Description and Response; and
- Incident Reporting.

Through this Plan it is expected that all contractors' personnel should be aware of potential risks and take steps to cope with hazards in their work area. In addition, all contractors' personnel are expected to alert the correct personnel if they discover an accident, fire or spill.

6.4.6 Environmental Responsibility

The Contractor will be required to assign the responsibility for environmental management to a senior staff member with the requisite experience and competence. This individual will also be responsible for conducting training and orientation of all construction workers on emergency response, spill response, waste management, health and safety and good housekeeping. The Contractor's environmental personnel will liaise routinely with the project's Environmental Specialist.

7. Environmental Monitoring Plan

The measures outlined in the ESMP are to be implemented by the project's management team and contractors. For the facilities rehabilitation component of the project, contractors will be responsible for environmental management and will be required to prepare an EMP and assign responsibly to personnel for implementation.

It is recommended that an Environmental Specialist be included as part of the project team and who would be responsible for monitoring and verifying compliance with the measures included in the project's ESMP, the implementation by the contractors of the Contractors EMP, and compliance with national environmental requirements. The Environmental Specialist should participate in all stages of the project, from planning and preparation to construction and oversee the overall project environmental and social performance.

The following table outlines the key impacts/issues which are to be monitored. These are consistent with the mitigation actions identified in Table 5.

Table 6: Key Impacts/ Issues to be Monitored

Impact/ Issue	Monitoring parameter	Sampling Frequency	Responsible Entity	Monitoring location
Construction Phase				
Generation of particulate matter, mainly from demolition activities, construction activities and storage of construction materials	Ease of visibility	Daily Weekly	Contractor Environmental Specialist	Construction areas and construction materials storage areas
Generation of construction and other waste materials generated by construction activities	Waste collection, storage and disposal method/s as per Contractors EMP	Daily Weekly	Contractor Environmental Specialist	Construction areas, construction materials storage areas, workers' area, designated waste holding areas
Generation of noise from equipment/ machinery and construction activities	Level of decibels	Daily Weekly	Contractor Environmental Specialist	Construction areas, areas around health facilities
Reduction in aesthetics due to construction and storage of materials	Number of sites with waste materials left unattended by contractors	Weekly Monthly	Contractor Environmental Specialist	Construction sites and areas
Effects on facilities drainage due to discharge of fuel,	Presence of waste materials in drains	Weekly Monthly	Contractor Environmental	Health facilities internal drainage and external drains

Impact/ Issue	Monitoring parameter	Sampling Frequency	Responsible Entity	Monitoring location
engine oil and lubricants as well as solid waste and construction waste			Specialist	
Decreased quality of soil due to accidental discharge of fuel, engine oil and transmission or hydraulic fluids	Fuel, Oils and Lubricants spills	Weekly Monthly	Contractor Environmental Specialist	At fuel, waste oil storage areas, oil changing areas and areas that show visible signs of contamination
Disruption of utilities	Frequency and type of utilities disrupted	Weekly Monthly	Contractor Environmental Specialist	All Construction sites
Health and Safety risk to patients, health facilities workers and visitors arising from construction Works	Number of incidents/accidents due to construction works	Daily Monthly	Contractor Environmental Specialist	All Construction sites
Social conflicts arising from presence of construction workers at health facilities	Number of reported complaints/grievances	Weekly Monthly	Contractor Environmental Specialist	All Construction sites

The Environmental Specialist will have the responsibility to oversee the overall project's environmental and social performance. As such, the Environmental Specialist must oversee the implementation of mitigation actions relating to the construction phase of the project.

During the operation of the facilities, the facility's OH&S Personnel will be expected to monitor the implementation of key actions. The following table provides an outline of the Monitoring Plan for the operation of the facilities.

Table 7: Monitoring Plan

Impact	Monitoring parameter	Monitoring Frequency	Responsible	Monitoring location
Operation Phase				
Handling and management of medical waste	Compliance with laws and regulations for health facilities Adequate receptacles Mechanism and System for the collection, storage and disposal of medical waste	Monthly	OH&S Personnel	Health Facilities

Impact	Monitoring parameter	Monitoring Frequency	Responsible	Monitoring location
	Appropriate trained personnel Appropriate PPE			
Maintenance of health facilities	Electrical, plumbing, air-conditioning, sanitation, sewage systems are fully functional Maintenance programme in place and active	Monthly	OH&S Personnel	Health Facilities
Air pollution from onsite incinerators	Open burning is prohibited Waste collection and management system functional	Monthly	OH&S Personnel	Health Facilities
Occupational Health and Safety Systems	OH&S personnel recruited Reports from OH&S personnel on training, awareness, etc. PPE available	Monthly	OH&S Personnel	Health Facilities
Fire Safety and Emergency Response System	Fire fighting equipment installed Record of maintenance Record of Fire drills Emergency Response System in place	Monthly	OH&S Personnel	Health Facilities
Noise from electricity back-up systems	Decibel levels	Monthly	OH&S Personnel	Health Facilities
Security Risk at Health Facilities	Number of security personnel Installation of security cameras	Monthly	OH&S Personnel	Health Facilities
Disaster Management Arrangements	Disaster Risk Assessments done Interventions being made to reduce risk Disaster Response Mechanism developed and implemented	Monthly	OH&S Personnel	Health Facilities

8. Public Participation

The GoG, through the MoPH has the overall responsibility to effectively engage stakeholders so as to achieve the project's objectives. In order to secure the public's support for the project's interventions and to minimize disruptions during construction activities, public information, awareness and engagement would be critical. This could enhance public understanding and support for the project.

During project implementation a Public Participation and Communication Programme should be developed and implemented. This Programme should outline the mechanism for receiving and addressing grievances, point of contact, contact information, etc. The Programme should also outline how the MoPH or facilities management will communicate with stakeholders, for example, if there is going to be a disruption or an inconvenience, as well as to find out from stakeholders if there are any grievances or nuisance. This should be pursued considering the following interventions:

- Public Service Announcements (PSAs) on the project, its component and activities. The PSAs could be placed on print and electronic media.
- Provision of information on the MoPH webpage.
- Notice Boards describing the project's interventions at the health facilities to be rehabilitated.
- Information to the public in a timely manner on the disruption to services at health facilities under rehabilitation.

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Annex A Stakeholders Engaged

Name	Designation	Institution
Dr. Kay Shako	Director, Regional Health Services	Ministry of Public Health
Dr. Ertenisia Hamilton	Adolescence Health Representative	Ministry of Public Health
Ms. Zoan Williams	Manager	Ministry of Public Health
Dr. Sheik Amir	Director of Medical and Professional Services	Georgetown Public Hospital Corporation
Mr. Andy Mahadeo	Deputy Maintenance Manager	Georgetown Public Hospital Corporation
Ms. Iona Cadogan	OH&S Officer	Georgetown Public Hospital Corporation
Dr. Maite	Administrator	Diamond Public Hospital
Dr. Michael Perreira	Superintendent	Diamond Public Hospital
Dr. Neil Jaffer	Regional Health Officer (a.g)	CC Nicholson Hospital
Mr. Vickram Bharrat	Chairman	Grove-Diamond NDC

Annex B Health Facilities Regulations 2008

Section 14 - Patient care arrangements:

(1) Every health facility shall be so designed and equipped as to be able to carry out the operations that the facility is licensed for in a safe and effective manner.
(2) The waiting areas and patient registration areas of every health facility shall be readily accessible to patients, including physically challenged persons.
(3) All the areas of a health facility shall be so constructed and located as to ensure patient privacy and confidentiality without compromising patient care.
(4) Where a health facility provides emergency medical care, wheelchairs and other ambulating aids as are necessary for patients in the emergency circumstances shall be readily available at the facility.
(7) Every health facility shall have an examination room that is properly equipped and commensurate with the type of services being offered at the facility.
(8) Every health facility shall have, wherever it is possible, at least one closed wash room and a sink with running water or a clean wash-basin with a supply of potable water for hand washing.
(9) The sink or wash basin referred to in paragraph (8) shall be available near to the location where a patient is required to give specimens for laboratory examination.
(10) Where a health facility contains a medical laboratory, the sink referred to in paragraph (8) shall be in the form of a fixture that is so constructed as to permit flushing of the eyes, the body and clothes with large quantities of water so as to neutralize any hazardous or corrosive substances in case of an accident.
(11) Every health facility shall have a sufficient number of flush toilets and washrooms or latrines to handle the number of patients and employees of the facility and such toilets and washrooms or latrines shall be conveniently located for the patients and employees.

Section 15-Equipment and supplies:

(1) In every health facility there shall be sufficient storage space for patient records and pharmaceuticals supplies.
(2) Every health facility shall establish a preventative maintenance programme to ensure that the equipment required by any manufacturer to be checked or calibrated is done with a frequency that is in accordance with the specifications of the manufacturer.
(3) Biological and other supplies requiring refrigeration shall be stored in a refrigerated enclosure and the refrigeration system should have a continuous temperature monitoring system.
(4) Infectious materials shall be stored in clearly marked containers designed specifically for storage of infectious waste that meet the requirements specified by the Guyana Bureau of Standards.
(5) Flammable liquids in excess of ten gallons shall be contained in a storage cabinet with a capacity of at least sixty gallons that meets the requirements of the Guyana Fire Service.
(6) “No smoking” signs shall be posted at areas in which flammable gases or liquids are stored.
(7) Every health facility shall install in its premises approved fire extinguishers in good working order in the number required by the Guyana Fire Service.

Section 19-Sanitation and safety:

(1) The occupational safety and health of persons at work in every health facility shall be the same as are required under the Occupational Safety and Health Act 1997.
(2) Every health facility shall be smoke free and the licensee shall ensure that no person smokes or holds lighted tobacco in the facility or in the nine metres radius surrounding any entrance or exit to the facility.
(3) The premises of every health facility shall be kept in a clean and hygienic sanitary condition and free from nuisance in accordance with the Environmental Protection Act 1996 and any other law.

(4) Syringes, needles, lancets or other blood-letting devices capable of transmitting infection from one person to another shall be disposed of in accordance with the requirements of the Guyana Solid Waste Management Division of the Ministry of Local Government (now Ministry of Communities).
(5) Every health facility shall ensure that linen, gauze, bandages or any other material that is contaminated with blood or other bodily fluid shall be treated as infectious waste in accordance with regulation 14.

Section 20- Disposal of infectious and radioactive wastes.
(1) Infectious waste, other than the infectious waste referred to in regulation 19(4), shall be kept separately from other wastes and shall be-

- (a) stored in double impervious plastic bags that are each at least 2mm. in thickness, that are securely fastened, that are conspicuously marked "infectious waste" and that when full do not exceed 25 pounds in weight.
- (b) transported in receptacles that are conspicuously marked "infectious waste";
- (c) processed to render the waste harmless or shall be held for pick–up in specially marked non– metal containers separate from regular waste;
- (d) secure from unauthorized persons;
- (e) secure from birds and animals;
- (f) removed otherwise than by mechanical means or compacted;
- (g) deposited other than in any sanitary landfill; and
- (h) disposed of in accordance with the requirements of the Guyana Solid Waste Management Division of the Ministry of Local Government (now Ministry of Communities)

(2) Broken or leaking bags of infectious waste shall not be permitted to be transported from a health facility unless it is re- bagged in accordance with these Regulations.
(3) Where trash that may constitute a hazard to any person or thing is compacted and the integrity of the container is compromised, the container shall be handled as infectious waste under this regulation.
(4) All radioactive wastes shall be stored, transported and disposed of in accordance with the requirements of the Guyana Solid Waste Management Division of the Ministry of Local Government (now Ministry of Communities).
(5) This regulation does not apply to articles that are dirty or contaminated but are intended to be reused after they have been cleared and sterilized.

