ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

for

Removal and Replacement of Incinerator at the Sir Lester Bird Medical Center (formerly Mount St. John's Medical Centre)

REPORT

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ABBREVIATIONS AND ACRONYMS

ABNMWMP	Antigua and Barbuda National Medical Waste Management Plan
CBD	United Nations Convention on Biological Diversity
CBH	Central Board of Health
CEDAW	Convention on the Elimination of forms of Discrimination Against Women
CGA	Country Gender Assessment
CPA	Country Poverty Assessment
CSW	Commission on the Status of Women 2008
DAS	Department of Analytical Services
DoE	Department of the Environment
DGA	Directorate of Gender Affairs
EPMA	Environmental Protection and Management Act 2015
FIA	Freedom of Information Act 2003
HCW	Health Care Waste
HCWM	Health Care Waste Management
IDB	Inter-American Development Bank
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
LBS Protocol	Protocol Concerning Pollution from Land Based Sources and Activities
MHWE	Ministry of Health, Wellness and the Environment
NAP	National Adaptation Policy
NGO	Non-governmental Organisations
NSWMA	National Solid Waste Management Authority
PPA	Physical Planning Act 2003
PPE	Personal Protective Equipment
Rio+20	United Nations Conference on Sustainable Development

SDG	Sustainable Development Goals
SIRMZP	Sustainable Island Resource Management Zoning Plan
SLBMC	Sir Lester Bird Medical Center formerly Mount St. John's Medical Center
UNFCCC	United Nations Framework Convention on Climate Change

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EXECUTIVE SUMMARY

The project is to remove the present incinerator system at the Sir Lester Bird Medical Center (SLBMC) formerly the Mount St. John's Medical Centre, and replace it with a new incineration unit. The project is part of the "Strengthening Resilience and Supporting Recovery in Antigua and Barbuda COVID-19 Health Response Project". The Caribbean Development Bank (CDB) is the funding agency. The Physical Planning Act (2003) Section 23 (1), (2) and in Schedule III requires the preparation of an Environmental Impact Assessment report for certain undertakings one of which is an incinerator. The CDB/IDB requires that developments classified as Category B have an Environmental and Social Impact Assessment and an attendant Environmental and Social Management Plan.

To elucidate baseline environmental and social conditions related the project site, several methods were used including a desk review of pertinent documents, interviews with relevant personnel, site visits and community surveys. Data gathered included but was not limited to physical attributes, biological environment, socio-economic conditions, archaeology, history and culture, infrastructure and proposed development. Impact of assessments evidenced no significant negative effects on the physical and biotic environments, no potential impacts on archaeology, history/culture. No negative health or socio economic impacts are expected which cannot be significantly reduced or eliminated through effective implementation of the monitoring plan. Potential issues include air pollution, contamination of hospital water supply, fire and occupational health and safety concerns. Mitigation based on the management plan include the development of bio-medical waste management plan to include protocols and procedures for segregation, storage, handling and transport, treatment and disposal of waste, proper installation and operation of the incinerator, initial and on-going training of staff and collaborative testing

and monitoring between the SLBMC team, the DOE, Department of Analytical Services and National Solid Waste Management Authority.

1.0 INTRODUCTION

1.1 Project Proponent

The Sir Lester Bird Medical Centre (hereinafter referred to as SLBMC) formerly Mount St. John's Medical Centre is seeking to procure a replacement incinerator as part of the project titled: "Strengthening Resilience and Supporting Recovery in Antigua and Barbuda COVID-19 Health Response Project". The hospital is the only public hospital providing tertiary healthcare for the twin-island state of Antigua and Barbuda. The source of funding for the project is the Caribbean Development Bank.

1.2 Purpose of the Project

The project aims to improve the handling and treatment of bio-medical waste generated by the SLBMC. Antigua and Barbuda have limited land space and presently most waste, including biomedical waste, is disposed of at the Cook's sanitary landfill. The COVID-19 pandemic saw a massive increase in the amount of bio-medical waste generated (MHWE, 2022) especially contaminated personal protective equipment. This meant that the hospital had to handle and store more waste, sub-contractors had to transport this waste to the landfill and this waste had to be deep buried in appropriately prepared chambers to reduce leaching, scavenging and other activities with potential hazards due to exposure to bio-medical waste. The present incinerator is no longer operational and interim procedures for dealing with bio-medical waste are not ideal and presents potential risks and hazards associated with handling, storage, transport and disposal. These risks are to employees of the hospital, subcontractors responsible for transport of the waste, employees at waste disposal sites, scavengers and the general public. Incineration using a properly functioning incineration unit operated according to international

standards and best practices, will reduce the volume of waste and minimize potential harm due to its toxicity, infection and injury potential. The project will see the removal of the present incinerator and its replacement with a new unit to be operated according to international best practices. The new incinerator will be placed on the site of the old incinerator in a purpose-built room. The new incinerator will also handle medical waste from other institutions such as the Clarevue Psychiatric Hospital.

1.3 Purpose of the Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan

Legal Authority: The Physical Planning Act (2003) Section 23 (1), (2) and in Schedule III requires the preparation of an Environmental Impact Assessment report for certain undertakings one of which is an incinerator. The CDB/IDB requires that developments classified as Category B have an Environmental and Social Impact Assessment and an attendant Environmental and Social Management Plan.

1.4 Scope of the ESIA

Under the Antigua and Barbuda Physical Planning Act 2003, Section 23, Third Schedule, for the procurement of a replacement incinerator as part of the project titled: "Strengthening Resilience and Supporting Recovery in Antigua and Barbuda COVID-19 Health Response Project", this ESIA pertains to the installation and operation of a replacement incinerator at the Sir Lester Bird Medical Centre and proposes measures that will mitigate risks, along with the development of a monitoring plan.

1.5 Objectives and Criteria of the ESIA

Specific objectives are to:

1. Assess potential significant environmental and social impacts of the project.
2. Assess baseline environmental and social conditions as they relate to the proposed location of the work.
3. Review relevant policies, legislation, and regulations framework which have implications for the successful implementation of the proposed work.
4. Identify receptors of impacts to include air, ecosystems, water bodies.
5. Identify stakeholders (e.g., Staff, patients, residents, and workers removing old incinerator and replacing and operating the new incinerator) who may be major recipients of impacts.
6. Identify mitigation strategies for direct and indirect impacts during the removal of the present incinerator, installation of the replacement incinerator and operation of it.
7. Develop associated mitigation and monitoring measures required for the successful implementation of the proposed project activities.

The format and criteria of the ESIA is based on the revised terms of reference as set out by the Department of the Environment (see Annex 1) and adheres to the Caribbean Development Bank Environmental and Social Review Procedures.

2.0 PROJECT DESCRIPTION

2.1 Project Description and Objectives

The task involves the procurement and installation of a replacement incinerator as part of the project titled: “Strengthening Resilience and Supporting Recovery in Antigua and Barbuda COVID-19 Health Response Project.” The project proposes the removal of the present non-

functioning incinerator system and replacement with Therm-tec G-20 incinerator (see Annex 2 for specifications).

Objectives of the Project

The major objectives of the project are to:

1. Incinerate hospital waste and waste generated from other medical facilities.
2. To prevent or reduce improper disposal of bio-medical waste
3. To reduce risk of injury and spread of disease to the general public due to improper disposal and handling of biomedical waste.
4. To reduce risk of injury and spread of disease to hospital workers and municipal workers who may be required to handle biomedical waste
5. To prevent scavenging of bio-medical waste

2.2 Benefits and Justification

Incineration of medical waste is widely practiced. It reduces organic waste to inorganic matter which is less combustible and less hazardous. Effective incineration requires high temperatures (850-1100 °C) to reduce the volume, mass and infection potential of bio-medical waste and is an effective way of dealing with waste that is difficult or impossible to reuse or recycle safely. Incineration increases waste management efficiency as it reduces the volume of waste to be disposed in landfills, reduces transportation costs and eliminates potential pathogens and toxins. This became especially important in 2020 to 2021 when the COVID-19 pandemic exponentially increased the volume of personal protective equipment, such as masks, gloves,

face shields, and other medical waste generated by the hospital. Incineration reduces land pollution, odour nuisance and potential groundwater contamination through leaching in landfills. It reduces the likelihood of scavenging by humans and animals through dangerous medical waste which may lead to the spread of diseases and reduced health among the population. Incineration in a controlled and efficient manner as opposed to haphazard and poorly controlled burning may reduce fumes and smoke and its constituents.

2.3 Analysis of Project Alternatives

2.3.1 No Project Alternative

The present incinerator will remain inoperable. Biomedical waste will most likely continue to be stored at the hospital under present conditions (in uncovered skips, then transported in unregulated vehicles to the landfill for disposal. This represents an unacceptable situation with the potential for contamination of ground and surface water due to leaching, leading to injury and infection to all workers and scavengers who may be exposed to biomedical waste and by extension the spread of pathogenic organisms to members of the general public. Landfills must be properly constructed and operated in order to reduce these hazards.

2.3.2 Alternative Location

The Cook's Sanitary Landfill is the most logical alternative site for a new incinerator. However, storage, handling and transport of bio-medical waste will remain potential routes for hazard. It is also likely that any incinerator obtained will be large enough to burn other waste which may mean that a critical volume of waste must be reached before it is operated. This means prolonged storage of bio-medical waste when international standards require it to be treated within 24 hours of generation and to be treated near the site of generation. There is

already a purpose-built room with all necessary infrastructure at the proposed location and no overt site preparation and construction will be required.

2.3.3 Alternative Technologies

There are other methods used for the treatment and disposal of bio-medical waste and each of these are described below. Most methods are either more expensive, less effective or require highly specialized training and qualifications which may present a challenge to obtain. All the descriptions below are taken from the draft Antigua and Barbuda National Medical Waste Management Plan (ABNMWMP).

i) Low heat Thermal

Low-heat thermal processes use thermal energy at elevated temperatures (100ºC and 180ºC) high enough to destroy pathogens, but not sufficient to cause combustion or pyrolysis of waste. The treatment processes take place in two environments – moist or dry environment. In the former, steam is used to disinfect waste, commonly performed in an autoclave or other steam-based system; also referred to as a wet thermal process whilst in the latter heat is used without the addition of water or steam.

ii) Chemical

Chemical Treatment Processes use chemical disinfectants such as dissolved chlorine dioxide, bleach (sodium hypochlorite), peracetic acid, lime solution, ozone gas, or dry inorganic chemicals. This process often involves shredding, grinding, or mixing to increase exposure of waste to the chemical agent and the treatment usually results in disinfection rather than sterilization. For liquid systems, wastes may go through a dewatering stage to remove and recycle the disinfectant.

iii) Irradiation

This is a process by which an object is exposed to radiation. The waste is treated using irradiation from electron beams, Cobalt-60, or ultraviolet sources to destroy pathogens. The effectiveness of pathogen destruction depends on absorbed dose by mass of waste. The operator is required to be shielded to prevent occupational exposure. This method is not commonly used for treating Health Care Waste because of the high investment cost.

iv) Biological

Specifically refers to the degradation of organic matter through processes occurring in nature. Examples include composting, vermiculture (digestion of organic wastes through the actions of

worms), bio digestion, and natural decomposition through burial of cadavers, tissues and anatomical parts. In some cases, enzymes may be added to speed up decomposition of organic waste. Composting and vermiculture methods have been successfully used for placenta and hospital kitchen waste.

v) Mechanical

This method generally supplements other treatment methods and includes shredding, grinding, mixing, and compaction which reduce waste volume. This method is unable to destroy pathogens. The advantage of this method is that the rate of heat transfer is improved and the waste has more surface area for treatment

vi) Inertisation (Stabilisation)

This process involves mixing waste with a mixture containing lime, cement and water in order to minimize the risk of toxic substances contained in the waste migrating into surface water or underground water. The mixture can be transported in liquid state to landfill. It is a suitable technology for disposing of pharmaceuticals and incineration ashes with a high metal content.

vii) Shredding

Shredders cut sharps into small pieces. This technology requires a worker skilled in the operation and maintenance of heavy-duty, rotating equipment. Simple shredders can be made from a manually operated grain mill. Due to the risks involved for workers during the operation, only disinfected needles and syringes should be processed.

viii) Non Incineration

Non-incineration technologies are used to disinfect infectious health-care waste, while avoiding the formation and release of dioxins. Depending on the waste being treated, alternative treatment technologies may also render health-care waste unrecognizable, reduce its volume, eliminate the physical hazards of sharps, decompose pathological or anatomical waste and/or degrade chemotherapeutic waste.

Source: the draft ABNMWMP, 2022

3.0 METHODOLOGY

Both primary and secondary data were used for this report. The data and information were gathered in the ways described below. Where possible, data was disaggregated by gender.

1. Desk review of available literature. This literature included but was not limited to policies such as the final draft of the Antigua and Barbuda National Medical Waste Management Plan, laws such as the Environmental Protection and Management Act and the Physical

Planning Act , regulations, and regional and international treaties including those pertaining to gender.

2. Interviews with appropriate hospital personnel and pertinent professionals including but not limited to the project proponent's representative in the person of the Operations Manager at SLBMC, employees of the SLBMC including the Facilities Manager, the current incinerator operator and the General Manager of National Solid Waste Management Authority.
3. Besides desk review of available reports such as the Antigua And Barbuda Country Gender Scorecard and Population and Housing Census, data for the socio-economic and gender impact assessment was gathered from questionnaires and informal interviews with community members. Field study dates and times are displayed in Table A..

   Questionnaires: Walk-throughs were conducted in communities adjacent to the hospital that were likely to be impacted by the use of the incinerator to conduct face-to-face interviews using the questionnaire as a guide. The questionnaire formats can be seen in Appendix C.

Table A. Field study dates and times

No.	Date	Time
1	Thursday 22nd September 2022	5:00 pm – 6:00 pm
2	Thursday 29th September 2022	5:00 pm – 6:00 pm
3	Friday 7th October 2022	1:00 pm – 6:00 pm
4	Thursday 13th October 2022	1:00 pm – 6:00 pm
5	Friday 14th October 2022	12:00 am – 5:30 pm
6	Saturday 15th October 2022	12:00 am – 5:30 pm

7	Sunday 16th October 2022	12:00 am – 5:30 pm
8	Sunday 13th November 2022	1:00 pm – 6:00 pm
9	Monday 21st November 2022	4:00 pm – 5:30 pm
10	Tuesday 22nd November 2022	7:00 am – 12 noon
11	Thursday 24th November 2022	3:30 pm – 5:30 pm
12	Saturday 26th November 2022	3:30 pm – 5:30 pm

4. Mapping software and ground truthing to gather data on physical attributes of surrounding areas for example, the number and types of dwellings and types of businesses (see table 1).
5. Site visits to the SLBMC for reconnaissance and to gather primary and secondary data.

4.0 POLICY, LEGISLATIVE AND ADMINISTRATIVE FRAMEWORK

Part of the desk review focused on examination of applicable laws, policies and non-regulatory framework including international treaties and agreements. These are outlined below.

4.1 Legislation

4.1.1 The Mount St. John's Medical Centre Act 2009

The Act provides regulations for the establishment of the hospital in 2009 as well as the efficient management, administration and organization of the hospital. The hospital was renamed the Sir Lester Bird Medical Center by parliamentary decision in May of 2021.

4.1.2 Environmental Protection and Management Act (2015)

The Act aims to "provide for sustainable environmental protection and management, to establish effective allocation of administrative responsibilities for environment management, the

undertaking and coordination of environmental management, and related activities, the incorporation of international treaty obligations with respect to the environment into national and law related matters," (p.9). Specific to this project, the Act provides for preventative and remedial measures for mitigation of all forms of environmental degradation. Further Schedule VIII Section 64 (3) issues air quality criteria and provides guidelines for the calculation of concentration of a substance in a point source discharge to determine if it exceeds the stated concentration and satisfies air quality standards as set out in parts 3 and 4 of the same schedule. Part 2 of the schedule provides classification of substances, while Parts 3,4 and 5 delineate air quality guidelines, air quality standards and emission standards respectively. The Act allows for public participation in and transparency of the decision-making process regarding environmental protection.