Section 32-Infection control:

Used blood–lines and dialyzers shall be treated as infectious waste in accordance with regulation 20.

Section 33-Water control:

The quality of water used in the dilution of dialysis concentrate shall be in accordance with AAMI water treatment equipment and quality recommendations for dialysis until alternate standards to be followed in Guyana are laid down by the Minister.

Section 43-Occupational Safety and Health:
(1) The administrator of every hospital shall ensure that one or more health and safety representatives are chosen from amongst the staff in the hospital in accordance with the provisions of the Occupational Safety and Health Act 1997.

Annex C Ambient Air Quality Parameter and Allowable Limits set by International Standards

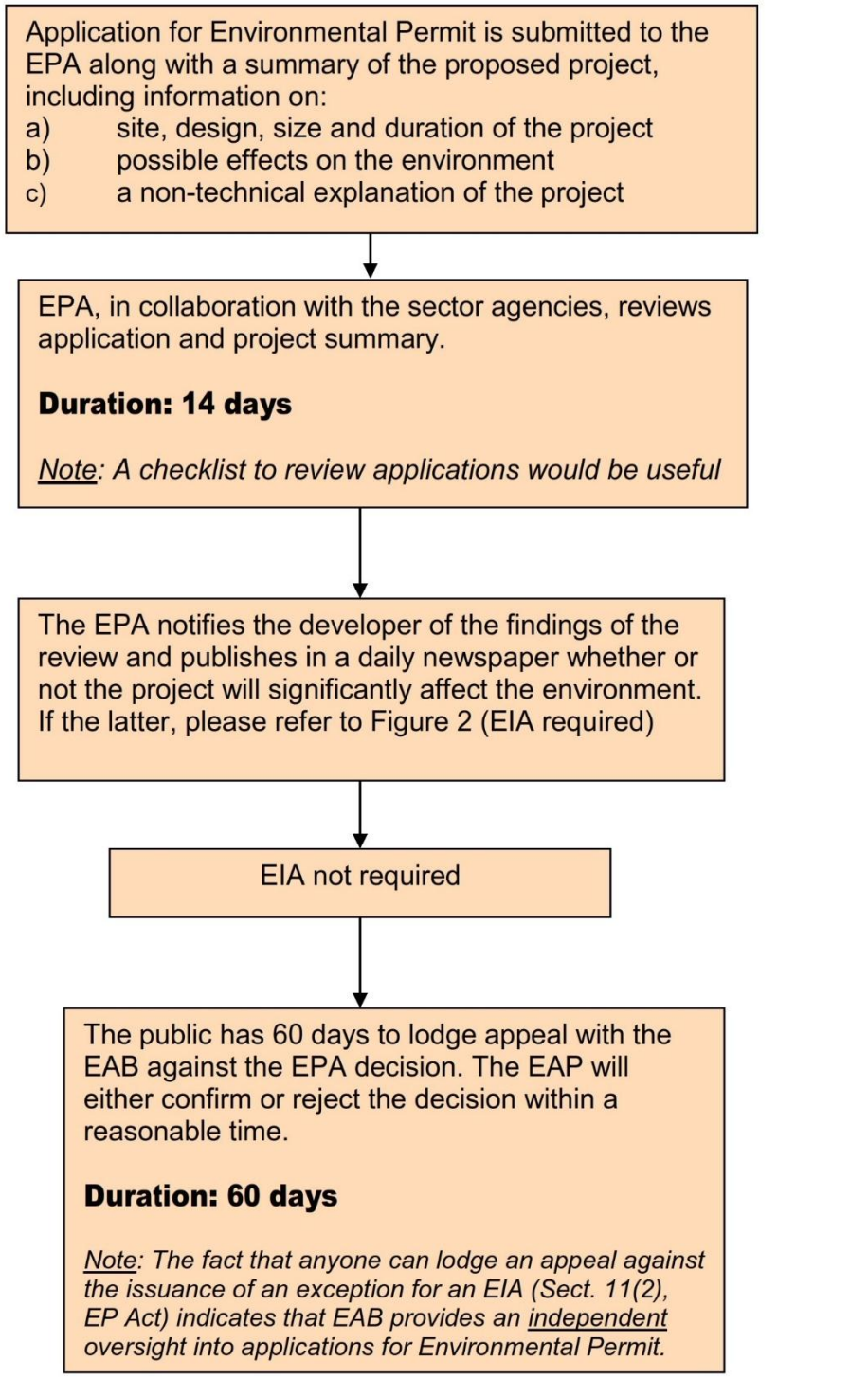
Parameters	WHO Standards	US EPA Standards	Jamaica NRCA
Sulphuric Acid			87.5ug/m3- 1 hour 35ug/m3- 24 hours
Sulphur Dioxide	20ug/m3- 24 hours 500ug/m3- 10 minutes	75ppb- 1 hour	80ug/m3-annual 365ug/m3-24 hours
		0.5ppm-3 hours	60ug/m3-annual 280ug/m3-24 hours
			700ug/m3- 1hour
Nitrogen Dioxide (No2)	40ug/m3- annual 200ug/m3-1 hour	100ppb- 1 hour	400ug/m3- 1hour 100ug/m3-annual
		53ppb- annual	
Nitrogen Oxide (NO)			
Particulate Matter (PM10)	20ug/m3- annual 50ug/m3-24hours	150ug/m3-24 hours	50ug/m3- annual 150ug/m3- 24hours
Particulate Matter (PM2.5)	10ug/m3- annual 25ug/m3-24 hours	12ug/m3- annual	-
		15ug/m3- annual	-
		35ug/m3- 24 hours	-
Carbon Monoxide (CO)		9ppm- 8 hours 35ppm- 1 hour	-
			10,000ug/m3- 8 hours 40,000ug/m3-1 hour
Hydrogen Sulphide			2.5ug/m3-1hour 1ug/m3-24hours
Hydrogen Fluoride			
Hydrogen Chloride			100ug/m3-1 hour 20ug/m3-24 hours
Chlorine Dioxide			75ug/m3- 1 hour 30ug/m3-24 hours
Methane*			
VOC*			

Source: Adapted from Environmental Protection Agency, Draft Ambient Parameter Air Quality Guidelines[31]

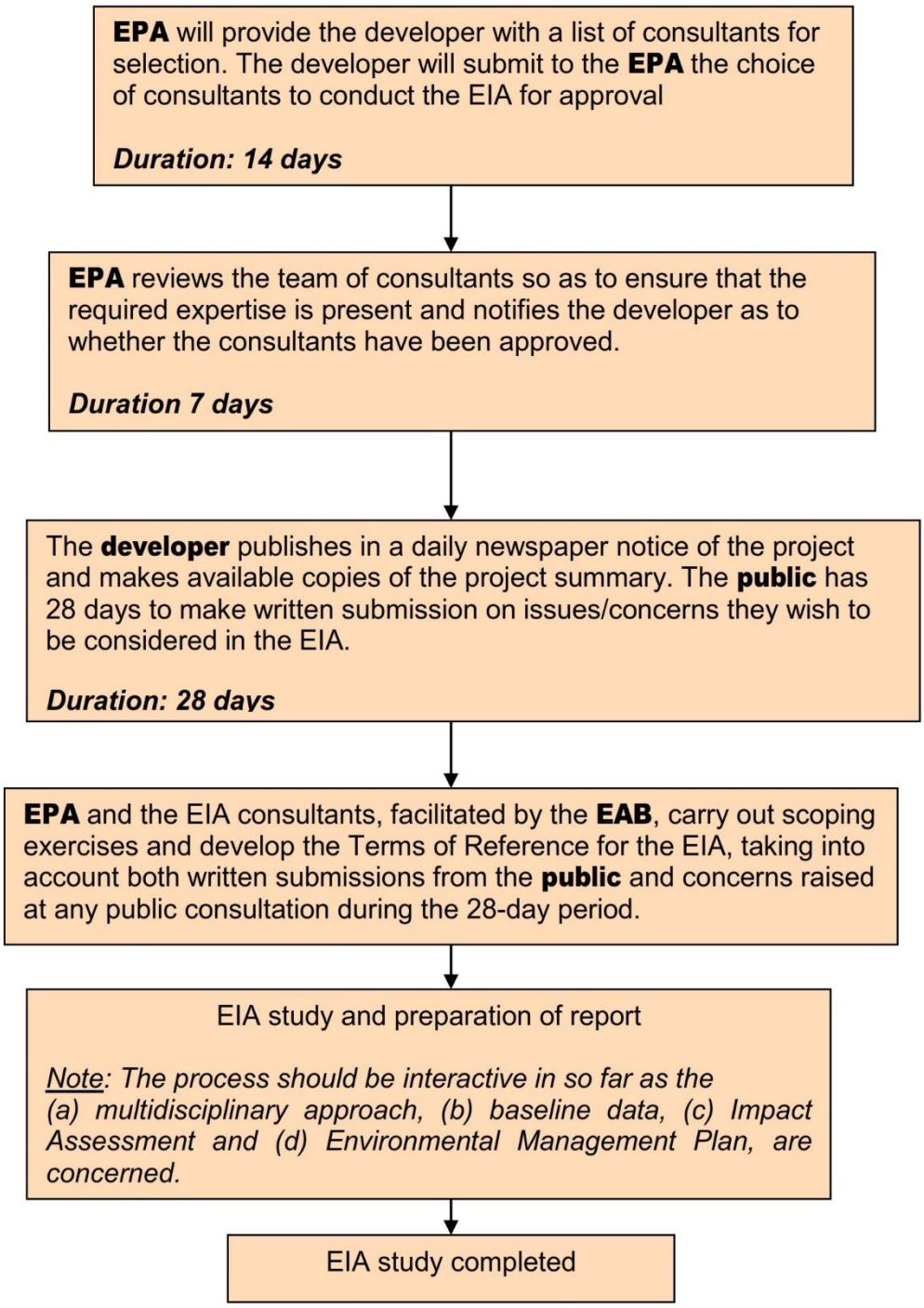
[31] Copy available from Agency

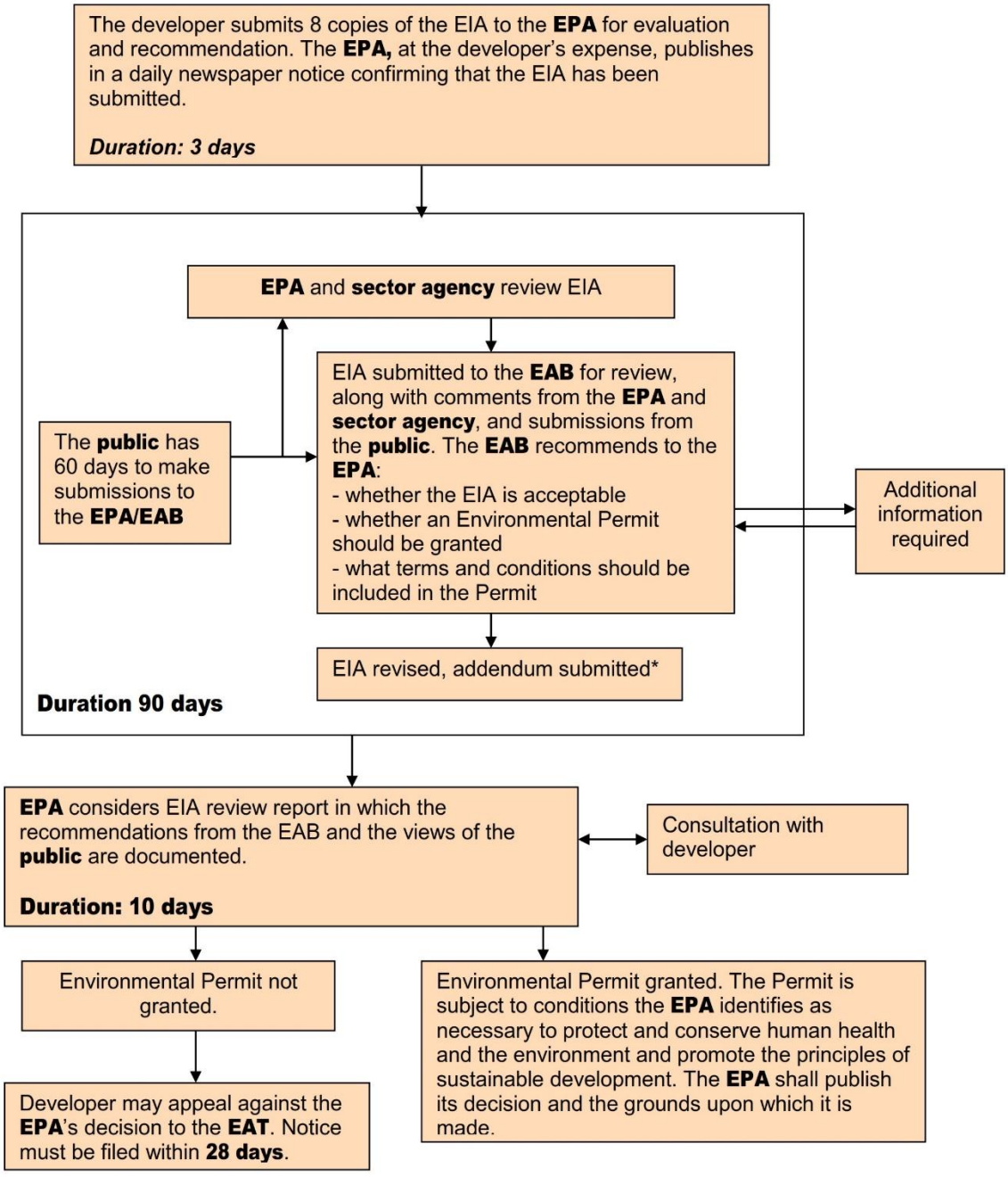
Annex D EPA Permitting Process Flow Chart

Preparatory Stages in Obtaining an Environmental Permit – EIA not required



Stages in Obtaining an Environmental Permit - EIA Required





Source: Environmental Protection Agency, EIA guidelines, Vol.1 Rules and Procedures for conducting and reviewing EIAs.

Annex E GNBS Standards for Industrial Effluent Discharge

Point source discharge Limits for Industrial Effluent for Operations other than Mining, Forestry and Agriculture

Parameter and Maximum Allowable Limits
(All values expressed as mg/L except pH, temperature and as otherwise noted)

Sector	pH	Temp.	BOD5	COD	DO	TSS	Nas NH3	Total N	P	CN (Tot)	PO4	Cl	Surfactants	Phenols	Coliforms	O&G	Other and/or Comments
Breweries	5.0-9.0	<40	<100 (t.v <50)	<250		<100 (t.v<50)	<50									10	
Cement Bagging, Manufacturing	5.0-9.0	<40			>4.0	50											WHO Stds for Ind. Manuf. Operations. Turbidity NTU: Max.dy: <150
Citrus Processing Plants	5.0-9.0	<40	<50	<250		<50	<50									<10	
Distilleries – (a) Blending Halls and Wineries	5.0-9.0	<40	<50			<50	<50										
Distilleries – (a) Fermentation/Distillation Units	5.0-9.0	<40	<500 (t.v.100)			<500 (t.v<100)											
Edible Oils	5.0-9.0	<40	<50	<250		50		<10								<10	
Meat and Seafood Processing	5.0-9.0		<100 (t.v<50)	<250		<100 (t.v<50)	<50									<30 (t.v<10)	
Metal Finishes	5.0-9.0	<40				(100 as settle-able solids			<0.5	< 10							CD:2.0; Cr(tot):2.0; Hg:1.0; Cu:3.0; Pb:0.1; Zn:3.0; Ni:3.0; Fe:5.0; Ba:10; Cr Vl: 0.5
Milk Based Industries	5.0-9.0	<40	<100 (t.v<50)	<250		<100 (t.v<50)	<50									<30 (t.v<10)	
Paint and Ink Manufacturing	5.0-9.0		<100			<100								<10		<30 (t.v<10)	Cu:<30; Pb:<10; Cr:<20; Cr Vl:0.5; Ni:<3.0; Zn:<3.0; Hg:<1.0
Pharmaceutical/ Chemical Production	5.0-9.0			<150	>40								<0.2	<0.5		<10	Secondary parameters: No3:40; SO4-2:1000; Cl:-300; NH4 as N:1.0
Petroleum Bulk Terminal	5.0-9.0	<40	<50	<250		<100										TPH<40	Pb:0.1; Cr GT 0; Cr)+A) 05

Sector	pH	Temp.	BOD5	COD	DO	TSS	Nas NH3	Total N	P	CN (Tot)	PO4	Cl	Surfactants	Phenols	Coliforms	O&G	Other and/or Comments
Printeries and photo-processing establishments	5.0-9.0	<40	<30	<150		<50										<10	Ag:0.5; Cd:0.1; Cr Vl:0.1; Cr(tot):0.5; Cu:0.5; Zn:2.0
Soft Drinks Plants	5.0-9.0	<40	<100 (t.v<50)	<250		<100 (t.v<50)	<50										
Sugar Factories	5.0-9.0	<40	<250 (t.v<100)	<250	>4.0	<250 (t.v<100)											
Textiles	5.0-9.0			<250	>4.0	<500 (t.v100)						300	<0.2 detergts	<0.5	400 MPN per 100 mls	<10	Cr(tot):0.5; Cu:0.5; Ni:0.5: Zn:2.0; Co:0.5
Thermal Power Plants	5.0-9.0	<40				<100					5	Free CL 0.5				<20	WB Stds for metals: Cr(tot):0.2; Fe:1.0; Zn:1.0; Cu:1.0; New units are to meet these stds. Old units will be phased out within 3 yrs or pollution equipment will be installed. New WB stds available. No WB std for phosphate, limit taken from India and Sri Lanka
General Environmental Guidelines	5.0-9.0	<40	50	250	50 BS TSS	10			2	1 Free:0.4		Cl:0.2		0.5	400 MPN per 100 mls	10	WB STd: Flourine:20: No limits given for metals

Annex F EPA - Environmental Guidelines: Storage, Transportation & Occupational Handling of Biomedical Waste

Environmental Guidelines

Storage, Transportation & Occupational Handing of Biomedical Waste

2011

Table of Contents

Environmental Guidelines for Storage, Transportation and Occupational Handling of Biomedical Waste

1. Objective

The objective of these Guidelines is to provide general information on the proper storage, transportation and handling of biomedical waste. It can also be used as a tool to help officers guide developers on proper handling of biomedical waste.

2. Scope and Contents

These guidelines are for any person who operates a business or facility that generates, stores and transports biomedical waste. It contains information on storage, transportation and occupational handling methods as well as guidelines on various treatment methods that are applicable to Guyana.

3. Definitions

3.1. Biomedical waste: Discarded biological material from teaching, clinical and research laboratories and operations.[1]

3.2. Containment: The action of keeping something harmful under control or within limits.

3.3. Human anatomical: This is any part of the human body.

3.4. Microbiological: Any substances that contain or constitute microbes, e.g. bacteria, fungi.

3.5. Sharps: All instruments used at hospital and health care facilities that have sharp edges.

3.6. Transportation: The action of transporting something or the process of being transported.

3.7. Treatment: The use of a chemical, physical, or biological agent to make a substance harmless

[1] http://www.uottawa.ca/services/ehss/docs/BiomedicalWasteDisposalProceduresSept07.pdf

4. Overview of the Biomedical Industry

The biomedical industry comprises the pharmaceutical, hospital and general health care facilities. This industry by large produces clinical waste which according to the Environmental Protection (Hazardous Wastes Management) Regulations 2000, is (i) any part of the human body including tissues and bodily fluids, (ii) Any part of the carcass of an animal infected with a communicable disease, (iii) non- anatomical waste infected with communicable disease, (iv) any waste that is generated in the diagnostic treatment or immunization of human beings and related activities that includes research or autopsies.

In Guyana, PAHO (2004), estimated that a total of 6,561kg of health care waste is generated daily, however the total hazardous content ranged between 1,640.25 kg (3616.13 lbs) to 2,624 kg (5785.3 lbs) with region four (4) generating the largest amount of health care waste. Currently there are the draft medical waste guidelines and draft medical waste regulations which will serve as means to manage and regulate hazardous waste generation in Guyana.

5. Environmental Issues and Mitigation Measures

5.1. Issues Identified

With most of Guyana's population in Region four (4), it is expected that the majority of biomedical waste would be generated in this Region; as such it would be important to place attention on this waste. Biomedical waste can be highly infectious and can pose a great threat to human health and the safety of the environment.

5.2. Storage

All biomedical waste must be properly labelled or colour coded

Only non- sharp waste should be placed in plastic bags while sharps should be placed in sharp containers.

5.2.1. Labelling can include words such as 'Infectious substances', 'Bio hazardous waste', 'Bio-hazard'.

5.2.2. If colour codes are being used:

Waste type	Colour coding
Human anatomical	Red
Animal waste	Red
Microbiological laboratory	Red
Blood & body fluids	Red
Waste sharps	Red

Table showing colour codes from various types of biomedical waste (http://www.ccme.ca/assets/pdf/pn_1060_e.pdf)

5.2.3 Storage of Biomedical waste should not exceed 30 days. The 30 days period commences when the first item is placed into the container.

5.2.4. Indoor storage areas should be away from pedestrian traffic and be in an area that is free of insects and rodents. The storage area should be made of smooth, easily cleanable material that is impervious to liquids.

5.2.5. Outdoor storage should be in a location that allows for protection from the elements of weather and animals. A six inch international biological hazard symbol should be placed on the storage containment.

5.2.6. Waste containers (after being filled) should not be opened until treatment.

5.2.7. If a rupture occurs, containers should be placed into containment, the seal should not be removed.

5.3. Transportation

5.3.1. When transporting Hazardous Waste, all possible caution must be applied in order to prevent any possible spill of materials.

5.3.2. All packaging material should be of good quality (strength, construction type) in order to prevent any breakage during transport.

5.3.3. Containers should be leak proof and should have corrosive resistant properties.

5.3.4. Containers should also be able to withstand shock during transportation.

5.3.5. Before transporting of waste, generators must ensure that waste is packaged and sealed in such in such a manner that is suitable for safe handling.

5.3.6. Containers should be properly labelled. Labelling should have:

- Name(location);
- Date;
- Type of waste, e.g. halogens, Cyanides, etc.;
- List of content; and
- Quantity.

5.3.7. Waste must be in closed containers at all times.

5.3.8. All vehicles used for transporting Hazardous Waste must be suitably designed for various types/kinds of Hazardous materials.

5.3.9. Vehicles must have some marking, preferably "HAZARDOUS WASTE/MATERIAL" written in red denoting the purpose of the vehicle.

5.3.10. Vehicles should not be used for any other purpose than for the transport of Hazardous Waste.

5.3.11. All vehicles must be equipped with a first-aid-kit and fire extinguisher in case of emergencies.

5.3.12. Transporters of Hazardous Waste must be in possession of the manifest form during the transport of Waste.

5.3.13. Any person who transports Hazardous Waste for treatment, storage or disposal must submit a hazardous waste manifest form to the Environmental Protection Agency (EPA).