4.1.3 Physical Planning Act, 2003

This Act controls the development of land, the protection of the natural environment; and building regulations. It legislates for a National Development plan and Local Area Plans for parts of Antigua and Barbuda. The Third Schedule of the Physical Planning Act (2003) Section 23 (1) lists matters which require an Environmental Impact Assessment (EIA) and specifically lists incinerators as one such instance.

4.1.4 Freedom of Information Act 2004

The FOI Act gives effect to those parts of the Constitution that grant rights to receive and disseminate information. It promotes maximum disclosure of information and requests the creation of an Information Officer for every Public Authority. Important as well for the project is the provision which requires that the Public Authority make available on an annual basis " the content of all decisions and policies it has adopted which affect the public, along with the reasons

for them, any authoritative interpretations of them, and any important background material; and ***(h)*** any mechanisms or procedures by which members of the public may make representations or otherwise influence the formulation of policy or the exercise of powers by that public authority." (Freedom of Information Act, 2004)

4.1.5 Childcare and Protection Act 2003

This Act passed in 2004 provides for the establishment of a Child Protection Agency, licensing of childcare agencies, and speaks to other matters relating to the safety, care and protection of children. The Act defines a child as someone not having reached the age of 18 years or a person who has attained this age but due to a disability is certified as in need of care and protection by the relevant agent. The act governs the maintenance of standards for childcare facilities which makes it applicable here as there is potential impact on childcare facilities in associated areas.

4.2 Agreements, Treaties and Conventions

The following Multilateral Agreements are pertinent to this project:

4.2.1 United Nations Framework Convention on Climate Change (UNFCCC), 1992

This convention, which entered into force in 1994, provides a framework for intergovernmental efforts to deal with climate change and its effects. The convention allows for the development and implementation of strategies for tackling emissions and the challenges of expected impacts and provides for financial and technical assistance for developing countries. Each country formulates its Intended Nationally Determined Contributions (INDC) to the UNFCCC. To ensure equality in addressing the needs of men and women, the UNFCCC aims for

gender balance in bodies established in conformation with the Convention and the Kyoto Protocol. This should improve women's participation and inform more effective climate change policy.

4.2.2 Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW)

In 1979, the General Assembly of the United Nations adopted the CEDAW as a tool for the protection of the rights of women. CEDAW was ratified by Antigua and Barbuda in 1989 and in 1996 signed the Optional Protocol. The aim of the CEDAW is to ensure that all women are afforded the opportunity to represent governments at the internationally and participate in the work of international organizations; have equal rights to all forms of financing available to men such as bank loans and mortgages. Additionally women from rural areas have the opportunity to (i) participate in and benefit from rural development; (ii) participate in development planning at all levels; (iii) obtain training, education, and extension services; (iv) have access to agricultural credit and loans, marketing facilities and appropriate technology; and (v) are treated equally in land, agrarian reform, and land resettlement schemes.

4.2.3 Beijing Declaration and Platform for Action from the Fourth World Conference on Women

The platform calls for the active involvement of women in environmental decision making at all levels, the integration of gender concerns and perspectives in policies and programs for sustainable development, and the strengthening or establishment of mechanisms at the national, regional, and international levels to assess the impact of development and environmental policies on women.

4.2.4 Commission on the Status of Women

The 52nd session of the Commission on the Status of Women (2008) identified gender perspectives on climate change as its key emerging issue. The Commission on the Status of Women urged governments to integrate a gender perspective in the design, implementation, monitoring and evaluation, and reporting of national environmental policies, strengthen mechanisms and provide adequate resources to ensure women's full and equal participation in decision making at all levels on environmental issues, on strategies related to climate change and the lives of women and girls.

4.2.5 United Nations Conference on Sustainable Development (Rio+20) outcome document.

Rio+20 affirms that green economy policies in the context of sustainable development and poverty eradication should enhance the welfare of women, mobilize their full potential and ensure the equal contribution of both women and men.

"The Future We Want" was adopted in Rio de Janeiro in June 2012.

It resolves to unlock the potential of women as drivers of sustainable development, including through the repeal of discriminatory laws and the removal of formal barriers. It also commits to actively promote the collection, analysis and use of gender sensitive indicators and sex-disaggregated data.

4.2.6 Sustainable Development Goals (SDGs)

The SDGs are the heart of the 2030 Agenda for Sustainable Development adopted in 2015 by the United Nations member states. The goals are formulated to end poverty and other

deprivations through strategies that improve health and education, tackle inequality and stimulate economic growth, within the context of dealing with climate change and preserving the environment. The Declaration assures equal rights and opportunities for women and men, promotes gender equality and the empowerment of women (SDGs 5 and 10) as effective ways to combat poverty, hunger and disease.

4.2.7 Lima Climate Change Conference 2014

The outcome of the Lima Work Programme on Gender states that the role of women is key to the response to climate change and needs to be strengthened. *Lima Work Programme on Gender* the Parties agreed on a Lima Work Programme on Gender to advance gender balance and promote gender sensitivity in developing and implementing climate policy.

4.2.8 The Stockholm Convention on Persistent Organic Pollutants (Stockholm Convention)

The Stockholm Convention on Persistent Organic Pollutants (POPs) is a global treaty which aims to protect human health and the environment from POPs. These chemicals share the characteristics of remaining in the environment for long years, are widely distributed geographically, can bio-magnify and bio-accumulate and harm the health of humans and animals and negatively affect the environment. Antigua and Barbuda acceded to the Stockholm Convention in 2003.

4.2.9 The *Minamata Convention* on Mercury (Minamata Convention)

The convention is a treaty that aims to protect human health and environment from the effects of mercury pollution. The treaty targets human activities that result in mercury pollution and some of these activities are actively carried out in the health sector such as:

1. the use of mercury in clinical thermometers and blood pressure machines and other detecting devices
2. vaccines that use mercury as preservatives
3. mercury batteries
4. use of mercury-containing products such as dental filings

The convention recommends a reduction in these activities as well as

5. Safe storage and disposal of all mercury-related products after their removal from the market
6. Phase out or control mercury air emissions from coal-fired power plants, industrial boilers, and cement production.

Antigua and Barbuda has been a party to the Minamata Convention since 2016.

4.3 National Policies

4.3.1 *Sustainable Island Resource Management Zoning Plan (SIRMZP 2012).* The Physical Planning Act of 2003 describes the intention for a Development Plan for any part of Antigua and Barbuda. The SIRMZP was commissioned with this in mind and approved in 2012.

4.3.2 *National Poverty Strategy 2011-2015* has as one of its strategies, "Building Resilience through Environmental Sustainability – by making disaster risk reduction a feature of the planning process in the light of the high environmental risks that the country faces from hurricanes, earthquakes, and now sea rise, as a result of global warming. "

4.3.3 *National Biodiversity Strategy and Action Plan*. Target 8 of the action plan calls for a 20% reduction of the pollution in demonstration areas, including from excess nutrients, bringing it to levels that are not detrimental to ecosystem function and biodiversity.

4.3.4 *Draft National Medical Waste Management Plan*

The plan is in its final draft and has not yet been adopted but is expected to be short. The plan was formulated in the absence of overarching policy and legislation for the management of medical waste in Antigua and Barbuda. The plan has five priorities: Develop and/or review oversight committee, policies, regulations, guidelines, standards and monitoring and evaluation (M and E) systems, improve infrastructure and equipment, increase capacity building, training,, and community awareness, ensure that there are adequate resources for HCWM, Promote best practices in HCWM (especially for the private sector and households)

5.0 DESCRIPTION OF THE RECEIVING ENVIRONMENT (BASELINE)

5.1 Environmental Baseline

5.1.1 Physical Environment

Geologically Antigua has 3 distinct regions: a volcanic region in the south and southwest, the central plain and the limestone region which occupies the north and eastern third of the island. The central region is a diagonal which extends from between Ferris Point and Corbinson Point in the northwest, across the centre of the island, to between Shirley Heights and Willoughby Bay in the south east. It is approximately 5 kilometers wide and the hospital is situated in the north western third of the belt.

Topography

Sir Lester Bird Medical Center is situated on a landform with a distinctly conical shape. The height is 37.49 metres (123) feet above sea level using a GARMIN GPS 12XL. The hill has a circular base and smooth sides with a gradient of 32 degrees.

Soil

The geology forms part of the clayey central region of the island (see Figure 1). The soil is of the Ottos Suite. It was developed over, thin, superficial deposits of Pleistocene clay and over sedimentary tuffs. The parent material consists of dull brown, very heavy clay that has been derived from the erosion of the rocks of the sedimentary tuff formations. These are hard to work, heavy clays with impeded drainage, and near neutral pH (Cooper & Bowen, 2001). They frequently contained layers of weathered chert stones and boulders.

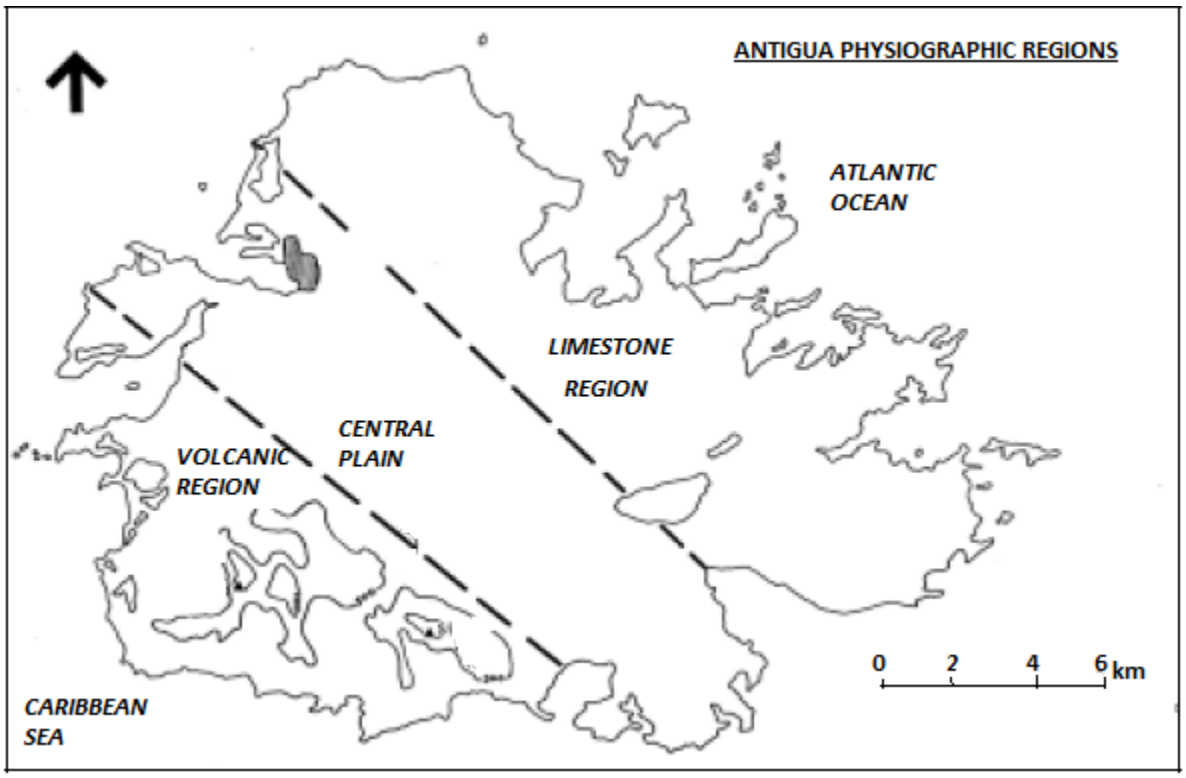


Figure 1: ***Topographic Zones of Antigua*** **(adapted from National Action Plan)**

Hydrology

The drainage pattern for Sir Lester Bird Medical Centre is radial. Rainfall develops around a central elevated point where the rainwater radiates outwards from a central high point. The tributaries from a summit follow the slope downwards and drain down in all directions.

Air and Climate

The islands of Antigua and Barbuda are subject to northeasterly Trade Winds and so experience fairly steady winds ranging from the northeast to the southeast. Monthly average wind speeds are 17 to 26 km/hour, with the lowest speeds from September to November. (Cooper & Bowen, 2001). The wind experienced at any given place is dependent on factors such as topography. Wind is predominantly from the east and northeast but may change due to atmospheric conditions. Other climactic features of Antigua are year round high temperatures, and a defined wet and dry season. The temperature extremes of 34 ℃ and 15℃ have been recorded but the average is 29°C. The traditional dry season is from January to March-April when less than 20% of rainfall takes place. The height of the wet season is from August to November. The frequency of storms increases as the wet season advances until it reaches a peak in August September. The wet season occurs through May to November, during which the island receives around 150 - 250 mm per month. Antigua and Barbuda also lies in the heart of the Atlantic hurricane belt, where cyclones and hurricanes occur throughout August, September and October. However rainfall is variable and fairly unpredictable. Up to November 2020, Antigua was enduring the most severe drought on record there being an accumulated deficit of an entire year's worth of rainfall since the beginning of the drought in 2013. The last 32 months (July 2013 to February 2016) have been the driest ever for that period on record and the drought has continued into 2022. The implications of this was continued heavy reliance on potable water generated by desalting or reverse osmosis. Communities in Antigua including the watershed, therefore had to rely on intermittent water supply from the government or personal storage arrangements such as tanks and cisterns.

5.1.2 Physical Infrastructure

The Sir Lester Bird Medical Center formally known as the Mount St. John Medical center is a 185-bed hospital, and the only public hospital on the island of Antigua. It officially opened in 2009 and offers primary care to advanced critical care. There are approximately 700 staff including about 200 medical personnel. The main building has 4 floors which house the wards, laboratories, radiology administration and other departments. The facilities annex is connected to the main hospital building by a covered walkway. This annex houses the laundry beneath which is the hospital's water supply. There are offices on the upper floors. The sewage treatment facility is located to the south of the facilities annex. The generator is also part of the same annex.

The incinerator room is an adjunct of the facilities annex and is purpose-built. Three of its 4 walls have thick steel mesh providing ventilation. There has been one main operator since its use began in 2009. Outside the room, there is a large garbage skip into which bio-hazardous waste is dumped. At present the skip is carried to the sanitary landfill when it is full, which may take 2 days to 1 week.

Built Environment

The hospital is located on the summit of a hill to the southeast of the city. The hill slopes down to the southern edge of town and to four villages. Ovals is generally west, Michael's Village and Ottos to the southwest and Radio Range to the south and south east (see Figure 2). The main portion of the city of St. John's lies to the north northwest. Directly east of the hospital is a Catholic church then open land. Directly north is the Cancer Treatment Center. There is a frequently used recreational field northeast of the hospital's hill and a major bus station. Hospital road is a major thoroughfare as it provides a route to the hospital and a by-pass from the busy Queen Elizabeth highway to the busy Independence Drive.

Figure 2. Villages near SLBMC

5.1.3 Biological Environment

The SLBMC is an already established structure which occupies land that previously housed a hotel. Therefore the original biological environment has already been altered. The proposed site is within the boundaries of the St. John's City limits. All the land within a 10 km area has had all original vegetation removed. It has been replaced by business and residential buildings and infrastructure such as roads or has been taken over by generic scrub. There are no national parks or biosphere reserves within the study area. There is a stand of mangroves about 700 m west north west of the SLBMC near the Nevis Street dock. No reports were found of any

rare or endangered or endemic or /threatened fauna or flora in the study area and none were observed during fieldwork.

Vegetation

The southeastern, southwestern, western, northern and northeastern slopes are sporadically covered with thorny Acacia, and *Prosopis* species; Antigua Hay grass (*Dichanthium aristsatum*), Seymour grass (*Bothriocloa pertusa*); Bambatsi grass (*Panicum colbratum*); Pangola grasses; Guinea grass (*Panicum maximum*); Coralita *(Antigonon leptopus*); L*eucas martini – earthaginensis*; and *Cassytha filiformis*. The eastern slopes display grass and a variety of Bouganvilla.

Mammals

Observed were the black rat, brown rat, and Mongoose. The bat's species include *Brachyphylla cavernarum, Natulus stramineus, and Molassus molossus*

Reptiles

The reptiles observed were *Amieva griswoldi, Annolis bimaculatus leachi, and Anolis wattsi wattsi, the Gecko (Sphaerodactylus elegantulus).*

Birds

The birds observed were Lesser Antillean Bullfinch *(Laxigilla noctis)* , Bananaquit (*Coereba flaveola*); White Crowned Pigeon (*Columba leucocephala*); Zenadia Dove (*Zenaida aurita*); Common Ground Dove (*Columbina passerina*), Antillean Crested Humming Bird (*Orthorhyncus cristatus*); Green Throated Carib (*Eulampis holosericeus*); Gray Kingbird (*Tyrannus dominicensis*); Caribbean Elaenia (*Elaenia martinica*); Carib Grackle (*Quyiscalus lugubris*); Black Faced Grassquit (*Tiaris bicolor*)

Arthropods

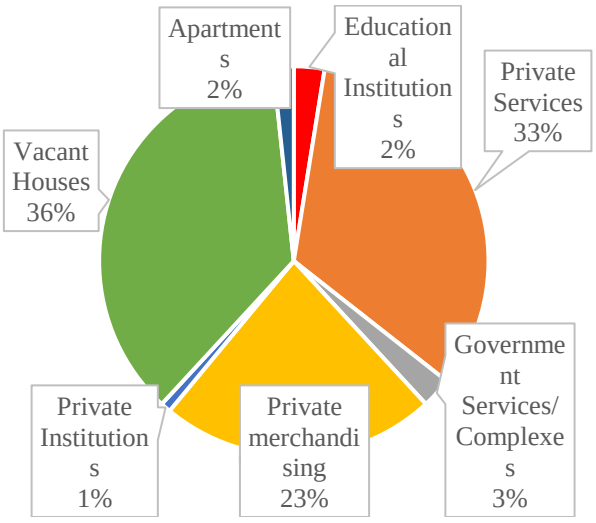
A wide variety were observed. These include butterflies (Sulphur, West Indian Buckeye, Monarch, White Peacock), dragonflies, walking sticks, wasps, bees, ants, centipedes and land hermit crabs.

6.0 SOCIO-ECONOMIC AND GENDER BASELINE

6.1 Socio-Economic Baseline

6.1.1 Distribution of Businesses

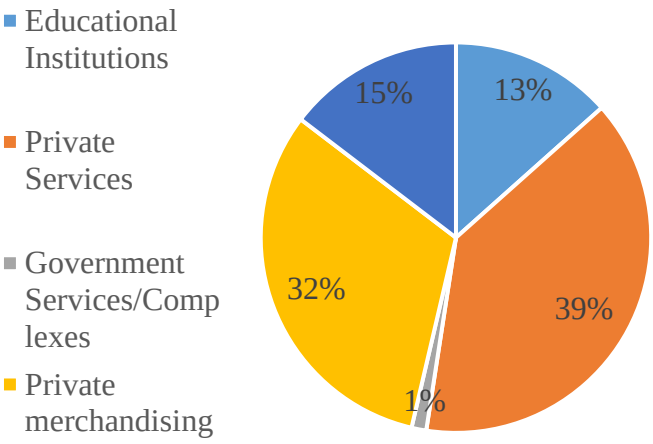
The graphs below represent the business demographics for the four main villages in Antigua and Barbuda surrounding the Sir Lester Bird Medical Centre that could be directly affected by an established incinerator – Ovals, Ottos, Michaels' Village and Radio Range. Educational Institutions refer to daycare institutions, all levels of schools and tutoring facilities. Private services are companies that provide a service to the public, such as, car wash, mechanics, medical practitioners, private clinics, law firms, barbers, and beauty salons, etc., whereas private merchandising are all retail-based business operations. Government services/complexes are those provided by the government, such as sports complexes, standpipes, gutters, clinics, government buildings, etc. Private institutions comprise places of general use by the public, such as, churches, radio stations, cinemas, etc.



Source: Author's Field Notes

Figure 3: Business Demographics within the Ovals Area on September 22nd, 2022, 5 - 6 p.m.

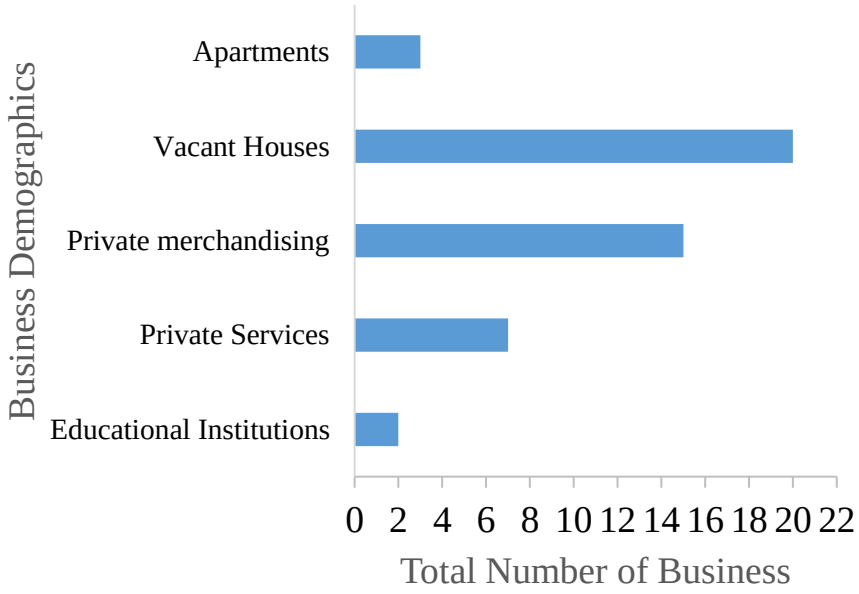
Trend: In Ovals Village majority of the businesses are from private services (33%) and Private merchandising (23%). Within the closely packed area 36% of the houses are vacant.



Source: Author's Field Notes

Figure 4: Business Demographics within the Michaels' Village Area on October 7th & 13th, 2022, 4 - 6 p.m.

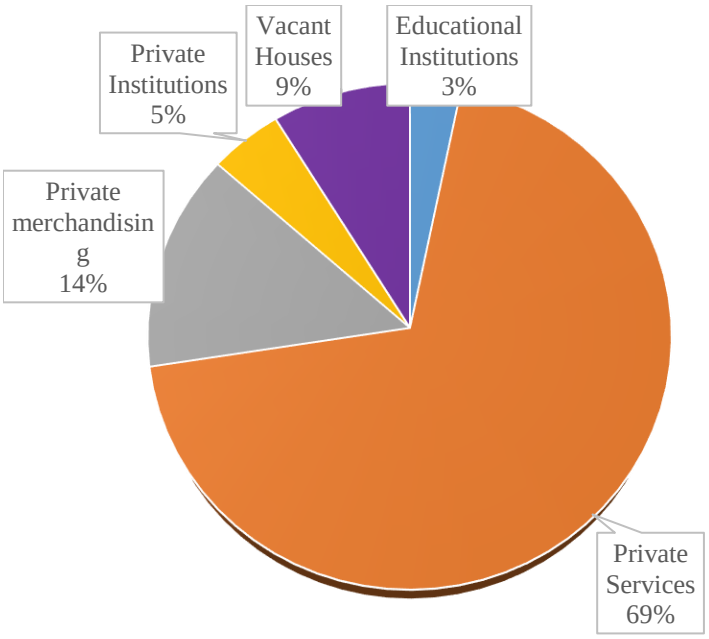
Trend: In Michaels Village majority of the businesses like the Ovals village are from private services (39%) and private merchandising (32%). Within this area, only 15% are vacant houses, while 13% are education practices.



Source: Author's Field Notes

Figure 5: Business Demographics for Upper Ottos on September 29th, 2022, 5 - 6 p.m.

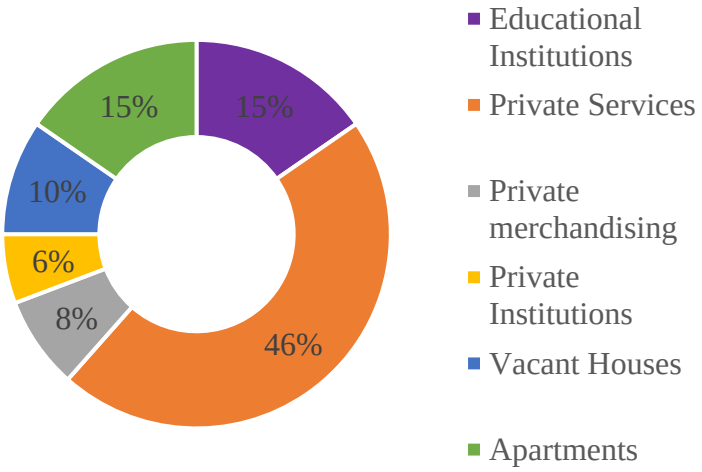
Trend: The business demographic within Upper Ottos is mostly private merchandising (15 businesses). There are seven private services. And only two educational institutions. There are over twenty vacant houses within this village.



Source: Author's Field Notes

Figure 6: Business Demographics for Lower Ottos on October 13th to November 13th, 2022, 1 - 6 p.m.

Trend: In Lower Ottos, 69% are private service operators, significantly higher than upper Ottos. Private merchandising stands at 14% and vacant housing at a low 9%.



Source: Author's Field Notes

Figure 7: Business Demographics for the Radio Range Area October 14th to 16th, 2022, 12 – 5:30 p.m.

Trend: Radio Range also has a large demographic of private services, but they are also many apartment complexes (15%) and significant educational institutions (15%). Only 10% of the houses are vacant.

6.1.2 **Social Demographics**

The following section details social parameters gathered from field work including vulnerable populations such as the differently abled, amenities, employment and education.

Table 1: Number of Houses and Residents Spoken to.

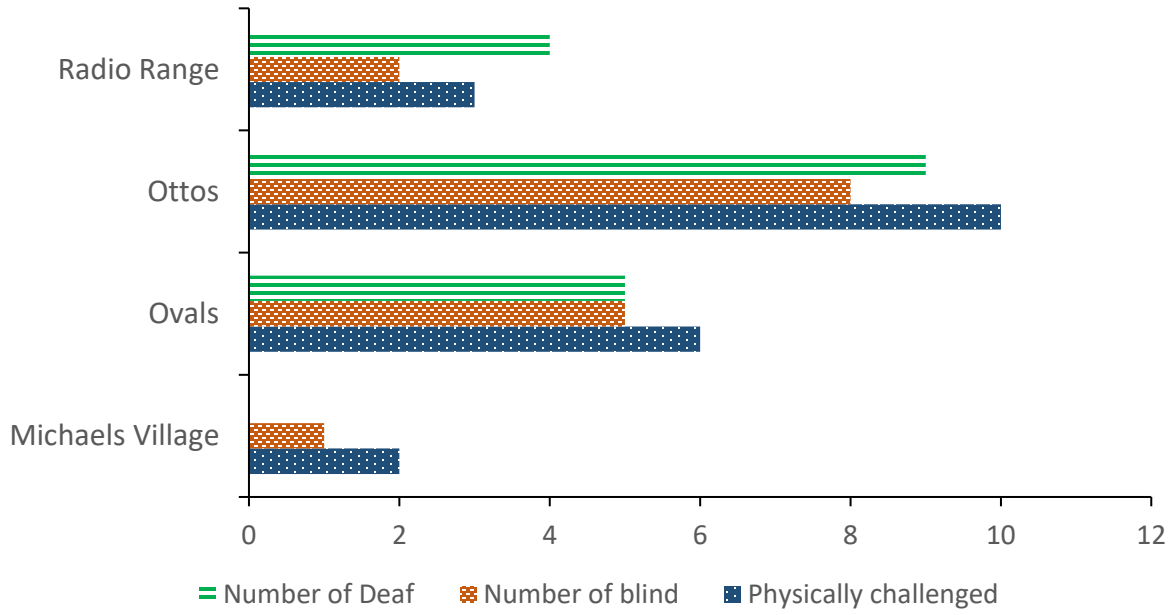
Village	No. of houses	No. of residents
Michaels Village	148	222
Ovals	280	530
Ottos	411	1315
Radio Range	188	282

Source: Author's Field Notes (November 2022)

Table 2: Number of Physically Challenged, Blind and Deaf Residents

Village	Physically challenged	Blind	Deaf
Michaels Village	2	1	0
Ovals	6	5	5
Ottos	10	8	9
Radio Range	3	2	4

Source: Author's Field Notes (November 2022)



Source: Author's Field Notes

Figure 8: Distribution of Individuals with Disability Within Michael's Village, Ovals Village, Ottos Village, And Radio Range.

Table 3: Number of Pregnant Persons

Michaels village	**6**
Ovals	19
Ottos	36
Radio Range	6

Source: Author's Field Notes (November 2022)

Table 4. Retired Persons

Village	Female	Male	Total
Michaels Village	39	40	79
Ovals	57	60	117
Ottos	123	92	215
Radio Range	29	25	54
Total	248	217	465

Source: Author's Field Notes (November 2022)

Table 5. Full Employed vs Unemployed

Village	Female Employed	Male Employed	Female Unemployed	Male Unemployed
Michael Village	106	94	15	7
Ovals	130	275	83	42
Ottos	589	590	102	26
Radio Range	139	137	2	0

Source: Author's Field Notes (November 2022)

Table 6. Number of Desktop Computers

Number	Michaels Village	Ovals	Ottos	Radio Range
0	180	140	185	12
1	36	102	156	110
2	15	36	49	40
3	3	0	12	15
4	0	0	0	2

Source: Author's Field Notes (November 2022)

Table 7. Number of Mobile Phones

Number	Michaels Village	Ovals	Ottos	Radio Range
0	0	10	140	0
1	192	390	923	160
2	52	90	230	107
3	0	0	0	8
4	0	0	0	0

Source: Author's Field Notes (November 2022)

Table 8. Waste Disposal Methods

Method	Michaels Village	Ovals	Ottos	Radio Range
Public garbage trucks	220	519	1284	282
Private garbage trucks	0	1	1	5
Dumping on land	0	1	1	0
Burning	0	0	0	0

Source: Author's Field Notes (November 2022)

Table 9. Bathroom Location

Location	Michaels Village	Ovals	Ottos	Radio Range
Inside dwelling	219	518	1284	282
Not inside dwelling	0	6	15	0
No Bathroom	0	2	10	0

Source: Author's Field Notes (November 2022)

Table 10. Air Conditioning Units

No. of Units	Michaels Village	Ovals	Ottos	Radio Range
0	140	262	397	253
1	2	6	2	3
2	0	2	2	3
3	0	0	2	1
4	0	0	0	0

Source: Author's Field Notes (November 2022)

Table 11. Water Supply

Source	Michaels Village	Ovals	Ottos	Radio Range
Public Standpipe	2	4	10	0
Public piped dwelling	198	494	1252	265
Public piped in yard	3	30	43	2
Cistern / tank	1	1	5	15
No response	2			

Source: Author's Field Notes (November 2022)

Table 12. Number of Bedrooms

No. of Bedrooms	Michaels Village	Ovals	Ottos	Radio Range
0	0	0	0	0
1	0	0	0	0
2	63	199	178	47
3	48	69	226	203
4	6	8	2	25

Source: Author's Field Notes (November 2022)

Table 13. Number of Cars Owned

No. of Cars	Michaels Village	Ovals	Ottos	Radio Range
0	16	345	1106	10
1	192	159	176	256
2	0	12	3	10
3	0	0	0	2

Source: Author's Field Notes (November 2022)

Table 14. Land Tenure

	Michaels Village	Ovals	Ottos	Radio Range
Owned	84	86	165	123
Rented	60	180	230	60
Squatter	0	6	12	2

Source: Author's Field Notes (November 2022)