5.3.14. All drivers should have knowledge on what to do in the case of any emergency.

5.4. Treatment

5.4.1. Hazardous Waste can be treated in a number of ways. However, it is advised that only the most practicable and suitable methods be applied. Some treatment methods include:

Steam Autoclaving: This is a low heat thermal process where steam is brought into direct contact with waste in a controlled manner for a sufficient duration to disinfect the waste. It is appropriate for laboratory waste, human blood and human body fluids, sharps and non-anatomical animal and human waste.

- ***Chemical decontamination****:* this is the removal or reduction of biological agents within waste rendering them less hazardous. This method can be used for treating microbiological laboratory waste, human blood, bodily fluids and sharps. Chemical decontamination should not be used for anatomical waste.

- ***Incineration:*** this is a controlled combustion process where waste is oxidised and harmful agents are destroyed at high temperatures. This method can be used on all types of biomedical waste.

5.5. Occupational Handling

5.5.1. All persons working in facilities that generate Biomedical Waste are at great risk of exposure and contraction of infection. As such, precautions must be taken when handling waste.

5.5.2. Employers should have the safety of their employees as a top priority.

5.5.3. *Training and Personal Protection*

- All employees must be aware and familiarize themselves with the facility's procedures for the reduction, collection, storage, labelling and coding of Hazardous Waste;
- Training sessions should highlight the need for personal hygiene;
- Employees should be trained to identify methods of preventing infection, the types of hazards they are likely to be exposed to, and procedures to be used in case of an accidental spill;
- Employees must have appropriate Personal Protective Equipment (such as water repellent aprons and disposable gloves); and
- There should be written procedures on how to handle and report various injuries caused by sharps.

5.5.4 *Immunization & Sharp Precautions*

- All workers who are responsible for handling and disposal of Biomedical Waste should be immunized to prevent against the many infections that can arise from the handling of these waste.
- Immunization should be done for infections such as Hepatitis B, Rabies and Tetanus.
- Sharps must be given special attention.
- Needles must not be clipped, bent or broken before disposal.

5.5.5. *Spills and Accidents*

- All employees should be educated and trained on the management of biomedical waste and spill management.
- There should be various procedural methods for containing and isolating each type of spill.
- If a spill occurs, staff responsible for clean - up should be notified immediately
- There should be proper equipment available for clean – up.
- If a spill involving blood or bodily fluids occur, the following procedures should be followed:

  - Put on protective clothing and gloves;
  - Pour bleach (for small spills use 1:100 dilution; for large spills 1:10 dilution) over spill and allow to sit for several minutes;
  - Put kitty litter/sand over the spill and wait until absorbed;
  - Place contaminated waste in bag;
  - Put on a new pair of gloves and mop area with soap and water;
  - Dry area with paper towel and discard of material;
  - Wash hands thoroughly and report the incident.

- If any accident or spill occurs; there should be a thorough investigation as to the cause of the incident and a report be prepared.

6. EPA Authorisation Process

The first step is to apply to the **Environmental Protection Agency (EPA)** for Environmental Authorisation. The developer must submit to the Agency a completed Application Form and all the required information:

New Projects	Existing Projects
☛ Identification of the Permit Applicant (National ID Card, Passport). ☛ Proof of Land Ownership ☛ A 'No-Objection' Letter for the operation from the relevant Local Authority – NDC/RDC/Town Council. Note the Approved Site Plan by the NDC/RDC/Town Council would be accepted as "no-objection". ☛ 'No Objection' from the Village Council and Ministry of Amerindian Affairs if project falls within Amerindian titled lands. ☛ Land use suitability letter/Outline Planning Permission from the Central Planning & Housing Authority ☛ Map showing surrounding land uses, identification of receiving water(s) and the location of any existing or proposed intake and discharge structures and the location of any discharge. ☛ Draft Site Plan (approved by the NDC/RDC/Town Council, as applicable to project site) showing the layout of the Operation (submit a final version after all necessary adjustments have been made). ☛ Project Description (summary). ☛ Business Registration/Certificate of Incorporation (if applicable). ☛ Indication whether or not a Permit or Licence from any other Government entity is required or have been obtained. Submit Permit, Licence, or Proof of Application from relevant sector Agency.	☛ Identification of the Permit Applicant (National ID Card, Passport). ☛ Proof of Land Ownership ☛ Map showing surrounding land uses, identification of receiving water(s) and the location of any existing discharge structures and the location of any discharge. ☛ Site Plan showing the layout of the Operation. ☛ Project Description (summary). ☛ Business Registration/Certificate of Incorporation (if applicable). ☛ Indication whether or not a Permit or Licence from any other Government entity is required or have been obtained. Submit Permit, Licence, or Proof of Application from relevant sector Agency.

According to the Environmental Protection (Hazardous Wastes Management) Regulations, 2000, Part II (Power to Issue Environmental Authorisation):

3. (1) Any person who, at the time of the commencement of these Regulations, is in operation of a facility that generates, treats, stores, disposes or transports hazardous waste shall submit a duly completed notice in the form set out in Schedule III to the Agency.

(2) The Agency shall publish the notification mentioned in paragraph (1) at least twice in a daily newspaper having wide circulation in Guyana and members of the public shall have at least sixty days from the date of the last publication to make objections to the operations of the facility to the Agency.

(3) The Agency shall, in deciding to grant an environmental authorisation in accordance with regulation 18 of the *Environmental Protection (Authorisation) Regulations 2000,* take into account the submissions that have been made to it under paragraph (2).

(4) The Agency shall send a copy of the objections to the person who has given notice of activity and thereupon such person shall make application to the Agency under regulation 4.

4. (1) Any person who at the time of the commencement of these Regulations is in operation of a facility that generates, transports, treats, stores or disposes of hazardous waste, shall, subject to paragraph (3), before commencing any action related thereto, submit an application to the Agency for an environmental authorisation within three years of the commencement of these Regulations or such other time as the Agency may determine.

(2) Any person who proposes to operate a facility that generates, transports, treats, stores or disposes of hazardous waste, shall, subject to paragraph (3), before commencing any action related thereto, submit an application to the Agency for an environmental authorisation within three years of the commencement of these Regulations or such other time as the Agency may determine.

(3) The fee prescribed in regulation 8 of the *Environmental Protection (Authorisations) Regulations 2000* shall accompany the application.

(4) The Agency may at any time request a person who engages in any of the activities specified in paragraph (1) to submit a notification of activity and an application to the Agency for an environmental authorisation.

(5) An application for an environmental authorisation shall be in accordance with the provisions of regulation 17 of the *Environmental Protection (Authorisations) Regulations 2000.*

(6) In addition to the information that is required for a grant of an environmental authorisation prescribed in regulation 17 of the *Environmental Protection (Authorisations) Regulations 2000,* the applicant shall provide written evidence of financial capability.

(7) The requirement in paragraph (1) for an environmental authorisation shall not apply to –(a) Facilities that generate or store hazardous wastes in quantities less than one hundred kilograms per month; *(b)* Facilities that generate less than one kilogram of acutely hazardous wastes per month; *(c)* Facilities that accumulates up to one thousand kilograms of hazardous wastes onsite at any time.

(8) Any person who contravenes this regulation shall be guilty of an offence and shall be liable on summary conviction to a fine of not less than seventy-five thousand dollars nor more than five hundred thousand dollars and to imprisonment for six months.

Annex G IFC – Environmental, Health & Safety Guidelines for Health Care Facilities

IFC International Finance Corporation
Environmental, Health, and Safety Guidelines
HEALTH CARE FACILITIES
WORLD BANK GROUP

Environmental, Health, and Safety Guidelines for Health Care Facilities

Introduction

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP)[1]. When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These industry sector EHS guidelines are designed to be used together with the **General EHS Guidelines** document, which provides guidance to users on common EHS issues potentially applicable to all industry sectors. For complex projects, use of multiple industry-sector guidelines may be necessary. A complete list of industry-sector guidelines can be found at: www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account. The applicability of specific technical recommendations should be based on the professional opinion of qualified and experienced persons. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment

[1] Defined as the exercise of professional skill, diligence, prudence and foresight that would be reasonably expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally. The circumstances that skilled and experienced professionals may find when evaluating the range of pollution prevention and control techniques available to a project may include, but are not limited to, varying levels of environmental degradation and environmental assimilative capacity as well as varying levels of financial and technical feasibility.

Applicability

The EHS Guidelines for Health Care Facilities include information relevant to the management of EHS issues associated with health care facilities (HCF) which includes a diverse range of facilities and activities involving general hospitals and small inpatient primary care hospitals, as well as outpatient, assisted living, and hospice facilities. Ancillary facilities may include medical laboratories and research facilities, mortuary centers, and blood banks and collection services. Annex A provides a description of activities in this sector. This document is organized according to the following sections:

Section 1.0 — Industry-Specific Impacts and Management
Section 2.0 — Performance Indicators and Monitoring
Section 3.0 — References
Annex A — General Description of Industry Activities

1.0 Industry-Specific Impacts and Management [2]

The following section provides a summary of EHS issues associated with health care facilities (HCF) which occur during the operations phase, along with recommendations for their management. Recommendations for the management of EHS impacts common to most large industrial facilities during the construction and decommissioning phases are provided in the **General EHS Guidelines**.

HCF Design Considerations

The design and functional layout of an HCF should ensure the following: separation of clean / sterilized and dirty / contaminated materials and people flows; development and inclusion of adequate disinfection / sterilization procedures and facilities; adequate space for the storage of recyclable materials (e.g. cardboard and plastic) for pickup; selection of heating, ventilation, and air conditioning (HVAC) systems that provide isolation and protection from airborne infections; design of water systems to provide adequate supplies of *potable* water to reduce risks of exposure to *Legionella* and other waterborne pathogens; provision of hazardous material and waste storage and handling areas; treatment and exhaust systems for hazardous and infectious agents; and selection of easily cleaned building materials that do not support microbiological growth, are slip-resistant, nontoxic, and nonallergenic, and do not include volatile organic compound (VOC)-emitting paints and sealants.

Internationally recognized guidelines for design and construction of hospitals and HCFs include the American Institute of Architects (AIA) and the Facility Guidelines Institute (FGI), the American Society for Healthcare Engineering (ASHE) of the American Hospital Association (AHA), and the Green Guide for Health Care (www.gghc.org). These guidelines should be used to verify the adequacy of planning for new HCFs or renovation of existing facilities.

[2] Information in these EHS Guidelines is drawn predominantly from the World Health Organization (WHO), Safe management of wastes from health-care activities, Pruss et al. (1999). This document is currently under review by the WHO, and updated practices will be incorporated into future versions of this these EHS Guidelines, as necessary.

1.1 Environmental

Environmental issues associated with HCF include the following:

- Waste management
- Emissions to air
- Wastewater discharges

Waste Management

Waste from health care facilities (HCF) can be divided into two separate groups. The first consists of general waste, similar in composition to domestic waste, generated during administrative, housekeeping, and maintenance functions. The second group consists of specific categories of hazardous health care waste, as detailed in Table 1 below.