Table 15. Marital Status

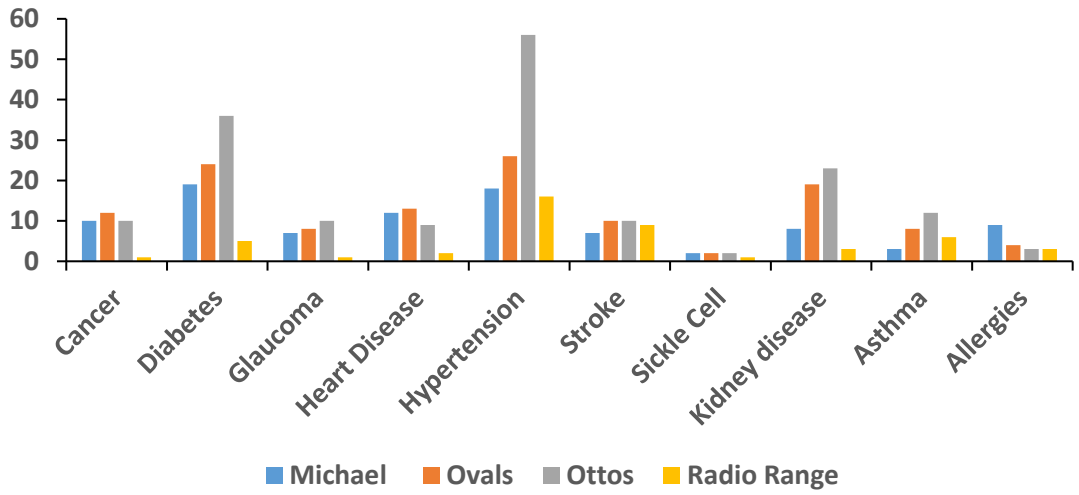
Status	Michaels Village	Ovals	Ottos	Radio Range
Never married	127	240	800	80
Married	69	203	413	151
Divorced	15	39	48	30
Widowed	4	12	10	12
Legally separated	2	24	15	2

Source: Author's Field Notes (November 2022)

Table 16. Disease Affecting Residents by Type (%)

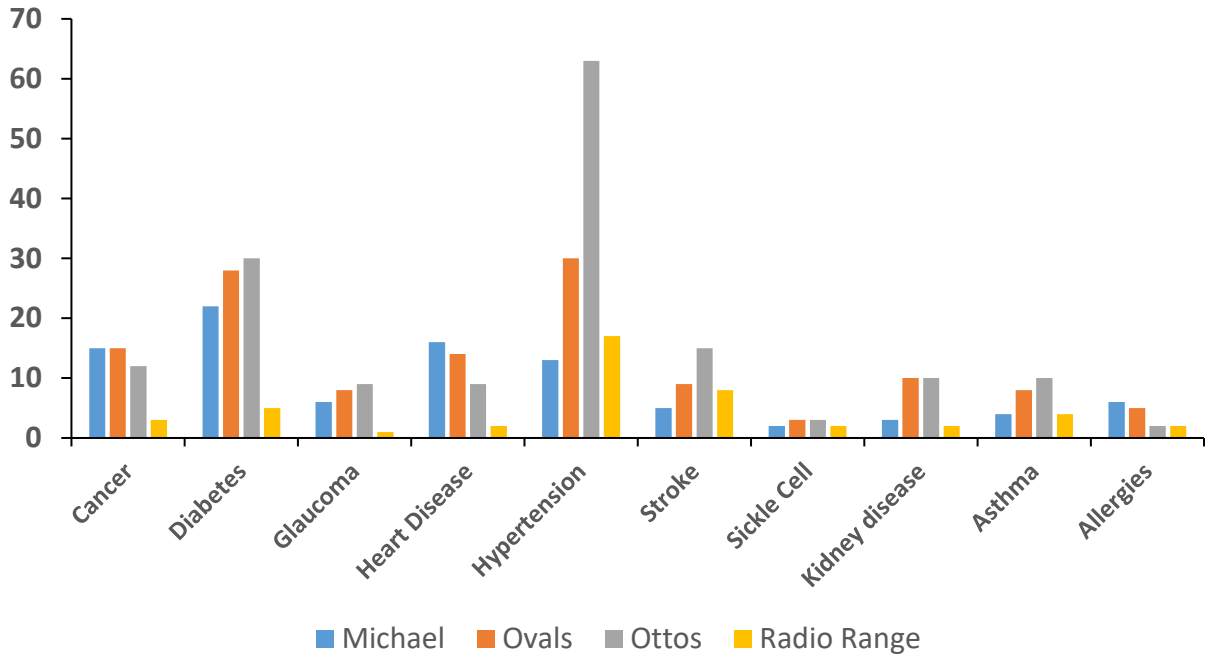
	Michael V		Ovals		Ottos		Radio Range	
	Male	Female	Male	Female	Male	Female	Male	Female
Cancer	10	15	12	15	10	12	1	3
Diabetes	19	22	24	28	36	30	5	5
Glaucoma	7	6	8	8	10	9	1	1
Heart Disease	12	16	13	14	9	9	2	2
Hypertension	18	13	26	30	56	63	16	17
Stroke	7	5	10	9	10	15	9	8
Sickle Cell	2	2	2	3	2	3	1	2
Kidney disease	8	3	19	10	23	10	3	2
Asthma	3	4	8	8	12	10	6	4
Allergies	9	6	4	5	3	2	3	2

Source: Author's Field Notes (November 2022)



Source: Author's Field Notes

Figure 9. Disease by Type among Males with Michaels Village, Ovals Village, Ottos Village, and Radio Range



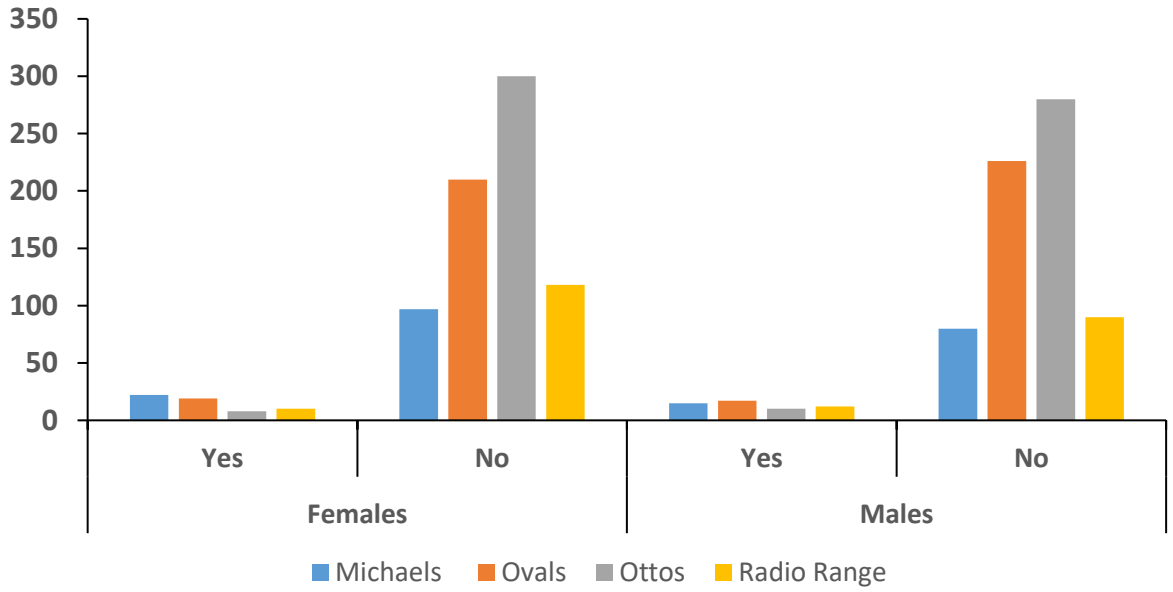
Source: Author's Field Notes

Figure 10. Disease by Type among Females with Michaels Village, Ovals Village, Ottos Village, and Radio Range

Table 17. Number of Residents who have heard the word 'incinerator.'

Village	Females		Males	
	Yes	No	Yes	No
Michaels V	22	97	15	80
Ovals	19	210	17	226
Ottos	8	300	10	280
Radio Range	10	118	12	90

Source: Author's Field Notes (November 2022)



Source: Author's Field Notes (November 2022)

Figure 11. Number of Females and Males with understanding of the word "Incinerator".

Table 18. Education Level

Level	Michael Village	Ovals	Ottos	Radio Range
Primary	89	264	687	35
Secondary	91	184	400	123
A 'Level	3	9	12	30
Business	3	18	26	18
Engineering	4	6	13	12
Hospitality	2	3	9	10
ABICE	9	10	32	2
ABIIT	10	5	10	18
Nursing	2	3	6	12
University	6	7	10	20
None	8	16	22	2

Source: Author's Field Notes (November 2022)

Table 19. Labour Force Characteristics, by Sex, 2018

	All	Men	Women
Population	92,093	43,086	49,007
Population 15 and over	71,993	32,235	39,758
Labour Force	51,931	24,525	27,406
Employed	47,429	22,728	24,701
Unemployed	4,502	1,797	2,705
Not in the labour force	20,062	7,710	12,352
Unemployment rate (%)	8.7	7.3	9.9
Employment rate (%)	65.9	70.5	62.1
Participation rate (%)	72.1	76.1	68.9

Source: Statistics Division, Ministry of Finance and Corporate Governance, Labour Force Survey, 2018.

Table 20. Total Resident Population by Sex, St. John's City

Females	12,439
Males	11,555
Total	23,994

Source: Statistics Division, Ministry of Finance and Corporate Governance, Labour Force Survey, 2018.

Table 21. Total Resident Population by Sex, St. John's Rural

Females	17,015
Males	15,727
Total	32,742

Source: Statistics Division, Ministry of Finance and Corporate Governance, Labour Force Survey, 2018.

Housing

The 2011 Population Census of Antigua and Barbuda posed eight main questions concerning housing and households, and the data derived from these forms the basis for the initial analysis presented here. The eight variables covered the type of dwelling, type of tenure, water supply,

toilet facilities, date of construction, materials of outer walls, number of rooms, type of lighting, and the fuel used for cooking.

The individual variables were selected as being broadly diagnostic of housing conditions in Michaels Village, Ovals, Ottos and Radio Range. Table 22 shows the Housing Characteristics for Michaels Village, Ovals, Ottos, and Radio Range

These were defined as follows:

1. Water supply: % of houses using public standpipe
2. Type of Human waste disposal system: %Pit Latrine toilet
3. Type of tenure: % of houses owner occupied
4. Age: % of houses built before 1960
5. Materials: % of houses built entirely of wood
6. Toilet Type: % of houses making use of pit latrines
7. Lighting Fuel: % of houses using electricity
8. Cooking gas: % of houses using bottled gas

Table 22. Key Indicators of Housing Quality 2022: Percentage Total Household Possessing Each Attribute.

	Michaels Village		Ovals		Ottos		Radio Range	
	%	# houses	%	# houses	%	# houses	%	# houses
Built before 1960	48.19	71	38.6	106	37.6	154	46.78	87
Constructed of Wood	60.36	89	73.58	206	57.26	235	45.29	85
Constructed of concrete	22.07	32	23.58	66	18.2	74	18.3	34
Pit latrine toilet	0	0	0	0	5,9	24	0	0
Flush toilet (water closet type)	90.0	133	78.11	218	80.22	329	96.82	180
Owner occupied	73.8	109	64.71	181	72.01	295	70.16	131
Electrical lighting	90.0	133	86.22	241	89.12	366	94.68	177
Gas for cooking	91.4	135	92.84	259	90.26	370	96.2	180

Water piped into yard	92.3	136	86.7	240	91.78	377	97.8	183
Owned structure not the land	45.0	66	43.77	122	39.16	160	19.28	36

Source: Author's Field Notes (November 2022)

Attitudes Towards Incinerators

Based on the questionnaire responses and informal conversations with the person in the Micheals Village, Ovals, Ottos, and Radio Range, there is diminished trust in the institution responsible for the management of the potentially hazardous facility. The consultant found that the residents exhibited a lack of trust in Sir Lester Bird Medical Centre personnel which operates the medical waste facility and the relevant government agencies that regulate the facility was the primary source of concern. Several reasons for people's distrust or lack of trust are possible. Some of the explanations offered are the people controlling or authorizing and regulating the incinerator. It seems that suspicions arise if track records are flawed or if it is sensed that facility advocates and regulators do not share one's own goals for their community. Apart from whether facility operators and regulators are regarded as honest, competent, and well-intended, scientific uncertainties can contribute to a lack of trust.

The first question residents asked was, "Is this really needed"? The consultant advises that if its promoters cannot convincingly demonstrate a pressing need for a new incinerator, people who are skeptical of the need or are otherwise opposed to it, will be disinclined to negotiate on other issues about it. In addition to having a perceived un-favourable or adverse effect on the economic, physical, and mental well-being of individual people in the surrounding area, an existing incineration facility can affect the area's social fabric. Some changes may be precipitated by economic factors, but others may be structural, that is, they may concern the formal and informal relationships of groups and individuals in the area. If individual health and

wellbeing, property values, and quality of life in the communities are substantially affected by the medical waste incinerator, the neighbourhood's character may begin to change.

The literature suggests that for decades incineration was the method of choice for the treatment of infectious wastes. The literature posits that the process of medical waste incineration poses a significant threat to public health if not carried out and regulated properly. The influence on health is the higher incidence of cancer and respiratory symptoms; other likely effects are congenital abnormalities, hormone defects, and an increase in the sex ratio. The 4 communities in this study already have notable instances of these diseases (see Table 16, Figures 9 and 10). In addition to possible physical health effects, a medical waste incineration facility may have other effects on individuals, groups, or the entire population of Ovals, Michaels Village, Ottos, and radio Range. The effects may be psychological (such as stress and stigma), economic (such as job creation or decrease in property values), or social (such as community fractionalization or unity). Desktop research reveals that there is little rigorous information on the impacts of medical waste incineration.

The residents of the surrounding area's concerns need to be heard and understood. Conflicts can increase the time and expense of conducting medical waste incineration which might be potentially beneficial to Antigua and Barbuda. Opposition to the incinerator can indicate that important concerns are not being addressed adequately. Perhaps much public opposition to medical waste incineration might be due to a lack of understanding of the relative health risks posed by incineration in comparison with other waste management methods. But health is not the only issue and the differences between the expert and public perceptions are not due merely to differences in information and understanding, they can also be due to differences in social values. It seems that the residents' perceptions are often extraordinarily resistant to

change, in part because they reflect underlying values. Efforts that ignore or try to change these perceptions radically are likely to fail. Risk communication should accept as legitimate the perception and concerns of various members of the public and involve them in consultative, participatory processes. Not only do members of the public have a right and responsibility to be involved in the assessment and management of hazards in their communities, but such involvement might result in improved assessments and management strategies.

Developing effective participatory programs is very difficult, but some general principles are beginning to emerge. The process of public involvement should be open, inclusive, and substantive, and members of the public in an affected area should be involved early and often. Major concerns are likely to include issues of safety, compensation, and local oversight and control. Satisfying the public's need for information on incineration safety requires continual assessment and demonstration of regulatory compliance with existing standards.

Results of the questionnaire administered to the residents of the Ovals, Michaels village, Ottos, and Radio Range.

The questions asked were:

1. Do you welcome an incinerator at the hospital?
2. List potential positive impacts of having and using an incinerator.
3. What issue (s) should be considered in operating an incinerator?
4. Do you foresee any negative impact of using an incinerator?
5. Are there any materials you think should not be incinerated at the hospital which you think might cause ill health or raise environmental concerns or other risks to people?
6. Any additional comments

Summary of responses from the questionnaire

A. Gender

- ✓ 50.8% Females; 49.2 % Males

B. Age Range

- ✓ 18 – 23 years – (22.5%)
- ✓ 24 – 29 years – (12.3%)
- ✓ 30 – 35 years – (13.9%)
- ✓ 36 – 41 years – (7.7%)
- ✓ 24 – 47 years – (11.9)
- ✓ 48 – 52 years – (9.2%)
- ✓ 53 – 59 years – (12.3%)
- ✓ 60+ years – (12.3%)

C. Education attainment

- ✓ Primary (26.1%)
- ✓ Secondary (44.7%)
- ✓ Tertiary (22.5%)
- ✓ Other (4.7%)

D. Marital Status

- ✓ Single (75.3%)
- ✓ Married (24.7%)

E. Employment status

- ✓ Full (67.7%)
- ✓ Part-time (6.1%)
- ✓ Seasonal (9.2%)
- ✓ Unemployed (17.0%)

1. Do you welcome an incinerator at the hospital?
   - ✓ 83% of respondents were negative; 17% were positive

2. List potential positive impacts of having and using an incinerator.
   - ✓ All the respondents said there were no positives

3. What issue (s) should be considered in operating an incinerator?
   - ✓ Fear of the smell
   - ✓ Air pollution
   - ✓ Toxic substances
   - ✓ Hazardous waste
   - ✓ Affect children in communities
   - ✓ Safety of the communities
   - ✓ Injuries

4. Do you foresee any negative impact of using an incinerator?

- ✓ 86% of respondents said there was a negative impact. 14% did not see any negatives

5. Are there any materials you think should not be incinerated at the hospital which you think might cause ill health or raise environmental concerns or other risks to people?