Health care facilities should establish, operate and maintain a **health care waste management system (HWMS)** adequate for the scale and type of activities and identified hazards. Facility operators should undertake regular assessment of waste generation quantities and categories to facilitate waste management planning, and investigate opportunities for waste minimization on a continuous basis. In addition to the guidance provided on solid and hazardous waste management in the **General EHS Guidelines**, the HWMS should include the following components:

Waste Minimization, Reuse, and Recycling

Facilities should consider practices and procedures to minimize waste generation, *without sacrificing patient hygiene and safety considerations*, including:

- Source reduction measures:
  - Consider options for product / material substitution to avoid products containing hazardous materials that require the product to be disposed as hazardous or special waste (e.g. mercury[3] or aerosol cans), and preferring products with less packaging or products that weigh less than comparable products that perform the same function
  - Use of physical rather than chemical cleaning practices (e.g. using microfiber mops and cloths), where such practices do not affect disinfection and meet relevant standards for hygiene and patient safety[4]
- Waste toxicity reduction measures[5]:
  - Consider options for product / material substitution for equipment containing mercury or other hazardous chemicals; products that may become hazardous waste when disposed; products made of polyvinyl chloride (PVC[6]); halogenated compounds[7]; products that off-gas volatile organic compounds (VOCs), or products that contain persistent, bioaccumulative and toxic (PBT) compounds; products that contain substances which are carcinogenic, mutagenic or reproductive toxins (CMR)
- Use of efficient stock management practices and monitoring (e.g. for chemical and pharmaceutical stocks), including:
  - Small / frequent orders for products that spoil quickly and strict monitoring of expiry dates
  - Complete use of old product before new stock is used
- Maximization of safe equipment reuse practices, including:
  - Reuse of equipment following sterilization and disinfection (e.g. sharps containers)

Waste Segregation Strategies

At the point of generation, waste should be identified and segregated. Non-hazardous waste, such as paper and cardboard, glass, aluminum and plastic, should be collected separately and recycled. Food waste should be segregated and composted. Infectious and / or hazardous wastes should be identified and segregated according to its category using a color-coded system, as detailed in Table 1 below. If different types of waste are mixed accidentally, waste should be treated as hazardous.[8] Other segregation considerations include the following:

- Avoid mixing general health care waste with hazardous health care waste to reduce disposal costs;
- Segregate waste containing mercury for special disposal. Management of mercury containing products and associated waste should be conducted as part of a plan

[3] Use of mercury-based medical devices (e.g. thermometers and blood pressure devices) should be avoided and / or replaced, with preference given to digital and aneroid alternatives. Further information is available from WHO (2005), Mercury in Health Care, available at: www.who.int/water_sanitation_health/medicalwaste/mercurypolpaper.pdf

[4] For more information see Hospitals for a Healthy Environment, available at: www.h2e-online.org/docs/h2emicrofibermops.pdf

[5] For more information on material and product substitution options in healthcare facilities, see Health Care Without Harm http://www.noharm.org/globalsoutheng/

[6] Products made of PVC may include intravenous (IV) bags, blood bags and tubing, basins, hemodialysis equipment, patient identification bracelets, bedpans, inflatable splints, respiratory therapy products, stationary supplies, catheters, lab equipment, drip chambers, medical gloves, thermal blankets, internal feeding devices, and packaging. When burned at certain temperatures, PVC has the potential to release dioxins and furans, and other persistent organic pollutants (POPs).

[7] For example, minimize use of halogenated compounds through work practice modifications including use of citrus-based solvents rather than xylene alternatives (without compromising the quality of the medical service provided); conduct initial cleaning with a used solvent, and use fresh solvents for final cleaning only; adopt calibrated solvent dispensers and unitized test kits; and reduce the variety of solvents used to minimize waste streams.

[8] Staff should not attempt to correct errors of segregation by removing contents of a waste receptacle, or placing one receptacle inside another.

involving specific personnel training in segregation and clean up procedures;

- Segregate waste with a high content of heavy metals (e.g. cadmium, thallium, arsenic, lead) to avoid entry into wastewater streams;
- Separate residual chemicals from containers and remove to proper disposal containers to reduce generation of contaminated wastewater. Different types of hazardous chemicals should not be mixed;
- Establish procedures and mechanisms to provide for separate collection of urine, feces, blood, vomits, and other wastes from patients treated with genotoxic drugs. Such wastes are hazardous and should be treated accordingly (see Table 1);
- Aerosol cans and other gas containers should be segregated to avoid disposal via incineration and related explosion hazard;
- Segregate health care products containing PVC[9] to avoid disposal via incineration (see Air Emissions below) or in landfills.

On-site Handling, Collection, Transport and Storage

- Seal and replace waste bags and containers when they are approximately three quarters full. Full bags and containers should be replaced immediately;
- Identify and label waste bags and containers properly prior to removal (see Table 1);
- Transport waste to storage areas on designated trolleys / carts, which should be cleaned and disinfected regularly;
- Waste storage areas should be located within the facility and sized to the quantities of waste generated, with the following design considerations:
  - Hard, impermeable floor with drainage, and designed for cleaning / disinfection with available water supply
  - Secured by locks with restricted access
  - Designed for access and regular cleaning by authorized cleaning staff and vehicles
  - Protected from sun, and inaccessible to animals / rodents
  - Equipped with appropriate lighting and ventilation
  - Segregated from food supplies and preparation areas
  - Equipped with supplies of protective clothing, and spare bags / containers
- Unless refrigerated storage is possible, storage times between generation and treatment of waste should not exceed the following:
  - Temperate climate: 72 hours in winter, 48 hours in summer
  - Warm climate: 48 hours during cool season, 24 hours during hot season
- Store mercury separately in sealed and impermeable containers in a secure location;
- Store cytotoxic waste separately from other waste in a secure location;
- Store radioactive waste in containers to limit dispersion, and secure behind lead shields.

Transport to External Facilities

- Transport waste destined for off-site facilities according to the guidelines for transport of hazardous wastes / dangerous goods in the **General EHS Guidelines**;
- Transport packaging for infectious waste should include an inner, watertight layer of metal or plastic with a leak-proof seal. Outer packaging should be of adequate strength and capacity for the specific type and volume of waste;
- Packaging containers for sharps should be puncture-proof;
- Waste should be labeled appropriately, noting the substance class, packaging symbol (e.g. infectious waste,

[9] For examples of products containing PVC, see footnote 6.

radioactive waste), waste category, mass / volume, place of origin within hospital, and final destination;

- Transport vehicles should be dedicated to waste and the vehicle compartments carrying waste sealed.

Treatment and Disposal Options

Facilities receiving hazardous health care waste should have all applicable permits and capacity to handle specific types of health care waste. Wastes from each category should be treated according to the treatment methods and technologies described in Table 1. When selecting a waste disposal technology, operators should consider other potential health and environmental issues that may be generated by the treatment. The main types of treatment and disposal technologies and techniques available for health care waste are described below.[10]

Incineration is a high temperature dry oxidation process to reduce organic, combustible waste to significantly smaller quantities of inorganic, incombustible matter. Incineration may produce gaseous air emissions, ash residues, and wastewater. Depending on the amount of waste generated and the other factors, HCFs may operate on-site incinerators, or waste may be transported to an off-site incineration facility[11]. Incinerators should have permits to accept health care waste and be properly operated and maintained.[12] Further guidance on incineration is contained in the 'Emissions to Air' section, below.

Chemical disinfection involves the addition of chemicals to kill pathogens in health care waste. Waste should be mechanically shredded prior to treatment. Treatment involves the use and handling of hazardous chemicals, in addition to disposal of hazardous residues following treatment.

Wet thermal treatment disinfects waste by exposing shredded waste to high temperatures / pressure steam inside an exposure tank. Wastewater discharges and odor may result. Autoclaving is a type of wet thermal disinfection process typically used to sterilize reusable medical equipment. Dry thermal disinfection involves the shredding, heating, and compacting waste in a rotating auger. Air emissions and wastewater may be generated, and residues require disposal.

Microwave irradiation involves the destruction of microorganisms through the microwave heating action of water contained within the waste. Following irradiation, waste is compacted and disposed of as part of the municipal waste stream. Contaminated wastewater may also be generated.

Land disposal involves the disposal of health care waste into landfill facilities. Properly designed and operated sanitary landfills will protect against air and groundwater contamination. Disposal of waste into open dumps is not considered good practice and should be avoided. Pretreatment of waste prior to land disposal may involve encapsulation (filling containers with waste and an immobilizing material and sealing the containers).

Inertization involves mixing waste with substances (e.g. cement) to minimize leaching of toxic waste into ground or surface water.

[10] Further detail on waste management and disposal methods and technologies can be found in Pruess (1999), US EPA (2005b) Sector Notebook on Health care Facilities; and Health Care Without Harm (2007). For Proper Disposal: A Global Inventory of Alternative Medical Waste Technologies.

[11] Further guidance on use of municipal incinerators for disposal of health care waste is addressed in Pruss (1999), page. 84.

[12] Health care waste should be disposed of using pyrolytic or rotary kiln incinerators. Single chamber incinerators should only be used in emergency situations (e.g. acute outbreaks of communicable disease) when other incineration options for infectious waste are not available.

Emissions to Air

Sources of air emissions at HCFs may include exhaust air from heating, ventilation, and air conditioning (HVAC) systems, ventilation of medical gases and fugitive emissions released from sources such as medical waste storage areas, medical technology areas, and isolation wards. Emissions may include exhaust from medical waste incineration if this waste management option is selected by the facility[13]. In addition, air emissions may result from combustion related to power generation. Recommended prevention and control for power generation combustion source emissions are addressed in the **General EHS Guidelines.**

Exhaust air (e.g. from medical technology areas [MTAs], including isolation wards, laboratories, and waste storage and treatment facilities) may be potentially contaminated with biological agents, pathogens, or other toxic materials, and should be treated by conveying the exhaust air to combustion air to render it non-toxic and non-contagious before discharge. Condensate and blowdown liquids should be classified as health care wastewater and treated accordingly (see 'Wastewater' below). A stack sufficiently tall to eliminate odor nuisances and optimize dispersion should be used. Stack heights for all waste treatment facilities should be determined in accordance with guidance provided in the **General EHS Guidelines**.

Incineration

Large general hospitals may be equipped with their own incinerator plant, which is the major source of emissions to air and wastewater. Typically, only a relatively small portion of medical waste should be incinerated[14], and the need for a hospital waste incinerator (HWI) should be carefully evaluated against other technologies and techniques for waste management and disposal discussed above[15]. Pollutants potentially emitted from HWIs include:

- Heavy metals;
- Organics in the flue gas, which can be present in the vapor phase or condensed or absorbed on fine particulates;
- Various organic compounds (e.g. polychlorinated dibenzo-p-dioxins and furans [PCDD/Fs], chlorobenzenes, chloroethylenes, and polycyclic aromatic hydrocarbons [PAHs]), which are generally present in hospital waste or can be generated during combustion and post-combustion processes;
- Hydrogen chloride (HCl) and fluorides, and potentially other halogens-hydrides (e.g. bromine and iodine);
- Typical combustion products such as sulfur oxides (SO_X), nitrogen oxides (NO_X), volatile organic compounds (including non-methane VOCs) and methane (CH_4), carbon monoxide (CO), carbon dioxide (CO_2), and nitrous oxide (N_2O).

Pollution prevention and control measures include:

- Application of waste segregation and selection including removal of the following items from waste destined for incineration: halogenated plastics (e.g. PVC), pressurized gas containers, large amounts of active chemical waste, silver salts and photographic / radiographic waste, waste with high heavy metal content (e.g. broken thermometers, batteries), and sealed ampoules or ampoules containing heavy metals;

[13] Controlled-air incineration (also referred to as pyrolytic, starved-air, two-stage incineration, or modular combustion) is the most widely used HWI technology. Single-chamber and drum / brick incinerators should be used only as a last resort option.

[14] Infectious and pathological waste, selected pharmaceuticals (combustibility to be determined from the manufacturer's specifications) and chemicals, and sharps may be combusted in a pyrolytic incineration facility designed for this purpose. The types of waste incinerated typically include a heterogeneous mix of some, or all, of the following: human and animal infected anatomical waste; absorbents; alcohol, disinfectants; glass; fecal matter; gauze, pads, swabs, garments, paper, and cellulose; plastics, PVC, and syringes; sharps and needles; and fluids and residuals.

[15] Non-incineration Medical Waste Treatment Technologies in Europe, Health Care Without Harm (2004).

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Table 1. Treatment and disposal methods for categories of health care waste

Type of waste	Summary of treatment and disposal options / notes
Infectious waste: Includes waste suspected to contain pathogens (e.g. bacteria, viruses, parasites, or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts. Includes pathological and anatomical material (e.g. tissues, organs, body parts, human fetuses, animal carcasses, blood, and other body fluids), clothes, dressings, equipment / instruments, and other items that may have come into contact with infectious materials.	**Waste Segregation Strategy**: Yellow or red colored bag / container, marked "infectious" with international infectious symbol. Strong, leak proof plastic bag, or container capable of being autoclaved. **Treatment**: Chemical disinfection; Wet thermal treatment; Microwave irradiation; Safe burial on hospital premises; Sanitary landfill; Incineration (Rotary kiln; pyrolytic incinerator; single-chamber incinerator; drum or brick incinerator)[e] • Highly infectious waste, such as cultures from lab work, should be sterilized using wet thermal treatment, such as autoclaving. • **Anatomical waste** should be treated using Incineration (Rotary kiln; pyrolytic incinerator; single-chamber incinerator; drum or brick incinerator[e]).
Sharps: Includes needles, scalpels, blades, knives, infusion sets, saws, broken glass, and nails etc.	**Waste Segregation Strategy**: Yellow or red color code, marked "Sharps". Rigid, impermeable, puncture-proof container (e.g. steel or hard plastic) with cover. Sharps containers should be placed in a sealed, yellow bag labeled "infectious waste". **Treatment**: Chemical disinfection; Wet thermal treatment; Microwave irradiation; Encapsulation; Safe burial on hospital premises; Incineration (Rotary kiln; pyrolytic incinerator; single-chamber incinerator; drum or brick incinerator)[e] • Following incineration, residues should be landfilled. • Sharps disinfected with chlorinated solutions should not be incinerated due to risk of generating POPs. • Needles and syringes should undergo mechanical mutilation (e.g. milling or crushing) prior to wet thermal treatment
Pharmaceutical waste: Includes expired, unused, spoiled, and contaminated pharmaceutical products, drugs, vaccines, and sera that are no longer needed, including containers and other potentially contaminated materials (e.g. drug bottles vials, tubing etc.).	**Waste Segregation Strategy**: Brown bag / container. Leak-proof plastic bag or container. **Treatment**: Sanitary landfill[a]; Encapsulation[a]; Discharge to sewer [a]; Return expired drugs to supplier; Incineration (Rotary kiln; pyrolytic incinerator [a]); Safe burial on hospital premises[a] as a last resort. • Small quantities: Landfill disposal acceptable, however cytotoxic and narcotic drugs should not be landfilled. Discharge to sewer only for mild, liquid pharmaceuticals, not antibiotics or cytotoxic drugs, and into a large water flow. Incineration acceptable in pyrolytic or rotary kiln incinerators, provided pharmaceuticals do not exceed 1 percent of total waste to avoid hazardous air emissions. Intravenous fluids (e.g. salts, amino acids) should be landfilled or discharged to sewer. Ampoules should be crushed and disposed of with sharps. • Large quantities: Incineration at temperatures exceeding 1200 °C. Encapsulation in metal drums. Landfilling not recommended unless encapsulated in metal drums and groundwater contamination risk is minimal.
Genotoxic / cytotoxic waste: Genotoxic waste may have mutagenic, teratogenic, or carcinogenic properties, and typically arises from the feces, urine, and vomit of patients receiving cytostatic drugs, and from treatment with chemicals and radioactive materials. Cytotoxic drugs are commonly used in oncology and radiology departments as part of cancer treatments.	**Waste Segregation Strategy:** See above for "infectious waste". Cytotoxic waste should be labeled "Cytotoxic waste". **Treatment**: Return expired drugs to supplier; Chemical degradation; Encapsulation[a]; Inertization; Incineration (Rotary kiln, pyrolytic incinerator); • Cytotoxic waste should not be landfilled or discharged to sewer systems. • Incineration is preferred disposal option. Waste should be returned to supplier where incineration is not an option. Incineration should be undertaken at specific temperatures and time specifications for particular drugs. Most municipal or single chamber incinerators are not adequate for cytotoxic waste disposal. Open burning of waste is not acceptable. • Chemical degradation may be used for certain cytotoxic drugs – See Pruss et al. (1999) Annex 2 for details. • Encapsulation and inertization should be a last resort waste disposal option.

Environmental, Health, and Safety Guidelines
HEALTH CARE FACILITIES

WORLD BANK GROUP

Table 1. Treatment and disposal methods for categories of health care waste

Type of waste	Summary of treatment and disposal options / notes
Chemical waste: Waste may be hazardous depending on the toxic, corrosive, flammable, reactive, and genotoxic properties. Chemical waste may be in solid, liquid, or gaseous form and is generated through use of chemicals during diagnostic / experimental work, cleaning, housekeeping, and disinfection. Chemicals typically include formaldehyde, photographic chemicals, halogenated and nonhalogenated solvents[d], organic chemicals for cleaning / disinfecting, and various inorganic chemicals (e.g. acids and alkalis).	**Waste Segregation Strategy**: Brown bag / container. Leak-proof plastic bag or container resistant to chemical corrosion effects. **Treatment**: Return unused chemicals to supplier; Encapsulation[a]; Safe burial on hospital premises[a]; Incineration (Pyrolytic incinerator[a]; • Facilities should have permits for disposal of general chemical waste (e.g. sugars, amino acids, salts) to sewer systems. • Small hazardous quantities: Pyrolytic incineration, encapsulation, or landfilling. • Large hazardous quantities: Transported to appropriate facilities for disposal, or returned to the original supplier using shipping arrangements that abide by the Basel Convention. Large quantities of chemical waste should not be encapsulated or landfilled.
Radioactive waste: Includes solid, liquid, and gaseous materials that have been contaminated with radionuclides. Radioactive waste originates from activities such as organ imaging, tumor localization, radiotherapy, and research / clinical laboratory procedures, among others, and may include glassware, syringes, solutions, and excreta from treated patients.	**Waste Segregation Strategy:** Lead box, labeled with the radioactive symbol. **Treatment**: Radioactive waste should be managed according to national requirements and current guidelines from the International Atomic Energy Agency. IAEA (2003). Management of Waste from the Use of Radioactive Materials in Medicine, Industry and Research. IAEA Draft Safety Guide DS 160, 7 February 2003.
Waste with high content of heavy metals: Batteries, broken thermometers, blood pressure gauges, (e.g. mercury and cadmium content).	**Waste Segregation Strategy:** Waste containing heavy metals should be separated from general health care waste. **Treatment**: Safe storage site designed for final disposal of hazardous waste. • Waste should not be burned, incinerated, or landfilled. Transport to specialized facilities for metal recovery.
Pressurized containers: Includes containers / cartridges / cylinders for nitrous oxide, ethylene oxide, oxygen, nitrogen, carbon dioxide, compressed air and other gases.	**Waste Segregation Strategy:** Pressurized containers should be separated from general health care waste. **Treatment**: Recycling and reuse; Crushing followed by landfill • Incineration is not an option due to explosion risks • Halogenated agents in liquid form should be disposed of as chemical waste, as above.
General health care waste (including food waste and paper, plastics, cardboard)**:**	**Waste Segregation Strategy**: Black bag / container. Halogenated plastics such as PVC should be separated from general health care facility waste to avoid disposal through incineration and associated hazardous air emissions from exhaust gases (e.g. hydrochloric acids and dioxins). **Treatment:** Disposal as part of domestic waste. Food waste should be segregated and composted. Component wastes (e.g. paper, cardboard, recyclable plastics [PET, PE, PP], glass) should be segregated and sent for recycling.

Source: Safe Management of Wastes from Health-Care Activities. International Labor Organization (ILO), Eds. Pruss, A. Giroult, and P. Rushbrook (1999)
Notes:
a. Small quantities only
b. Low-level infectious waste only
c. Low-level liquid waste only
d. Halogenated and nonhalogenated solvents (e.g. chloroform, TCE, acetone, methanol) are usually a laboratory-related waste stream for fixation and preservation of specimens in histology / pathology and for extractions in labs.
e. Note on incinerators. Pyrolytic and rotary kiln incinerators should be used. Use of single-chamber and drum / brick incinerators are not normally considered good practice, except in emergency situations as a last option.

- Incinerators should have permits issued by authorized regulatory agencies and be operated and maintained by trained employees to ensure proper combustion temperature, time, and turbulence specifications necessary for adequate combustion of waste.[16] This includes implementation of operational controls including combustion and flue gas outlet temperatures (combustion temperatures should be above 850 °C while flue gases need to be quenched very quickly to avoid formation and reformation of POPs) as well as use of flue gas cleaning devices meeting international standards.[17]

Secondary air pollution control measures for hospital waste incinerators include the following:

- Wet scrubbers to control acid gas emissions (e.g. hydrochloric acid [HCl)], sulfur dioxide [SO_2, and fluoride compounds]). A caustic scrubbing solution will increase the efficiency for SO_2 control;
- Control of particulate matter may be achieved through use of cyclones, fabric filters, and / or electrostatic precipitators (ESP). Efficiencies depend on the particle size distribution of the particulate matter from the combustion chamber. Particulate matter from hospital incinerators is commonly between 1.0 to 10 micrometers (µm). ESPs are generally less efficient than baghouses in controlling fine particulates and metals from HWI;
- Control of volatile heavy metals depends on the temperature at which the control device operates. Fabric filters and ESP typically operate at relatively high temperatures and may be less effective than those that operate at lower temperatures. Venturi quenches and venturi scrubbers are also used to control heavy metal emissions. The volatile heavy metals usually condense to form a fume (less than 2 µm) that is only partially collected by pollution control equipment;
- Management of incineration residues such as fly ash, bottom ash and liquid effluents from flue gas cleaning as a hazardous waste (see **General EHS Guidelines**) as they may contain high concentrations of POPs.

[16] Technical information on the proper operation and maintenance of hospital waste incinerators may be obtained from WHO (1999) Chapter 8 and the US EPA Handbook on the Operation and Maintenance of Medical Waste Incinerators (2002).

[17] Refer to Guidelines on BAT/BEP practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants, Section V.

Wastewater

Process Wastewater

Wastewater from HCFs often has a quality similar to urban wastewater. Contaminated wastewater may result from discharges from medical wards and operating theaters (e.g. body fluids and excreta, anatomical waste), laboratories (e.g. microbiological cultures, stocks of infectious agents), pharmaceutical and chemical stores; cleaning activities (e.g. waste storage rooms), and x-ray development facilities. Wastewater may also result from treatment disposal technologies and techniques, including autoclaving, microwave irradiation, chemical disinfection, and incineration (e.g. treatment of flue gas using wet scrubbers which may contain suspended solids, mercury, other heavy metals, chlorides, and sulfates).