- ✓ Human body parts
- ✓ Vaccines
- ✓ Expired goods
- ✓ Plastics
- ✓ Chemical waste
- ✓ No burning at all
- ✓ Biological waste

Gender Analysis

Gender inequality can lead to differentiated vulnerability for men and women, boys and girls. A thorough understanding and appreciation of the distinct roles and contributions of each gender will increase recognition of their peculiar needs and interests. This will ensure assessment of impacts and choice and design of mitigating measures are effective in reducing vulnerability. Data collection for this project has been constrained by time and the size of the project. Besides time-limited field surveys, the main sources of information concerning gender are reports such as the Country Gender Assessment 2015 and the Antigua and Barbuda Workforce Survey 2018. Many sources are dated and lack important data and indicators.

Although both boys and men may be affected by the project, the burden of negative outcomes may be borne more by women than men. This may be ascribed to biological differences, but much of it is due to the social, institutional and legal context, which reinforces differences in women and men. The differences are apparent in the productive and social-reproductive roles and responsibilities, differential access to productive resources, including land, credit and employment, and women's limited participation in political decision-making both at the community and governmental levels. Females are a significantly larger proportion of every department of the hospital save the Board of Directors (54.5% male), Building and

Grounds (100% male), M.I.S. (Management Information Systems, 66.7% male), Transport (100% male), Orthopaedics Tech (100% male) (source SLBMC, 2022). See Appendix B for more details. Females constitute 75% of hospital staff. This state of affairs is probably due to the traditional roles of women as the givers of healthcare especially as nurses, nurses aides, cleaners. Women also traditionally bear the brunt of childcare and care for the elderly and infirm. The Board has slightly more males which means reduced decision and policy making agency for women. Women physicians outnumber male physicians by a significant margin (59% female, 41% male) and this may translate into greater power for women.

The gender differences in employment statistics for the hospital is not reflective of the country situation. According to statistics from the Antigua and Barbuda Labour Force Survey 2018 (Statistics Division, 2020), the labour market population is 51, 931 (56% of the population) and there is a 72.1% participation rate. Labour force participation was higher among men (76.1%) than women (68.9%) although more women were employed. The employment to population ratio was higher for men (70.5%) than for women (62.1%). Unemployment was higher for women (9.9%). Unemployment was four times as high in the 15-24 years age group, than in the 25-54 years group, probably because many of these persons are still at schools.

In the communities surveyed, the number of employed males generally outnumbered employed females except in Michael's Village (see Table 5), among those surveyed. For the country, senior males are more likely to remain active in the workforce than senior women which may account for there being slightly more retired females than males among those surveyed (see Table 4). There was a country dependency ratio of 44.3% (Statistics Division, 2020), meaning that each 100 employed persons supports on 44 persons from the dependent younger (0-15 years) and older (65 years and older) age groups. Besides financial dependency, consideration

must also be given to the undocumented contribution through reproductive roles such as work in the household, raising children, cooking and cleaning. Men do also perform these tasks as well as productive roles. Culture and tradition mean that reproductive roles most often fall to women although there are men who also perform them. Since the hospital's employees are predominantly female, it is a reasonable conclusion that both productive and reproductive roles will be affected in large part by any potentially negative aspects of the project.

7.0 ENVIRONMENTAL AND SOCIAL IMPACTS IDENTIFICATION AND MITIGATION MEASURES

WHO (2018) identified the most common issues associated with health care wastes. These were lack of awareness, about health hazards, absent or inadequate waste management and disposal systems and inadequate human and financial resources. Improperly managed bio-medical waste has the potential to increase risk to humans, especially those employed in health care, patients, communities surrounding the health care facility, workers at disposal sites and waste contractors. There are also potential threats to the environment such as contamination and pollution. The main objective of the installation of a new incinerator at the SLBMC is to efficiently and safely destroy or otherwise render less harmful and bulky, biomedical waste generated during normal hospital operation and to enable the hospital to deal with larger volumes of waste in cases such as a pandemic. A short familiarization with the meaning and categorization of biomedical waste is appropriate before a discussion on possible impacts of the project.

7.1 Bio-medical Waste

Bio-medical waste refers to liquid or solid waste created during diagnosis, treatment or vaccination of humans (Hirani et al., 2014). Biomedical waste can be largely categorized as hazardous or non-hazardous based on its potential impact on human and environmental well-being. Hospitals are a major source of biomedical waste as the generation of this waste is regular and in large quantities. Most hospital waste is non-hazardous having similar characteristics to ordinary domestic waste but approximately 15% of hospital waste may be hazardous (WHO, 2018) due to toxicity and infectivity. The major classes of bio-medical waste can be seen in Table 23.

Table 23 . Classes of Bio-medical Waste

CLASS OF BIO-MEDICAL WASTE	DESCRIPTION
Infectious waste	Waste contaminated with blood and other bodily fluids, cultures and stocks of infectious agents from laboratory work, or waste from patients with infections (e.g. swabs, bandages)
Pathological waste	Human tissues, organs or fluids, body parts and contaminated animal carcasses, sharps waste syringes, needles, disposable scalpels and blades, etc.
Chemical waste	Solvents and reagents used for laboratory preparations, disinfectants, sterility and heavy metals contained in medical devices (e.g. mercury in broken thermometers) and batteries;
Cytotoxic waste	Waste containing substances with genotoxic properties (i.e. highly hazardous substances that are, mutagenic, teratogenic or carcinogenic), such as cytotoxic drugs used in cancer treatment and their metabolites;
Radioactive waste	Products contaminated by radionuclides including radioactive diagnostic material or radio therapeutic materials;
Pharmaceutical waste	Expired, unused and contaminated drugs and vaccines;
Non-hazardous or general waste	Waste that does not pose any particular biological, chemical, radioactive or physical hazard.

Adapted from Healthcare Waste, (WHO, 2018) https://www.who.int/news-room/fact-sheets/detail/health-care-waste

There are adverse health conditions related to exposure to bio-medical waste and its by-products. These include:

- Injuries inflicted by sharps such as scalpels, broken class and needles;

- Exposure to toxic pharmaceutical products, for example, antibiotics and cytotoxic drugs, and exposure to substances such as mercury or dioxins. This may occur during handling or incineration of bio-medical waste;
- Chemical burns arising from handling waste as well as disinfection, sterilization or waste treatment activities;
- Air pollution that may occur if particulate matter is released during medical waste incineration;
- thermal injuries occurring with the operation of medical waste incinerators;
- radiation burns.
- inhalation of ash generated from incineration

Source: WHO, 2018

POPs are chemicals of global concern because they have the following characteristics: they remain for many years, become distributed widely through natural processes notably air movements, persist in the environment, can bio-magnify and bio-accumulate in ecosystems including through humans, and are toxic to the health of humans and other wildlife (UNEP, 2022). Unintentional POPs (u-POPs) are generated from thermal processes that involve chlorine and organic matter. Polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF) commonly known as dioxins and furans can be produced by medical waste incinerators and other combustion processes including fires in landfills. Contact with dioxins and furans can result in health impacts such as:

- skin disorders, such as chloracne
- liver problems

- impairment of the immune system, the endocrine system and reproductive functions
- effects on the developing nervous system and other developmental events
- certain types of cancers

National Medical Waste Management Plan, 2022

Mitigation aims to identify measures to safeguard communities and the environment from potentially negative effects of an action. A framework for mitigation considers measures devised to enhance beneficial aspects, minimize, avoid or remedy adverse effects or keep them within an acceptable level. Avoidance is the preferred choice followed by minimizing of hazards and then by remedial action. Important factors in this project make mitigation important. The location of the incinerator as part of a facility that houses patients some of whom may have limited mobility due to health, the location of the hospital near villages, five schools and the densely populated city of St. John's are also important considerations. Although difficult to measure with absolute certainty, the hospital environs may host upwards of 500 persons to include in-patients, out-patients attending clinics and using other hospital services such as diagnostics, administrative, medical and other staff and visitors, at any one time.

There are internationally accepted principles that guide effective waste management.

1. The polluter pays principle: the waste producer is legally and financially responsible for the safe handling of waste and disposal of that waste in an environmentally sound manner and the creation of incentives to reduce the amount of waste generated.
2. The precautionary principle: notwithstanding the lack of conclusive scientific knowledge about the possible impacts of an action, there is a social responsibility

to protect society from any potential negative outcomes. Not implementing cost-effective measures to prevent degradation of the environment should not be based on lack of conclusive evidence of a threat.

3. The duty of care principle: sound ethics dictate that the person managing or handling waste must exercise the utmost care in doing so.
4. The proximity principle: hazardous waste should be treated and disposed of as close as possible to its origin or point of production within environmental and technical parameters to minimize transport risks.
5. The prior informed consent principle: Communities and stakeholders who may be impacted, must be informed of risks and hazards associated with the location and operation of waste treatment and disposal facilities and transport of wastes to and from them.

7.2 Risk Assessment

7.2.1 Classification of Impacts

Evaluation of the significance of the impacts was done using a risk assessment matrix (see Figure 12 below). The risks were identified based firstly on what phase of the project they may occur and then given a risk rating from low to high. Table 24 shows the classification of identified risks.

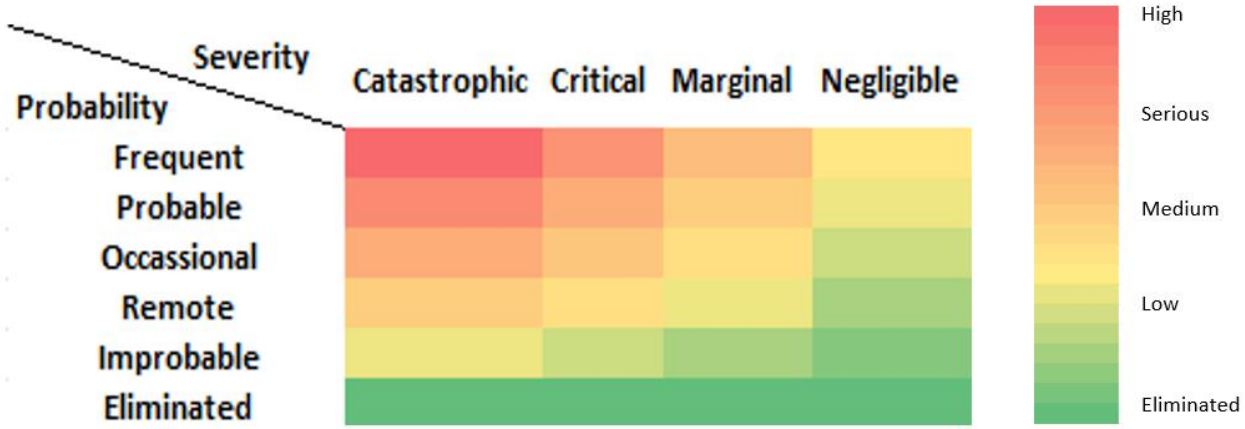


Figure 12. Risk Assessment Matrix

Source: TOR for plan application #G28-2021: Replacement of Incinerator for Sir Lester Bird

7.2.2 Removal of Incinerator

The incinerator has a single combustion chamber from which a chimney flue exits. The incinerator flue passes through the roof of its ground floor room, slopes at an approximately 45 degree angle towards the wall of the facilities annex and thence up this wall to pass through the roof overhang and thence atop the building where it projects approximately 46 cm above the building roof. The incinerator room has open wire mesh forming a large portion of 2 walls to provide ventilation. The entrance is through a large metal gate which is kept locked. The incinerator does not appear to be fixed to the floor. The incinerator operated from its commissioning in 2009. It is presently heavily rusted and dilapidated. The existence of any asbestos material as part of the incinerator is unknown. The incinerator burned a load 4 to 5 times a day when in operation (Bissett, personal com.) and has been turned on recently. Waste was placed into the incinerator and the resulting ash removed using a shovel. The ash residue is

stored in plastic and half metal drums, left uncovered before being taken to the local landfill. The incinerator combustion chamber and the chimney flues are likely to contain residue and can be considered contaminated possibly with chemicals such as dioxins and furans (known carcinogens), and heavy metals. There is a risk of inhalation of this residue or releasing it into the environment during removal and transport of the incinerator. There is risk of injury from the rusted chimney flues.

Photo credit Joseph Prosper 6 Sep 2022

Figure 13. Drum used to store ash from the incinerator

The incinerator room is presently filled with discarded materials obviously not meant for incineration such as boxes, mattresses, and other debris. There are many containers containing body parts and ordinary cardboard boxes filled with discarded medical materials. All these are potential hazards and obstructions to the safe disassembly and removal of the incinerator. Outside the incinerator room is a garbage skip into which is thrown both medical and general hospital waste. The skip remains until it is full enough to warrant a call to a sub-contractor to collect it. The medical waste is stored in appropriate bags and containers but they are amongst ordinary garbage bags containing regular waste. There is thus a risk of exposure to workers

disassembling and removing the incinerator. The volume of debris generated is not expected to pose any challenges with transportation in conventional 20 tonne trucks or in a garbage skip. There should be no disruption to traffic outside hospital grounds or on roads leading to the Cook's landfill.

Traditional gender roles may make it unlikely that women will apply for or be hired to be part of this phase of the project as it is considered dangerous work that involves heavy lifting. Conversely, the extensive involvement of men mean that this gender group will be most likely affected by potential injuries and hazards associated with this job.

Mitigation

All the debris from the incinerator room should be removed before decommissioning the incinerator. The garbage skip should be emptied or moved as well during the process. All workers must be fitted with appropriate protective equipment. Decommissioning should proceed with caution. All old incinerator materials and/or parts should be carefully dismantled in a negative pressure environment, adequately wrapped with fire retardant polythene sheets and transported safely for destruction at the dump. The residual ash should be vacuumed and removed before decommissioning. It is most important to minimize or avoid release of incinerator ash to the environment which may contaminate other hospital facilities. Since the furnace is small and has had minimal use within the last few months, there is not expected to be any significant environmental impact from decommissioning. The decommissioned incinerator parts should be transported in approved vehicles to the Cook's landfill immediately after removal and disposed of according to best practices. Trucks should be covered during transport and cleaned thoroughly after the exercise. Appendix C has details for the creation of a safe decommissioning environment and disposal of the incinerator. An integrated gender action plan

that prescribes against discrimination based on gender should be developed and followed. See Table 24 for summary.

7.2.3 Installation of New Incinerator

The most likely negative impacts from installation of the incinerator are noise pollution (low) and waste generation specifically packaging (medium). The incinerator may be installed incorrectly due to lack of local expertise. Women may be excluded from employment due to traditional gender roles and both genders are not expected to suffer extensive negative impacts from this phase of the project. Other impacts may occur as a result of operation but mitigation to reduce or eliminate them may take place during installation.

Mitigation

It is recommended that the project invoke the manufacturer installation, training and maintenance option. The incinerator should be assembled according to manufacturer's instructions by appropriately trained workers. The connections must occur as prescribed in order to allow flow of noxious gases through the machine to ensure operator safety. The equipment should be installed in a protected and well-ventilated area to allow temperature management and protection from adverse weather conditions. The area should have adequate water supply for fire emergencies and a well-equipped sprinkler system, with surrounding gutters for runoff. Waste should be collected in a prearranged area or skip and transported for disposal as soon as possible. Noise generation is expected to be very small and have little impact on the hospital environs. A gender action plan that ensures opportunities for training and employment for all genders should be developed and adopted. It should be noted that the installation of the operator may require

skill that precludes the imposition of a gender equal policy. Timely and efficient installation should reduce any noise impact.

7.2.4 Operation of New Incinerator

Occupational Health and Safety

In general a medical facility poses potential risks to health care workers as it is a source of infectious waste. Of particular concern are injuries due to handling of infectious waste such as sharps without adequate protective gear, storage of sharps and other waste in containers that are not puncture or leak-proof and management of radioactive waste. Potential impacts include burns and injuries to workers due to improper handling of waste and improper operation of the incinerator, and improper transportation of incinerator waste. The residue from incineration may still contain sharps such as needles which although no longer infective, pose a risk of physical injury. Ash may have elevated levels of still toxic components such as heavy metals and by-products of low incineration temperatures (200 - 450°C) such as doxins and furams (WHO, 2014). The acceptable WHO tolerable daily intake (TDI) is 0.000000000001 g TEQ/kg/day. At present both biological and other hazardous medical waste are deposited in an open skip near the incinerator room. When the skip is full, the facilities personnel contact a sub-contractor who collects the skip and takes it to the landfill where the waste is buried. The skip may take up to 2 weeks to fill and the waste remains uncovered in the skip for the duration. This is a protracted period in which hospital employees and visitors may be exposed to potential injury and infection. It is also aesthetically displeasing. Records pertaining to the volume of waste generated daily and the exact nature and proportion of waste were not available. However, it is reasonable to assume that the waste includes the normal components of bio-medical waste as described in Table 1. Both bio-medical and general hospital waste are stored in the skip even though the bio-medical

waste is separated into appropriate bio-medical waste containers including bins for sharps and colour-coded bags. There are adverse health outcomes associated with bio-medical waste. Injuries due to sharps such as syringes and broken glass implements, toxic exposure to pharmaceuticals such as cytotoxic chemicals and chemical burns are possible. Incineration of medical waste may be associated with thermal injuries and air pollution. Incineration of inappropriate materials such as those containing heavy metals or materials with high metal content (such as lead, mercury and cadmium) can lead to the spread of toxic metals in the environment. As regards gender-specific impacts, traditional roles make it unlikely that women will apply for or be considered for employment in roles specifically related to the operation of the incinerator. This means a likely disproportionate benefit and risk for men. Women are more likely to be exposed to the generation and disposal of bio-medical waste at the source due to their traditional roles as nurses, and as cleaners, however the transport of waste will most likely fall to men.

Mitigation

The primary strategy for reducing risks to health must be prevention and avoidance. Thus specific and general risks must be identified and pro-active measures instituted to avoid them. Therefore, proper protocols and guidelines, such as general operation of the incinerator, burn procedures and maintenance checks must be formulated and followed to facilitate proper operations. The following is recommended as a minimum:

A. Development of a written gender-responsive Waste Management Plan for the hospital which should be adhered to. It should be based on the principles of waste management as outlined below.

There are suggested protocols for the management of bio-medical waste. The recommended steps in dealing with hospital waste are segregation, storage, handling and transportation and treatment (Chakraborty et al., 2014).

1. **Segregation** sorts the waste by storing specific types of waste based on characteristics as this will determine treatment and disposal options. Some waste may require higher temperatures or longer incineration times. Segregation should begin at the point of generation. Waste should be segregated at source by those who generate it. Segregation should not take place after waste has been placed into their waste containers. Segregation should ensure that only non-polluting material is sent for incineration.
2. **Waste storage** occurs between the point of generation and the point of treatment and disposal. Attention must be made to containers, their labeling and the place and time of storage.
3. **Handling and transport** move the waste from storage to the point of treatment in this case incineration. Consideration must be given to safe handling and movement to minimize or eliminate any peril to human and environmental health. Suggestions are designating routes for transport, regular disinfection of conveyances, scheduled times for transport, use of PPE.
4. **Treatment and disposal** should occur as near the source of generation of the waste as possible. Different methods are recommended for different types of waste and some waste may require further treatment after incineration.

Adapted from Chakraborty et al., (2014)

The present practice of storing the waste in an open skip outside the incinerator room should be discontinued. The skip should be covered or placed inside an appropriately prepared and ventilated structure so as to minimize exposure to the elements and pests such as flies and rats. Hazardous biomedical waste should be separated from general hospital waste. The waste should be transported from the source to storage or incineration in appropriate, designated, leak and puncture proof conveyances (trolleys and wheelbarrows). The waste should be secured from unauthorized personnel. The waste should be evacuated regularly (daily is ideal). Prominently display signage using gender-sensitive language, outlining procedures.

B. Training is an important component of mitigation and the following is recommended:

6. Initial and continuous gender-responsive training of all hospital staff in proper procedures for dealing with waste especially hazardous bio-medical waste. Training should encompass everything from segregation all the way through to disposal of waste.
7. Initial and continuous gender-responsive training of incinerator operators and assistants to include technical instruction in operating the incinerator as well as general training in the hospital's waste management procedures, occupational health and safety, fire prevention and first aid.

C. Proper Operation and Maintenance of Incinerator

The incinerator model should meet the standard below:

- Primary and secondary chambers
- Capable of reducing waste to ashes (95%) reduced into ashes)
- Use fuel burners
- Emission conform to national and international standards

Recommended minimum operating procedures:

- operators should wear appropriate PPE
- the area around the incinerator must be cleaned
- weigh, record and maintain records for the HCW to be incinerated
- all needed tools and equipment should be readily available before and during operation.
- ashes from previous day's combustion process should be removed before operation
- warm up the incinerator with dry waste
- Monitor temperature
- the incinerator should be allowed to cool down sufficiently (5 hours) before removing ash.
- appropriate PPEs should be worn when removing the ash. Do not handle the ash or other solids with bare hands.
- Use a shovel or rake to remove ash and other non-burnable waste
- Do not allow the ash to remain for long periods of time (more than 2 days).
- Sweep the around the incinerator to remove non-combustible waste such as needles.

In addition:

1. Incinerator to be operated only by authorized trained personnel.
2. Invoke the manufacturer installation, training and maintenance option
3. Training to include appropriate operating temperatures, appropriate and inappropriate materials to be incinerated.
4. Schedule regular maintenance and safety checks based on manufacturer's instructions.
5. Keep detailed records of maintenance and safety checks.
6. Create and maintain records of the daily operation of the incinerator to include volume and type of waste incinerated, temperatures used and a record of any incidents or observations which may affect the operation of the incinerator.
7. Prominently displayed signage outlining procedures, dos and don'ts.

8. Regular testing of incinerator residue and other emissions.

D. Procedures for Accidents

1. All at-risk workers, both incinerator workers and general staff, must be provided with adequate and effective personal, protective gear to include as needed: heavy puncture -resistant gloves, aprons or overalls, boots or protective footgear with puncture resistant soles and toes, face shields and respirators, all according to international safety standards and guidelines. Staff should be trained in their proper use and be required to use them.
2. Develop written protocols for dealing with accidents and injuries to include burns.
3. Create and maintain records of accidents and incidents.
4. Prominently display signage outlining procedures.

E. Require that all health workers and incinerator staff receive preventative vaccines such as for Hepatitis B and Tetanus. Institute and require medical surveillance of workers. Require twice yearly health checks for incinerator staff.

Land

Improper storage of bio-medical waste before incineration may negatively impact soil quality. Ash and other residue generated as a result of incineration may also impact soil quality. This impact is expected to be low however.

Mitigation

Adequate storage facilities and disposal mechanisms will reduce or eliminate impact on land environment. Incineration ash should be stored in appropriate water proof containers which are sealed to prevent escape of ash into the environment. This ash should be collected by an authorized sub-contractor approved by the NSWMA. A waste management plan detailing protocols and procedures for waste management should be developed, staff trained and its use strictly adhered to. Besides storage and handling, the plan should detail what substances can and cannot be placed in the incinerator and minimum operating temperatures (850-1100 °C).

Noise

There may be a small amount of noise associated with the operation of the incinerator but this is not expected to impact the hospital and its environs in any negative way. The hospital is air conditioned and the main building is sufficiently far away that noise-sensitive processes are unlikely to be affected.

Mitigation

Hand tools or small powered tools can be used. Decommissioning and removal should occur in as minimum time as is efficient and safe.

Air

Flue gases are a potential threat to persons who live or work near the incinerator. Poorly controlled emissions, due to inappropriate maintenance and operation of the incinerator, for example temperatures that are too low or the attempted incineration of certain materials such as PVC or materials containing heavy metals may result in air pollution from respirable ash, furans and dioxins. In particular low operating temperatures may result in incomplete combustion of material and some gases. The easterly prevailing winds create the possibility of this pollution

being carried towards the Radio Range and beyond. Occasional changes in wind direction may carry these pollutants towards the main hospital building, to the villages beyond and to St. John's City. Health risks are associated with respiratory and cardiovascular morbidity and mortality due to particulates, immune and neurological systems, kidneys and lungs due to volatile metals such as mercury and other effects such as cancers due to dioxins and furans (WHO, 2014).

Mitigation

It is recommended that the project invoke the manufacturer installation, training and maintenance option. Chimney and stack installation should be done according to best practices to maximise reduction of waste material. Adequate and ongoing training for incinerator operation as described above is essential. The incinerator and its parts including the chimney stack should be monitored and inspected regularly. The air quality around the hospital should be monitored both when the incinerator is operating and when it is not. There should also be examination and testing of incinerator residue in collaboration with the Department of Analytical Services and overseen by the Central Board of Health. A waste management plan detailing protocols and procedures for waste management should be developed, staff trained and its use strictly adhered to. Besides storage and handling, the plan should detail what substances can and cannot be placed in the incinerator and minimum operating temperatures (850-1100 °C).

Fire

The operation of an incinerator carries the inherent risk of fire. The results could be catastrophic with disastrous life and financial impacts. As the only public tertiary healthcare facility, the impact of a fire can have devastating domino effects on the health of the general population and the finances of the government. Hospitals are especially vulnerable as they have patients many of whom may not be ambulatory due to health or the treatments required (e.g.

those in intensive care or on ventilators). Note that the risk of fire is present in many places in a hospital such as laboratories, and due to electrical faults. A fire at the hospital will pollute the air with smoke potentially containing hazardous compounds. This smoke will likely spread to the west of the hospital towards St. John's City and nearby villages. The reproductive and productive roles of both men and women will be affected. Women, as the more represented gender among the employees, may suffer a disproportionately larger impact.

Mitigation

The best approach is avoidance. It is recommended that the project invoke the manufacturer installation, training and maintenance option to reduce the likelihood of fires due to the operation of the incinerator. A written fire prevention and emergency management plan should be developed and put in place. If there is already such a plan then it should be reviewed periodically and specifically include measures for fire originating from the incinerator. These measures will target the confinement of the fire to the incinerator room as much as is practicable. The fire prevention and emergency plan should include the following elements as a minimum:

a. Provide fire extinguishers/fire blankets, charged hoses, sand buckets and other necessary equipment of an appropriate number and placement including the incinerator room, adjacent rooms and throughout the hospital. Fire extinguishers and hoses should be checked and maintained in working order.
b. Adequate working sprinkler system that is regularly checked and maintained.
c. Key healthcare staff and incinerator staff as well as facilities workers should have basic training in fire control;
d. Fire emergency telephone numbers should be displayed in communal areas;
e. Undertake fire drills at healthcare facility, at a minimum once a quarter.

f. Adequate training of operators.

Contamination of Hospital Water Supply

Since the water storage containers for the hospital are beneath the facilities building where the incinerator room is located, the potential exists for contamination of this water supply. This can be potentially devastating resulting in widespread illness.

Mitigation

Avoidance is best. The water storage tanks must be sealed completely from the incinerator room and the area in which bio-medical waste and incinerated material such as ash are stored. There should be regular testing of the hospital's water supply to ensure that it remains potable.

Social Resistance

There is a general negative perception of the use of the hospital incinerator. Residents in nearby villages perceive potential harm in the operation of the incinerator with different questions revealing a high expectation of negative outcomes. This most likely reflects lack of accurate knowledge and awareness about how incinerators function and can be beneficial compared to other means of dealing with healthcare waste. Most persons had never heard the word incinerator and were unaware that one had operated at the hospital since 2009. Although the new incinerator can operate without public support, it is unethical and counter-productive to ignore the concerns of those which may be directly or indirectly affected by the operation of potentially hazardous equipment.

Mitigation

Develop a gender-responsive public relations and communications strategy to inform and educate communities, including hospital employees about the project. Focus should be on an honest and accurate presentation of information about the incinerator's operation, including any potential negative impacts and proposed mitigation. The strategy must consider that the issue of medical waste is sensitive and elicits negative reactions from people due to fear of health hazards and the visual impacts of anatomical waste (WHO, 2014). The strategy should use established, social media platforms, local television and radio stations. The education and training of staff should be gender-responsive, use gender sensitive language. There is a higher proportion of females than males in 33 of the 37 departments of the hospital. The exceptions are Board of Directors, Building and Grounds, M.I.S. and Transport. Therefore training must consider traditional gender roles such as child care being a predominantly female role, in decisions about scheduling and duration of training and education sessions.

Table 24. Impacts and risk assessment associated with various stages of the project.

Impact	Risk Significance	Mitigation	Residual Risk
Decommissioning and removal of present incinerator			
1. Air pollution from residual ash	Medium	Vacuuming and creation of negative pressure environment, covered transport to landfill	Very low
2. Exposure of workers to hazardous waste	Medium	Removal/emptying of skip before decommissioning	Eliminated
Injury due to obstructions	Medium	Removal of debris/obstruction before decommissioning	Eliminated

Exclusion of women from work opportunities	Serious	Integrated Gender Plan	Low
Disruption to traffic	Low	Move after 8:30 am when traffic has reduced	Very low
Aesthetics	Very low	No impact as incinerator room not normally traversed by public	Very low
Installation of new incinerator			
Generation of solid waste which may pollute the land	Medium	Collection and immediate removal	Very low
Noise pollution	Very low	Quick and efficient installation	Very low
Women excluded from employment	Serious	Gender Action Plan	Low
Incorrect installation of incinerator	Low	Invoke manufacturer installation, training and maintenance option	Eliminated
Operation of the Incinerator			
Infection and injury due to exposure to bio-medical waste or operation of incinerator	Serious	Waste Management Plan It is recommended that the project invoke the manufacturer installation, training and maintenance option Training (incinerator operators and other hospital staff in waste management Training of incinerator operators in proper operation of incinerator. Adequate storage Proper installation of incinerator. Regular maintenance checks Protocols for accidents Vaccines	Very low

		Regular health checks. Prominently displayed signs. Record keeping	
Poor aesthetics of waste storage	Medium	Waste management plan: storage out of sight or covering of skip	Very low
Air pollution from ash, smoke, possibly dioxins and furans	Medium	Training of incinerator operators in proper operation of incinerator. Maintenance checks Air quality monitoring Residue testing Operation of incinerator at temperatures between 850°C to 1100°C.	Very low
Land pollution	Medium	Waste management plan: proper storage and transport of waste	Very low
Fire hazard	High	Fire Prevention and Emergency plan Prominently displayed signs outlining procedures and emergency numbers.	Low
Noise pollution	Very low	Use hand tools or small powered tools. Keep time period at a minimum.	Very low
Water contamination	Low	Proper storage Water testing	Very low
Accumulation of bio-medical waste due to incinerator failure	Low	Training of incinerator operators in proper operation of incinerator. Maintenance checks	Low
Negative public perception	High	Public Education Campaign	Low
Women excluded from employment	Serious	Integrated Gender Action Plan	Low

High	Serious	Medium	Low	Very low	Eliminated

Key for Risk Categorization.

Positive Impacts

There are few extra employment opportunities associated with the operation of the incinerator as there is already staff fulfilling this role. Employment opportunities may exist in the following spheres:

a. Decommissioning of the incinerator: may be subcontracted and the subcontractor may need to hire personnel but this will be a one-time instance
b. Installation of the incinerator- extra staff may be needed to assist with the installation but this is not expected to be a large number.
c. Operation and maintenance of the incinerator: besides the present single operator, a second person should be hired for data collection and record-keeping
d. Training in gender awareness and the incorporation of gender analysis into existing hospital procedures such as waste management and fire prevention plans.