Depending on the effectiveness of hazardous waste management practices (in particular waste segregation strategies described above), hazardous health care wastes may enter the wastewater stream, including microbiological pathogens (wastewater with a high content of enteric pathogens, including bacteria, viruses, and helminthes / parasitic worms), hazardous chemicals, pharmaceuticals, and radioactive isotopes. Pollution prevention measures to minimize the generation of wastewater include the following:

- Waste segregation measures should be employed to minimize entry of solid waste into the wastewaster stream, including:
  - Procedures and mechanisms for separate collection of urine, feces, blood, and vomit from patients treated with genotoxic drugs to avoid their entry into the wastewater stream (as described above under waste segregation for hazardous and other wastes);
  - Collection of large quantities of pharmaceuticals for separate treatment or return to manufacturer (see Table 1). Small quantities of mild, liquid pharmaceuticals, excluding antibiotics or cytotoxic drugs, may be discharged to sewer systems with a large water flow.

Municipal Wastewater Treatment [18]

If wastewater is discharged to sanitary sewage treatment systems, the HCF should ensure that wastewater characteristics are in compliance with all applicable permits, and that the municipal facility is capable of handling the type of effluent discharged, as discussed in the **General EHS Guidelines**.

On-site Wastewater Treatment

In cases where wastewater is not discharged to sanitary sewage systems, HCF operators should ensure that wastewater receives on-site primary and secondary treatment, in addition to chlorine disinfection.

Techniques for treating wastewater in this sector include source segregation and pretreatment for removal / recovery of specific contaminants such as radio isotopes, mercury, etc.; skimmers or oil water separators for separation of floatable solids; filtration for separation of filterable solids; flow and load equalization; sedimentation for suspended solids reduction using clarifiers; biological treatment, typically aerobic treatment, for reduction of soluble organic matter (BOD); biological or chemical nutrient removal for reduction in nitrogen and phosphorus; chlorination of effluent when disinfection is required; dewatering and disposal of residuals as hazardous medical / infectious waste. Additional engineering controls may be required for (i) removal of active ingredients (antibiotics and miscellaneous pharmaceutical products, among other hazardous constituents), and (ii) containment and treatment of volatile constituents and aerosols stripped from various unit operations in the wastewater treatment system.

Wastewater generated from use of wet scrubbers to treat air emissions should be treated through chemical neutralization, flocculation, and sludge settling. Sludge should be considered hazardous, and may be treated off-site in a hazardous waste facility, or encapsulated in drums with mortar and landfilled. Sludge treatment should include anaerobic digestion to ensure destruction of helminthes and pathogens. Alternatively, it can be dried in drying beds before incineration with solid infectious wastes.

Other Wastewater Streams & Water Consumption

Guidance on the management of non-contaminated wastewater from utility operations, non-contaminated stormwater, and sanitary sewage is provided in the **General EHS Guidelines**. Contaminated streams should be routed to the treatment system for industrial process wastewater. Recommendations to reduce water consumption, especially where it may be a limited natural resource, are provided in the **General EHS Guidelines**.

1.2 Occupational Health and Safety

Occupational health and safety impacts during the construction and decommissioning of health care facilities (HCF) are

[18] Additional criteria for disposal to municipal systems may be found in WHO (1999).

common to those of most civil construction facilities and their prevention and control is discussed in the **General EHS Guidelines**. General health and safety hazards occurring in HCFs include manual handling injuries, such as sprains and strains from lifting and carrying patients; falls, trips, and slips; injuries caused by moving objects; and mental stress. These and other typical physical hazards are discussed in the **General EHS Guidelines**.

HCF health and safety hazards may affect health care providers, cleaning and maintenance personnel, and workers involved in waste management handling, treatment, and disposal. Industry specific hazards include the following:

- Exposure to infections and diseases
- Exposure to hazardous materials / waste
- Exposure to radiation
- Fire safety

Exposure to Infections / Diseases

Health care providers and personnel may be exposed to general infections, blood-borne pathogens, and other potential infectious materials (OPIM)[19] during care and treatment, as well as during collection, handling, treatment, and disposal of health care waste.

The following measures are recommended to reduce the risk of transferring infectious diseases to health care providers:

- Formulate an exposure control plan for blood-borne pathogens;[20]
- Provide staff members and visitors with information on infection control policies and procedures;[21]
- Establish Universal / Standard Precautions[22] to treat all blood and other potentially infectious materials with appropriate precautions, including:
  - Immunization for staff members as necessary (e.g. vaccination for hepatitis B virus)
  - Use of gloves[23], masks, and gowns
  - Adequate facilities for hand washing[24]. Hand washing is the single most important procedure for preventing infections (e.g. nosocomial and community). Hand washing should involve use of soap / detergent, rubbing to cause friction, and placing hands under running water. Washings of hands should be undertaken before and after direct patient contacts and contact with patient blood, body fluids, secretions, excretions, or contact with equipment or articles contaminated by patients. Washing of hands should also be undertaken before and after work shifts; eating; smoking; use of personal protective equipment (PPE); and use of bathrooms. If hand washing is not possible, appropriate antiseptic hand cleanser and clean cloths / antiseptic towelettes should be provided. Hands should then be washed with soap and running water as soon as practical

[19] According to US OSHA, blood-borne pathogens are pathogenic microorganisms that are present in human blood and can cause disease in humans, including human immunodeficiency virus (HIV), hepatitis B virus (HIB), and hepatitis C virus (HCV). Other potentially infectious materials (OPIM) refers to (1) The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids; (2) Any unfixed tissue or organ (other than intact skin) from a human (living or dead); and (3) HIV-containing cell or tissue cultures, organ cultures, and HIV- or HBV-containing culture medium or other solutions; and blood, organs, or other tissues from experimental animals infected with HIV or HBV.

[20] U.S. Department of Labor Occupational Health and Safety Administration (OSHA). Regulations (Standards - 29 CFR) Bloodborne pathogens. - 1910.1030 for health care facilities.

[21] U.S. Centers for Disease Control (CDC), Guideline for infection control in health care personnel (1998) , Available at: http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/InfectControl98.pdf

[22] Transmission-based precautions include air, droplet, and contact precautions are available from the US Occupational Health and Safety Administration (OSHA) at http://www.osha.gov/SLTC/etools/hospital/hazards/univprec/univ.html

[23] Health care workers may be latex sensitive, resulting in serious allergic reactions. Hypoallergenic gloves, glove liners, powderless gloves, or other similar alternatives should be available to those workers who are allergic.

[24] US CDC Guideline for Hand-Washing in Health Care Facilities (2002). Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5116a1.htm

- Procedures and facilities for handling dirty linen and contaminated clothing, and preparing and handling food
- Appropriate cleaning and waste disposal practices for the health care workplace

- The following recommendations should be implemented when using and handling of needles / sharps:
  - Use safer needle devices and needleless devices to decrease needlestick or other sharps exposures[25]
  - Do not bend, recap, or remove contaminated needles and other sharps unless such an act is required by a specific procedure or has no feasible alternative
  - Do not shear or break contaminated sharps
  - Have needle containers available near areas where needles may be found
  - Discard contaminated sharps immediately or as soon as feasible into appropriate containers
  - Used disposable razors should be considered contaminated waste and disposed of in appropriate sharps containers
- Establish policies to exclude animals from facility property.

In addition to the above recommendations, the following measures are applicable to personnel involved in waste management to reduce the risk of transferring infectious diseases:

- Implement immunization for staff members, as necessary (e.g. vaccination for hepatitis B virus, tetanus immunization);
- Provide adequate supplies of PPE for personnel involved in waste management including: overalls / industrial aprons, leg protectors, boots, heavy duty gloves, helmets, visors / face masks and eye protection (especially for cleaning of hazardous spills), and respirators (for spills or waste involving toxic dust or incinerator residue) as necessary;
- Provide washing facilities for personal hygiene, particularly at waste storage locations.

Exposure to Hazardous Materials and Waste

HCF workers may be exposed to hazardous materials and wastes, including glutaraldehyde (toxic chemical used to sterilize heat sensitive medical equipment), ethylene oxide gas (a sterilant for medical equipment), formaldehyde, mercury (exposure from broken thermometers), chemotherapy and antineoplastic chemicals, solvents, and photographic chemicals, among others. In addition to the guidance provided above, hazardous materials and wastes should be handled according to occupational health and safety guidance provided in the **General EHS Guidelines**.

Waste Anesthetic Gas (WAG) Exposure

Health care workers may be at risk of toxic exposure to nitrous oxide; the halogenated agents halothane (fluothane), enflurane (ethrane), isoflurane (forane); and other substances typically used as inhalation anesthetics.

Recommended measures to control exposure to waste anesthetic gas (WAG used in the operating room for example) include use of a scavenging unit attached to the anesthesia unit. The scavenging unit may have a charcoal filter that absorbs halogenated anesthetic gases, but not nitrous oxide. Spent charcoal filters should be disposed of as hazardous waste. If

[25] OSHA recommends the following safety devices: Needleless connector system s: needleless connectors for IV delivery systems (e.g. blunt cannula for use with prepierced ports and valved connectors that accept tapered or luer ends of IV tubing). Self-Sheathing Safety Feature: Sliding needle shields attached to disposable syringes and vacuum tube holders (e.g. disposable scalpels with safety features such as a sliding blade shield). Retractable Technology: Needles or sharps that retract into a syringe, vacuum tube holder, or back into the device (e.g. syringe with a retractable needle, retractable finger / heel-stick lancets). Self Blunting Technology: Self-blunting phlebotomy and winged-steel "butterfly" needles (a blunt cannula seated inside the phlebotomy needle is advanced beyond the needle tip before the needle is withdrawn from the vein). Add-on Safety Feature: Hinged or sliding shields attached to phlebotomy needles, winged steel needles, and blood gas needles.

there is no scavenging unit, or if the scavenging unit does not have a filter, vacuum lines are used to collect WAGs which are subsequently vented outside and dispersed.

Radiation

Occupational radiation exposure may result from equipment emitting X-rays and gamma rays (e.g. CT scanners), radiotherapy machines, and equipment for nuclear medicine activities. HCF operators should develop a comprehensive plan to control radiation exposure in consultation with the affected workforce. This plan should be refined and revised as soon as practicable on the basis of assessments of actual radiation exposure conditions, and radiation control measures should be designed and implemented accordingly. Recommendations to prevent and control exposure to radiation are discussed in the **General EHS Guidelines**.

Fire Safety

The risk of fire in health care facilities is significant due to the storage, handling, and presence of chemicals, pressurized gases, boards, plastics, and other flammable substrates. Fire safety recommendations applicable to occupational areas are presented under 'Occupational Health and Safety' in the **General EHS Guidelines**. Recommendations applicable to buildings accessible to the public, including health care facilities, are presented under 'Life and Fire Safety' in the **General EHS Guidelines**. Additional recommendations for fire safety include:

- Installation of smoke alarms and sprinkler systems;
- Maintenance of all fire safety systems in proper working order, including self-closing doors in escape routes and ventilation ducts with fire safety flaps;
- Training of staff for operation of fire extinguishers and evacuation procedures;
- Development of facility fire prevention or emergency response and evacuation plans with adequate guest information (this information should be displayed in obvious locations and clearly written in relevant languages).

1.3 Community Health and Safety

Community health and safety issues during the construction, operations, and decommissioning of HCFs are generally common to those of most industrial facilities, and are discussed in the **General EHS Guidelines**. Community hazards associated with health care facility environments, particularly related to hazardous health care waste, necessitate that members of the public receive adequate information regarding potential infection hazards within the facility, and at associated waste disposal sites (e.g. landfills). Guidance on community disease transmission is provided in the **General EHS Guidelines**.

2.0 Performance Indicators and Industry Benchmarks

2.1 Environmental Performance

Emissions and Effluent Guidelines

Tables 2 and 3 present emission and effluent guidelines for this sector. Guideline values for process emissions and effluents in this sector are indicative of good international industry practice as reflected in relevant standards of countries with recognized regulatory frameworks. These guidelines are achievable under normal operating conditions in appropriately designed and operated facilities through the application of pollution prevention and control techniques discussed in the preceding sections of this document. Emissions guidelines are applicable to process emissions. Combustion source emissions guidelines associated with steam- and power-generation activities from sources with a capacity equal to or lower than 50 megawatt thermals (MWth) are addressed in the **General EHS Guidelines** with larger

power source emissions addressed in the **EHS Guidelines for Thermal Power**. Guidance on ambient considerations based on the total load of emissions is provided in the **General EHS Guidelines**.

Effluent guidelines are applicable for direct discharges of treated effluents to surface waters for general use. Site-specific discharge levels may be established based on the availability and conditions in the use of publicly operated sewage collection and treatment systems or, if discharged directly to surface waters, on the receiving water use classification as described in the **General EHS Guidelines.** These levels should be achieved, without dilution, at least 95 percent of the time that the plant or unit is operating, to be calculated as a proportion of annual operating hours. Deviation from these levels in consideration of specific, local project conditions should be justified in the environmental assessment.

Table 2. Effluent Levels for Health Care Facilities

Pollutants	Units	Guideline Value
pH	S.U	6 - 9
Biochemical oxygen demand (BOD_5)	mg/L	50
Chemical oxygen demand (COD)	mg/L	250
Oil and grease	mg/L	10
Total suspended solid (TSS)	mg/L	50
Cadmium (Cd)	mg/L	0.05
Chromium (Cr)	mg/L	0.5
Lead (Pb)	mg/L	0.1
Mercury (Hg)	mg/L	0.01
Chlorine, total residual	mg/L	0.2
Phenols	mg/L	0.5
Total coliform bateria	MPN[a] / 100ml	400
Polychlorinated dibenzodioxin and dibenzofuran (PCDD/F)	Ng/L	0.1
Temperature increase	°C	<3[b]

Notes:
[a] MPN = Most Probable Number
[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity

Table 3. Air Emission Levels for Hospital Waste Incineration Facilities[b]

Pollutants	Units	Guideline Value
Total Particulate matter (PM)	mg/Nm^3	10
Total organic carbon (TOC)	mg/Nm^3	10
Hydrogen Chloride (HCl)	mg/Nm^3	10
Hydrogen Fluoride (HF)	mg/Nm^3	1
Sulfur dioxide (SO_2)	mg/Nm^3	50
Carbon Monoxide (CO)	mg/Nm^3	50
NO_x	mg/Nm^3	200-400[(a)]
Mercury (Hg)	mg/Nm^3	0.05
Cadmium + Thallium (Cd + Tl)	mg/Nm^3	0.05
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V	mg/Nm^3	0.5
Polychlorinated dibenzodioxin and dibenzofuran (PCDD/F)	ng/Nm^3TEQ	0.1

Notes:
a. 200 mg/m3 for new plants or for existing incinerators with a nominal capacity exceeding 6 tonnes per hour; 400 mg/m3 for existing incinerators with a nominal capacity of 6 tonnes per hour or less
b. Oxygen level for incinerators is 7 percent.

Environmental Monitoring

Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during normal operations and upset conditions. Environmental monitoring activities should be based on direct or indirect indicators of emissions, effluents, and resource use applicable to the particular project. Monitoring frequency should be sufficient to provide representative data for the parameter being monitored. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken. Additional guidance

on applicable sampling and analytical methods for emissions and effluents is provided in the **General EHS Guidelines**.

Resource Consumption, Energy Use, and Waste Generation

Environmental performance of hospital installations should also be evaluated against internationally published benchmarks for resource consumption, energy use and waste generation. If inefficiencies are identified, the comparison with published benchmarks should be followed by a detailed audit or survey to identify potential opportunities for improvement, without compromising the objective of providing quality, safe, health care.[26]

2.2 Occupational Health and Safety

Occupational Health and Safety Guidelines

Occupational health and safety performance should be evaluated against internationally published exposure guidelines, of which examples include the Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®) published by American Conference of Governmental Industrial Hygienists (ACGIH),[27] the Pocket Guide to Chemical Hazards published by the United States National Institute for Occupational Health and Safety (NIOSH),[28] Permissible Exposure Limits (PELs) published by the Occupational Safety and Health Administration of the United States (OSHA),[29] Indicative Occupational Exposure Limit Values published by European Union member states,[30] or other similar sources.

Accident and Fatality Rates

Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. Facility rates may be benchmarked against the performance of facilities in this sector in developed countries through consultation with published sources (e.g. US Bureau of Labor Statistics and UK Health and Safety Executive)[31].

Occupational Health and Safety Monitoring

The working environment should be monitored for occupational hazards relevant to the specific project. Monitoring should be designed and implemented by accredited professionals[32] as part of an occupational health and safety monitoring program. Facilities should also maintain a record of occupational accidents and diseases and dangerous occurrences and accidents. Additional guidance on occupational health and safety monitoring programs is provided in the **General EHS Guidelines**.

[26] Examples of reference sources include: Energy Consumption: United States Department of Energy, Energy Information Administration (http://www.eia.doe.gov/); Natural Resource Canada, Office of Energy Efficiency (http://oee.nrcan.gc.ca); Water Use: Healthcare Environmental Resource Center (http://www.hercenter.org/); Waste Generation: Hospitals for a Health Environment (http://www.h2e-online.org/)
[27] Available at: http://www.acgih.org/TLV/ and http://www.acgih.org/store/
[28] Available at: http://www.cdc.gov/niosh/npg/
[29] Available at: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992
[30] Available at: http://europe.osha.eu.int/good_practice/risks/ds/oel/
[31] Available at: http://www.bls.gov/iif/ and http://www.hse.gov.uk/statistics/index.htm
[32] Accredited professionals may include Certified Industrial Hygienists, Registered Occupational Hygienists, or Certified Safety Professionals or their equivalent.

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Annex A: General Description of Industry Activities

The Health Care Facilities (HCF) sector includes a diverse range of facilities and activities involving general hospitals, small inpatient primary care hospitals, outpatient facilities, assisted living facilities, and hospice facilities. Ancillary facilities may include medical laboratories and research facilities, mortuary centers, and blood banks and collection services.

The HCF sector involves close contact among patients, health care providers, and support staff; extensive use of sharps and instruments designed for diagnostic and curative (invasive and noninvasive) procedures; and utilization of pharmaceutical, chemical, radiological, and other agents for diagnosis, treatment, cleaning, and disinfection.

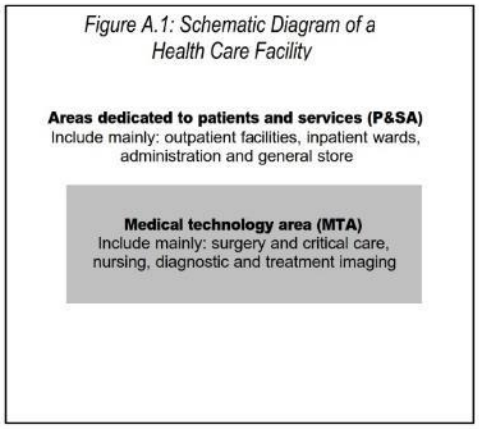
The basic infrastructure elements / activities of HCF facilities are to improve the health of patients, prevent transmission of infections among patients and staff, and control impacts to environment, health, and safety including maintenance of sanitary conditions; use of appropriate disinfection and sterilization techniques; provision of potable water and clean air for all operations; and nosocomial infection control.

The medical technology area (MTA) is the central focus of a hospital / clinic. Typically, it is not present in outpatient facilities, assisted living facilities for elderly or handicapped persons, or hospice facilities. Dedicated patient and services areas (P&SA) are of major significance in hospitals and clinics, as well as in assisted living facilities for elderly or handicapped persons, and hospice facilities.

Typically an HCF needs between 60 to 100 square meters (m^2) per bed, in addition to an area of equal or similar size for parking and facility access. With periodic upgrading of technologies, the relevant investment involved ranges from US$175,000 to 500,000 per bed in developed countries, and in developing countries may range from US$175,000- 200,000 per bed.

As part of day-to-day operations, HCFs generate a variety of wastes, including air emissions, wastewater effluents, health care waste (e.g. infectious, pathologic, and chemical wastes), and municipal solid waste. Average electricity consumption for an HCF is influenced by its design criteria, particularly by the availability or need for specific services. These may include a dedicated heating plant or in-house services such as kitchens and laundries, which may require outsourcing if unavailable in the HCF. The energy consumption of a general hospital is almost double that consumed by all other types of buildings, mostly because of MTA energy needs.

Figure A.1: Schematic Diagram of a Health Care Facility



Annex H Images of Current Practices at Health Care Facilities

Georgetown Public Hospital (GPHC)

H-1: Non-infectious Waste Collection Bin at GPHC

H-2: Waste Collection Skip at GPHC

H-3: Sharps Collection Container at GPHC

H-4: Sharp Collection Container at GPHC filled beyond capacity

H-5: Medical Waste Holding Area

H-6: GPHC Hydroclave

H-7: GPHC Biohazard truck

H-8: One of the Older Generator

H-9: New Generator being Installed

H-10: Main Fuel Storage Tank

H-11: Minor Fuel Spill outside of Containment

H-12: Fire Extinguisher at GPHC

H-13: Fire Hydrant at GPHC

H-14: Fire Hose within a Building at GPHC

Diamond Hospital

H-15: General Waste Collection Bin at Diamond Hospital

H-16: Waste Collection Skip at the Diamond Hospital

H-17: Sharps Collection Bin at Diamond Hospital

H-18: Other Waste Types placed in Sharps Collection Container

H-19: Medical Waste Collected via Red Bags

H-20: Medical Waste Storage Shed

H-21: Medical Waste within Storage Shed

H-22: Back-up Power Generator

H-23: Water Accumulation within the Compound

H-24: Water Accumulation on Floor within the Building

H-25: Fire Extinguisher at the Diamond Hospital

H-26: Fire Extinguisher not inspected since 2009

H-27: Moulds Growing on the Walls

H-28: Backed-up Toilet

H-29: Exposed electrical wiring

H-30: Faulty AC in use

H-31: Littering within the Compound

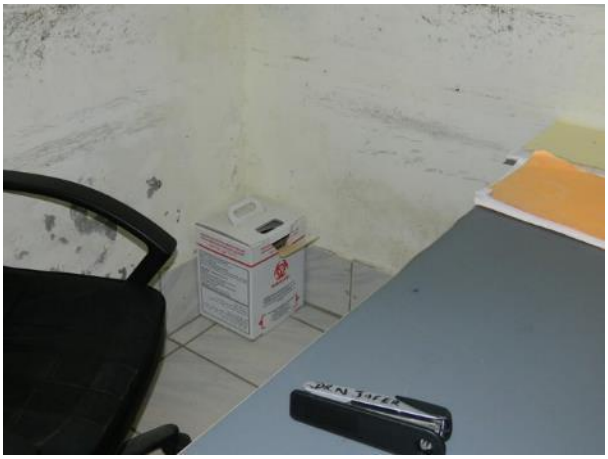
H-32: Areas within the Compound requiring improvements

H-33: Some HSE related Signs installed at the Diamond Hospital

CC Nicholson Hospital

H-34: Regular Waste Bin at CC Nicholson Hospital

H-35: Waste Collection Skips at CC Nicholson Hospital



H-36: Sharps Collection Box

H-37: Storage of Sharp Boxes

H-38: Makeshift Incinerator Onsite

H-39: Expired Pharmaceuticals

H-40: Soak-away System Onsite

H-41: Septic Tanks

H-42: Fire Extinguishers

H-43: Some HSE Related Signs at the CC Nicholson Hospital