8.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

8.1 Introduction

According to the draft ABNMWMP (2022), there are gaps in the management of bio-medical waste in Antigua and Barbuda. The gaps concern segregation practices, waste storage, training of staff, availability of equipment and supplies, and disposal. Waste is transported in open tray and other types of vehicles by sub-contractors who utilize them for other purposes. There is inadequate monitoring of medical waste management activities and ambiguity as to which Government department is responsible. The ABNMWMP aims to fill this gap and so some recommendations are based on it.

8.2 Summary of Impacts:

Positive impacts from the project may include:

1. reduction in the volume and infectious potential of bio-medical waste
2. review of the present waste management plan
3. reduction in air pollution from improperly functioning incinerator
4. some employment opportunities

The major negative impacts which may result from this project are summarized in the table below. The largest concern is with the exposure of hospital workers and subcontractors to hazardous bio-medical waste, possible air pollution including the generation of POPs, and fire hazards. Gender-specific impacts revolve mainly around the exclusion of females from employment in this sector due to traditional roles. Social impacts are expected to be minimal.

Table 25. Major Impacts Expected from Project

Impact	Category	Risk Significance
Decommissioning and removal of present incinerator		
Air pollution from residual ash	Environmental	Medium
Exposure of workers to hazardous waste	Social	Medium
Injury due to obstructions	Social	Medium
Exclusion of women from employment opportunities	Social	Serious
Disruption to traffic	Social	Low
Aesthetics	Social	Very low
Installation of New Incinerator		

Generation of solid waste which may pollute the land	Environmental	Medium
Noise pollution	Environmental	Very low
Women excluded from employment	Social	Serious
Operation of the Incinerator		
Infection and injury due to exposure to bio-medical waste or operation of incinerator	Social	Serious
Poor aesthetics of waste storage	Social	Medium
Air pollution from ash, smoke, possibly dioxins and furans	Environmental	Medium
Land pollution	Environmental	Medium
Fire hazard	Environmental Social	High
Noise pollution	Environmental	Very low
Water contamination	Environmental	Low
Accumulation of bio-medical waste due to incinerator failure	Environmental	Low
Negative public perception	Social	Low
Women excluded from employment	Social	Serious

8.3 Mitigation

The mitigation principle to be applied in reducing any negative project impacts is illustrated in figure below.

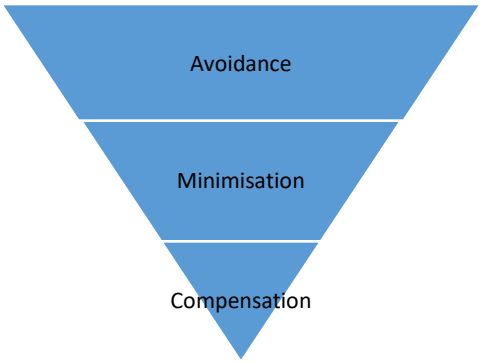


Figure 14. Mitigation Principles

Adverse impacts should be avoided as the first strategy of mitigation and preventative measures should be sought automatically. Once these avenues are exhausted, the second strategy is to minimize or reduce adverse impacts to as low a level as possible. Compensation for adverse, unavoidable impacts is the third level of mitigation. The recommendation is the polluter pays principle where compensation for negative outcomes proven related to this project's activities should be borne by the SLBMC.

There are internationally accepted principles that guide effective waste management and will be applied here.

a. The polluter pays principle: the waste producer is legally and financially responsible for the safe handling of waste and disposal of that waste in an environmentally sound manner and the creation of incentives to reduce the amount of waste generated.
b. The precautionary principle: notwithstanding the lack of conclusive scientific knowledge about the possible impacts of an action, there is a social responsibility to protect society from any potential negative outcomes. Not implementing cost-effective measures to prevent degradation of the environment should not be based on lack of conclusive evidence of a threat.

c. The duty of care principle: sound ethics dictate that the person managing or handling waste must exercise the utmost care in doing so.

d. The proximity principle: hazardous waste should be treated and disposed of as close as possible to its origin or point of production within environmental and technical parameters to minimize transport risks.

e. The prior informed consent principle: Communities and stakeholder who may be impacted, must be informed of risks and hazards associated with the location and operation of waste treatment and disposal facilities and transport of wastes to and from them.

8.4 Management Structure and Responsibilities

The SLBMC as the implementing and executing agency has ultimate responsibility for the project. It is responsible for:

1. the implementation of the environmental and social management plan.
2. the provision of guidance or contracting persons to provide guidance in following the mitigating measures while the activities of the project are being carried out.
3. environmental monitoring and reporting.
4. ensuring compliance with the ESMP and the GIAP by any contractors or site supervisors.
5. where unforeseen factors occur, reviewing and updating the ESMP to minimize any environmental or social impacts.
6. organizing and hosting public or other forms of consultation with stakeholders as needed during project execution.

The site supervisor may be the contractor supervising or performing the activities of the project or the SLBMC or one of its agents such as the project manager, that are on-site to observe the project activity. The site supervisor is responsible for:

1. ensuring that the tenets of the ESMP are implemented and adhered to during operations.
2. recording and reporting to the SLBMC administration or Board any contravention or non-compliance as they occur and any factors which may have led to it.
3. completing a compliance report.
4. recording and reporting any complaints that are made with respect to the activities of the project.
5. recording and reporting as soon as possible, any incident that causes or has the potential to cause material or serious environmental harm.

8.5 Public Consultation and Environmental and Social Disclosure

Public consultation and disclosure is to be an integral part of the project implementation. Following the guidelines outlined below and in accordance with DOE policies, the contents of the ESIA shall be made available to the public and the public will have the opportunity to express their opinions on the contents of the ESIA or on any part of the project that may affect them.

8.6 Grievance Mechanism

Since the SLBMC will be fulfilling the terms of the ESIA and ESMP in conjunction with the Department of Environment (DOE), their established Complaints Procedure is included as part of the Grievance Mechanism for this project. Complaints pertaining to project activities will be directed to designated personnel at SLBMC.

Affected persons can submit complaints related to the activities of the project to

1. the SLBMC

or

2. the DOE via the following channels:

- On the DoE's website:
- http://www.environmentdivision.info/submit_a_complaint_en_365cms.htm
- Filling out the form and emailing it to antiguaenvironmentdivision@gmail.com
- In writing to: Director, Department of Environment, Ministry of Health and the
- Environment, #1 Victoria Park Botanical Garden, P.O. Box W693, St. John's Antigua
- By email: antiguaenvironmentdivision@gmail.com
- By Phone: Monday to Thursday: 8am to 2pm, Fridays: 8 am to 12 pm, by calling:

(268) 462 4625; (268) 562-2568; (268) 460-7278

When a complaint is communicated, the following information is recorded:

- The nature of the problem
- The location of the problem
- When the problem occurred (date and time)
- Who or what is the perceived source of the problem
- Any information or evidence you may have—particularly eyewitness information,
- documents or photographs, a videotape, or a water or soil sample (the
- information or evidence must be credible and relate directly to the incident being
- reported).
- The contact information of the complainant

The Department will produce a report of its findings and recommendations and action if necessary. Complainants may request for a copy of the reports related to the complaint, as per the

Freedom of Information Act. Once the Department has completed its investigations, the Department will notify the complainant, either verbally or in writing, about the results.

A complaints register should be kept and updated throughout the life of the project.
The SLBMC is ultimately responsible for recording and dealing with complaints.

8.7 Environmental Procedures and Site and Activity-Specific Work Plans/Instructions

The SLBMC in consultation with the contractor or site supervisor will devise a site or activity-specific description and checklist for all activities to ensure the minimizing of any environmental hazards. The contractor or site supervisor is required to follow and complete the checklist on a daily or weekly basis and submit it to the SLBMC administration for revision. The SLBMC will follow-up and make necessary adjustments.

8.8 Performance Criteria

There are a set of minimum criteria based on environmental and social indicators which should be met. These criteria are described below, followed by a table detailing the management plans.

Performance Criteria/Standard

1. Reduction of air pollution hazard.
2. Reduction of land pollution hazard.
3. Reduction or elimination of sickness or injury due to exposure to bio-medical waste.
4. Gender neutral participation of men and women in all aspects of the project; participation and involvement of vulnerable populations.

The education and training of staff should consider that females significantly outnumber males in 33 of the 37 departments of the hospital. The exceptions are Board of Directors, Building and Grounds, M.I.S. and Transport. Therefore training must consider traditional gender roles such as

child care being a predominantly female role, in decisions about scheduling and duration of training and education sessions.

8.9 Management and Monitoring Plan

Table 26.Management and Monitoring Plan

Table 26. Environmental Management and Monitoring Plan esired Outcomes	Mitigation	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Time	Responsibility	Cost United States dollars
Decommissioning and removal of incinerator					
Reduction of air pollution from residual ash during dismantling and transport to landfill.	Decommissioning plan including: HEPA filter vacuuming, creation of negative pressure environment, wet wiping	Air pressure monitor with alarm.	Before and during dismantling of incinerator.	Sub-contractor	$ 5000
	Covered transport to landfill		During transport to landfill		
Reduction of exposure of workers to hazardous waste stored near incinerator room entrance.	Removal/emptying of skip before decommissioning	Empty skip or skip in different location so workers do not come in contact with waste	During dismantling of incinerator.	Site supervisor	$ 200

Table 26. Environmental Management and Monitoring Plan esired Outcomes	**Mitigation**	**Monitoring: Performance Indicators/Targets or Acceptance Criteria**	**Time**	**Responsibility**	Cost United States dollars
Reduction of injury due to obstructions	Removal of debris/obstruction before decommissioning	Cleared incinerator room and immediate environs outside room.	During dismantling of incinerator.	Site supervisor	$ 200
Equitable access of all genders to employment	Gender Action Plan	Employment opportunities offered to genders equitably.	Before dismantling of incinerator.		NA
Reduced disruption to traffic	Move after 8:30 am when traffic has reduced	No disruption in traffic due to transport of incinerator parts.	During transport of old incinerator.	Site supervisor	NA
Improved aesthetic	No impact as incinerator room not normally traversed by public	No unsightly aesthetics.	During dismantling of incinerator	Site supervisor	NA
Equitable access of all genders to employment	Gender Action Plan	Employment opportunities offered to genders equitably.	Before installation	Site supervisor Subcontractor	NA
Installation of new incinerator					
Reduced generation of solid waste which may pollute the land	Collection and immediate removal of packaging and other waste.	No accumulation of solid waste outside designated area. No solid waste visible	During installation	Site supervisor Subcontractor	

Table 26. Environmental Management and Monitoring Plan esired Outcomes	**Mitigation**	**Monitoring: Performance Indicators/Targets or Acceptance Criteria**	**Time**	**Responsibility**	Cost United States dollars
		for more than a day.			
Reduced noise pollution	Quick and efficient installation. Use of hand held tools.	No complaints of noise from patients, staff or visitors.	During installation	Site supervisor Subcontractor	NA
Equitable access of all genders to employment	Gender Action Plan	Employment opportunities offered to genders equitably.	Before installation	Site supervisor Subcontractor	NA
Properly functioning incinerator	Invoke the manufacturer installation, training and maintenance option	Correct functioning of incinerator	Before installation	SLBMC administrator	
Operation of new incinerator					
Reduced infection and injury due to exposure to bio-medical waste	Waste Management Plan	Written plan presented.	Throughout duration of operation of the incinerator.	Facilities manager/ incinerator operations supervisor.	$ 2000
	Training (incinerator operators and	Certification. No infections or injury due to possible	Before and intermittently	SLBMC administrator.	$ 5000

Table 26. Environmental Management and Monitoring Plan esired Outcomes	**Mitigation**	**Monitoring: Performance Indicators/Targets or Acceptance Criteria**	**Time**	**Responsibility**	Cost United States dollars
	other hospital staff in waste management Adequate storage	exposure to bio-medical waste. Bio-medical waste segregated into appropriate containers and separated from general waste. Covered skips or waste stored out of sight in appropriate room.	during operation of the incinerator. Before and during operation of the incinerator.	Facilities manager/ incinerator operations supervisor.	
Reduced infections or injury from operation of incinerator	Training of incinerator operators in proper operation of incinerator. Invoke manufacturer training option	Certification. No infections or injury from operation of incinerator.	Before and during operation of the incinerator.	SLBMC administrator.	$ 3000 ^
	Proper installation of incinerator.	Certified inspection by appropriate professional.	Before operation commences.	SLBMC administrator.	

Table 26. Environmental Management and Monitoring Plan esired Outcomes	**Mitigation**	**Monitoring: Performance Indicators/Targets or Acceptance Criteria**	**Time**	**Responsibility**	Cost United States dollars
	Regular maintenance checks.	Written records. No infections or injury from operation of incinerator.	During operation of incinerator.	Facilities manager/ incinerator operations supervisor.	$ 4000
	Protocols for accidents	Written records	Before operation of incinerator commences.	SLBMC administrator.	
	Vaccines Regular health checks.	Written records	Before operation of incinerator commences or before worker allowed to work.	SLBMC administrator.	$ 500
	Prominently displayed signs. Record keeping	Signs	Before operation commences and remain displayed during operation.	Facilities manager/ incinerator operations supervisor	$ 1000

Table 26. Environmental Management and Monitoring Plan esired Outcomes	**Mitigation**	**Monitoring: Performance Indicators/Targets or Acceptance Criteria**	**Time**	**Responsibility**	Cost United States dollars
Improved aesthetics of waste storage	Waste management plan: storage out of sight or covering of skip	Written plan	Before and during operation of incinerator.	SLBMC administrator.	
Reduced air pollution from ash, smoke, possibly dioxins and furans	Training of incinerator operators in proper operation of incinerator.	Certification. Air quality within acceptable standards.	Before and intermittently during operation of incinerator.	SLBMC administrator in conjunction with DAS.	Included in ^ above
	Maintenance checks	Written records.	At regular intervals based on international best practices.	Facilities manager/ incinerator operations supervisor	
	Air quality monitoring	Records showing air quality within acceptable standards.	At regular intervals based on international best practices.	SLBMC administration in conjunction with DAS.	$2000
	Residue testing Operation of incinerator at	Records showing residue components within	At regular intervals based on	SLBMC administrator in	$2000

Table 26. Environmental Management and Monitoring Plan esired Outcomes	Mitigation	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Time	Responsibility	Cost United States dollars
	temperatures between 850°C to 1100°C	acceptable international standards.	international best practices	conjunction with DAS.	
Elimination of land pollution	Waste management plan.	Written plan presented.	Before operation of incinerator.	SLBMC administrator	NA
	Proper storage and transport of waste	Waste stored and transported appropriately. No land pollution.	During operation of incinerator	Facilities manager/ incinerator operations supervisor	
Reduction or elimination of fire hazard	Fire Prevention and Emergency plan.	Written plan presented. Adherence to procedures e.g. Regular fire drills (every quarter) and practice sessions.	Before operation of incinerator. Before and during operation of incinerator.	SLBMC administrator.	
	Prominently displayed signs		Before and during	SLBMC administrator.	$2000

Table 26. Environmental Management and Monitoring Plan esired Outcomes	Mitigation	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Time	Responsibility	Cost United States dollars
	outlining procedures and emergency numbers.	Signs using gender-sensitive language displayed.	operation of incinerator.		
	Trained staff. Implementation of Fire Emergency Plan.	Trained staff	Before and during operation of incinerator For fire emergencies.		$2000
Reduced noise pollution	Use hand tools or small powered tools. Keep time period at a minimum.	No complaints of noise.	During operation of incinerator.	Facilities manager/ incinerator operations supervisor	
Prevention of water contamination	Proper storage of waste. Water testing.	Records showing acceptable water quality.	During operation of incinerator.	Facilities manager/ incinerator operations supervisor in collaboration with CBH and DAS	$ 2000
Prevention of accumulation of	Training of incinerator	Certification.	Emergency use.	Facilities manager/	

Table 26. Environmental Management and Monitoring Plan esired Outcomes	Mitigation	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Time	Responsibility	Cost United States dollars
bio-medical waste due to incinerator failure	operators in proper operation of incinerator. Maintenance checks. Revert to deep burying at Cook's landfill or use autoclave if commissioned.	Maintenance records.		incinerator operations supervisor	
Equitable access of all genders to employment	Gender and Inclusivity Action Plan	Employment opportunities offered to genders equitably.	Before installation	Site supervisor Subcontractor	NA
Negative public perception	Education Campaign	Increase in positive perception evidenced by survey results.	Before operation of incinerator	SLBMC administrator	$8,000

8.10 Gender and Inclusivity Action Plan

A gender action plan (GAP) is project specific document addressing the gender-based constraints and opportunities peculiar to that project. It is informed by the social and gender impact and analysis carried out in relation to the project. Since considerations related to gender means the identification of vulnerabilities, other vulnerable groups will also be considered as part of this management plan. The major gender-based and inclusivity constraints identified for this project are outlined briefly below.

1. Traditional roles expect that decommissioning, installation and operation of an incinerator is man's work and women may not apply or be considered for any job opportunities.
2. Widely held view that the inherent danger associated with the decommissioning, installation and operation of an incinerator precludes the application or selection of persons with disabilities for employment.
3. Poor public perception of the incinerator.

The SLBMC as the implementing and executing agency has ultimate responsibility for the execution of the GAP. It is responsible for:

1. the implementation of the GAP through the assignment of senior staff or the contracting of a gender expert.
2. the provision of guidance or contracting persons to provide guidance in following the mitigating measures while the activities of the project are being carried out.
3. monitoring and reporting.
4. ensuring compliance with the GAP by any contractors or site supervisors.
5. where unforeseen factors occur, reviewing and updating the GAP to minimize any environmental or social impacts.
6. organizing and hosting public or other forms of consultation with stakeholders as needed during project execution.

The site supervisor may be the contractor supervising or performing the activities of the project or the SLBMC or one of its agents such as the project manager, that are on-site to observe the project activity. The site supervisor is responsible for:

1. ensuring that the tenets of the GAP are implemented and adhered to during operations.
2. recording and reporting to the SLBMC administrator any contravention or non-compliance as they occur and any factors which may have led to it.
3. completing a compliance report.
4. recording and reporting any complaints that are made with respect to the activities of the project.
5. recording and reporting as soon as possible, any incident that causes or has the potential to cause material or serious harm

In designing the action plan, note was taken of several points. The installation and operation of an incinerator may require skill that exists mainly in one gender (most likely men) due to traditional roles. Thus the incinerator manufacturer/company may be unable to ensure equitable representation of genders in personnel. There are few extra employment opportunities associated with the operation of the incinerator as there is already staff fulfilling this role. Employment opportunities may exist in the following spheres:

a. decommissioning of the incinerator: may be subcontracted and the subcontractor may need to hire personnel but this will be a one-time instance
b. installation of the incinerator- extra staff may be needed to assist with the installation but this is not expected to be a large number.
c. operation and maintenance of the incinerator: besides the present single operator, a second person should be hired for data collection and record-keeping
d. training in gender awareness and the incorporation of gender analysis into existing hospital procedures such as waste management and fire prevention plans.

Table 27. Gender Action Plan

GENDER ACTION PLAN					
ACTIVITIES	OUTPUTS (WITH TARGETS/QUOTAS)	INDICATORS	TIMEFRAME	BUDGET	PERSON RESPONSIBLE
OUTCOME 1: Skills-based employment for the decommissioning, installation and operation of the incinerator that considers both men and women					
Offer job opportunity to both genders	At least one woman hired for each phase of project	At least one woman hired	6 months	NA	SLBMC, sub-contractors

without prejudice.		for each phase of project			
OUTCOME 2: Gender-responsive training for both men and women					
Gender-responsive training for sub-contractors and SLBMC staff	All sub-contractors trained in gender response	Certification of staff	6 months	$ 1000	SLBMC
Gender-responsive training for operation of the incinerator	All incinerator operators trained	Certification of staff Sex-disaggregated data on attendance and completion	6 months	$3000	SLBMC and manufacturer
Gender-responsive training in waste-management for hospital staff	All hospital staff trained	Certification of staff Sex-disaggregated data on attendance and completion	6 months	$5000	SLBMC
Gender-responsive training in fire prevention and reduction for key staff (e.g. incinerator operators)	All key staff trained	Certification of staff Sex-disaggregated data on attendance and completion	6 months and on-going	$2000	SLBMC
OUTCOME 3: Men and women within surrounding society and community informed about incinerator					

Gender-responsive public relations campaign	Surrounding communities informed about incinerator	Sex-disaggregated data from attitudinal surveys conducted after the campaign	6 months	$8000	SLBMC

9.0 SUMMARY AND CONCLUSION

The project goal is the replacement of the present debilitated incinerator unit at the SLBMC with a new unit. The primary positive outcome is the reduction of the volume, infective and injurious potential of medical waste produced at the facility. Incineration is a widely used and accepted method of dealing with bio-medical waste. Negative impacts are mainly the potential for production of harmful air pollutants such as doxins and furans, hazards to workers associated with the collection, storage and treatment of the waste, negative perceptions of incineration by the general public including nearby communities. Mitigation recommends the development and implementation of waste management plan for the hospital, invocation of the manufacturer installation, training and maintenance option for the installation of the new incinerator, training, public relations, incorporation of gender-sensitive response into present hospital policies.

References

Caribbean Development Bank. (2014) Environmental and social review procedures. CBD

Chakraborty, S., Veeregowda, B., Gowda, L, Sannegowda, S.N., Tiwari, R., Dhama, K. & Singh, S.V. (2014). Biomedical waste management. *Adv. Anim. Vet. Sci.* 2 (2): 67 – 72

Hirani, D. P., Villaitramani, K. R., & Kumbhar, S. J. (2014). Biomedical waste: an introduction to its management. *International Journal of Innovative Research in Advanced Engineering (IJIRAE)*, *1*(8), 82-87.

Ministry of Health, Wellness and the Environment. 2022. *Antigua and Barbuda national medical waste management plan (Final draft)*. Government of Antigua and Barbuda.

Ministry Of Health, Community Development, Gender, Elderly And Children. (2017) National standards and procedures for health care waste management. United Republic of Tanzania

Silva, S., & Lopes, A. M. (2017). Environmental aspects and impacts of a waste incineration plant. *Energy Procedia*, *136*, 239-244.

Statistics Division, (2020). *Antigua and Barbuda 2018 Labour Force Survey Report*. Government of Antigua and Barduda.

World Health Organization. (2017). *Safe management of wastes from health-care activities: a summary* (No. WHO/FWC/WSH/17.05). World Health Organization.

PATH. (2010). *The Incinerator GuideBook: A Practical Guide for Selecting, Purchasing, Installing, Operating and Maintaining Small – Scale Incinerators in Low re source Settings.* Ver. 1: 1 – 58.

UNEP http://chm.pops.int/theconvention/thepops/tabid/673/default.aspx

Appendix A

Questionnaire

JOSEPH WRENCH PROSPER

OLD PARHAM ROAD **TELEPHONE: 462 - 1163**
ST JOHN'S, ANTIGUA **773 - 1159**

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The purpose of the questionnaire is to get your views on placing and operating an incinerator within the Sir Lester Bird Medical Centre. The incinerator is expected to handle general and medical waste generated during the operation of the hospital.

1. Do you welcome an incinerator at the hospital? Yes No

2. List potential positive impacts of having and using an incinerator.

_____

3. What issue (s) should be considered in operating an incinerator?

_____

5. Do you foresee any negative impact of using an incinerator? Yes No

If yes (list them)

_____

6. Are there any materials you think should not be incinerated at the hospital which you think might cause ill health or raise environmental concerns or other risks to people?

_____

7. Any additional comments

_____

8. Gender: male female other

9. Age range: 18 – 23 24 – 29 30-35 36 – 41 42 – 47 48 – 52 53 – 59 60 +

10. Highest level of education: primary secondary tertiary other

11. Marital status: single married other

12. Employment status: full part time seasonal unemployed

Appendix B

SLBMC Employees by Department (Gender Disaggregated)

Department	Gender	Percentage (%)
ADMINISTRATION	**Female** **Male**	**90** **10**
ADMITTING/PBX	**Female** **Male**	**88.8** **1.2**
BOARD OF DIRECTORS	**Female** **Male**	**45.5** **54.5**
BUILDING & GROUNDS	**Male**	**100**
CENTRAL SUPPLY & STERILIZATION	**Female** **Male**	**72.7** **27.3**
CRITICAL CARE NURSE	**Female** **Male**	**93.8** **6.2**
DIALYSIS NURSE	**Female** **Male**	**92.9** **7.1**
DIETARY	**Female**	**100**
EDUCATION	**Female**	**100**
EMERGENCY ROOM NURSE	**Female** **Male**	**89.4** **1.6**
FINANCE	**Female** **Male**	**83.8** **16.2**
HUMAN RESOURCES	**Female**	**100**
LABOR/DELIVERY NURSE	**Female**	**100**
LABORATORY	**Female** **Male**	**78.3** **21.7**
LAUNDRY/LINEN	**Female** **Male**	**71.4** **28.6**
M.I.S.	**Female** **Male**	**33.3** **66.7**
MATERIELS MANAGEMENT	**Female**	**62.5**

	Male	**37.5**
MEDICAL RECORDS	**Female** **Male**	**85.2** **14.8**
MEDICAL UNIT NURSE	**Female** **Male**	**94.3** **5.7**
NURSERY NURSE	**Female**	**100**
NURSING MANAGEMENT	**Female** **Male**	**91.9** **8.1**
OPERATING ROOM NURSE	**Female** **Male**	**94.4** **5.6**
ORDERLIES	**Female** **Male**	**97.2** **2.8**
ORTHOPAEDICS TECH	**Male**	**100**
OUT PATIENT CLINIC NURSE	**Female**	**100**
PEDIATRICS NURSE	**Female**	**100**
PHARMACY	**Female** **Male**	**75** **25**
PHYSICAL THERAPY	**Female** **Male**	**75** **25**
PHYSICIANS	**Female** **Male**	**59.7** **40.3**
PUBLIC RELATIONS	**Female**	**100**
QUALITY ASSURED	**Female** **Male**	**92.9** **7.1**
RADIOLOGY TECH	**Female**	**100**
SURGICAL UNIT NURSE	**Female**	**100**
TRANSPORTATION	**Male**	**100**
WOUND CARE CLINIC NURSE	**Female**	**100**
NURSING PERSONEL	**Female** **Male**	**96.2** **3.8**

TOTAL EMPLOYEES	**Female** **Male**	**75.2** **24.8**

SUMMARY

NB: Table represents the male to female ratio per department of the total number of staff employed by the Sir Lester Bird Medical Centre.

Physicians are represented as one (1) department but in practice work within individual Clinical Specialties and Diagnostic Departments.

Data provided by: Director of Operations
Sir Lester Bird Medical Centre (formally Mount St. John's Medical Centre)

Appendix C

MANAGEMENT PLAN FOR DECOMMISSIONING OF HOSPITAL INCINERATOR AT SLBMC (FORMERLY MSJMC)

Considerations

There may be ash and other residue including heavy metals and dioxins and glass shards remaining in the main combustion chamber and flues. The chamber and chimney and associated ducts systems may therefore be contaminated so must be decommissioned using appropriate procedures to prevent the release of the ash, metals or dioxins into the environment. A containment approach is recommended. Decommissioning should be carried out by a competent contractor using appropriately trained personnel. Ideally ash sampling and analysis should be carried out. However, once the recommendations are adhered to the risk will be minimal.

Site Preparation and Construction

The floor drain in the incinerator room shall be covered with a temporary seal during the decommissioning and demolition works. The top of the chimney should be sealed with polyethylene sheets at least twenty-four (24) hours before the works commence. The flue opening on the side connected with the incineration furnace shall be sealed with 2 layers of fire retardant polythene sheets. Preliminary site decontamination of all debris shall be carried out using High Efficiency Particulate Air (HEPA) vacuum cleaner. Except the incinerator, all other existing items shall be removed from the incinerator room as far as practicable to avoid obstructing the subsequent work activities. The walls, floor and ceiling of the incinerator room shall then be lined with 3 layers of fire retardant polythene sheets. At the entrance to the incinerator room, a 3-chamber decontamination unit shall be constructed for entry and exit from the work area. The walls of the room shall be used as the boundary for the segregation. All workers must carry out decontamination procedures in this unit every time they leave the work area. Warning signs should be put up in conspicuous areas.

The 3-chamber decontamination unit shall comprise a dirty room, a shower room and a clean room of at least 1m x 1m base each with 3 layers of fire retardant polythene sheet where the worker shall carry out decontamination before leaving the work area. All bagged material shall egress the containment through the decontamination unit after thorough cleaning. An air mover shall be provided to exhaust air from the work area. Sufficient air movement shall be maintained to give a minimum of 6 air changes per hour to the work area, and maintain a negative pressure of 0.05-0.15 inches of water within the work area throughout the entire course of the decommissioning works. A pressure monitor with printout records and audible alarm shall be installed at an easily accessible location to demonstrate that the negative pressure is maintained. A standby air mover shall be made available for use. New pre-filters shall be used at the air movers.

Removal

All workers shall wear full protective equipment, disposable protective coverall (such as Tyvek) (with hood and shoe covers), inner and outer nitrile gloves, rubber boots (or boot covers), and full-face positive pressure respirators equipped with a combination cartridge that filters particulate and removes organic vapour.

The top vertical section of the incinerator flue shall be removed first. The detached sections of the flue shall be wrapped with 2 layers of fire retardant polythene sheets. A third layer shall then be wrapped and secured with duct tape. Decontaminate the outer layer of the wrapped flue sections by wet wiping when passing them out of the containment through the decontamination unit for disposal. If a flue section is large, it should be left in the contaminant for later removal.

The combustion furnace, upon removal, shall be wrapped with 3 layers of fire retardant polythene sheets. The outermost layer shall be secured with duct tape. Workers shall carry out decontamination in the 3-compartment decontamination unit and have the used coveralls, nitrile glove, and rubber boots disposed of as chemical waste in the dirty room. All wastewater generated within the decontamination unit shall pass through a filtration system for removal of particles down to 5 micron in suspension, before being discharged into the drainage system. After completion of removal, decontaminate all surfaces, including the wrapped incinerator chambers and flue sections left within the containment, by wet wiping and HEPA vacuum. Then spray the innermost layer of the fire retardant polythene sheet covering the wall, ceiling and floor with PVA. Upon drying, peel off this innermost layer of the polythene sheet covering the containment and dispose of as chemical waste. Repeat the above decontamination procedure for the second innermost layer of fire retardant polythene sheet, including the wrapped incinerator chambers and flue sections left within the containment by wet wiping and HEPA vacuuming. After spraying with PVA, peel off this second innermost layer of the polythene sheet covering the wall, ceiling and floor and dispose of as chemical waste.

Disposal

The dismantled incinerator furnace and flue sections wrapped in polythene sheets shall be disposed of at a designated landfill site. In addition, cloths which have been used for wet wiping will not be re-used and will be disposed of at the landfill. A suitably licensed waste carrier will be used to transport the wastes to the designated landfill.

Waste Management Implications

As a prudent approach, the polythene sheets wrapped incinerator furnace and flue sections shall be regarded as chemical waste, and shall be placed into appropriate containers such as drums, jerricans, or heavy duty and leak-proof plastic bags and disposed of appropriately.

Labelling and Storage of Chemical Wastes.

Potentially contaminated waste generated from the dismantlement of the containment and decontamination units, and cloth used in wet wrapping, etc. shall also be disposed of as chemical waste.

Adapted from Parsons Brinkerhoff

Annex 1

TERMS OF REFERENCE

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Application #G28-2021
Replacement of Incinerator at the Sir Lester Bird Medical Centre,
St. John's, Antigua and Barbuda

An Environmental and Social Impact Assessment (ESIA) predicts the environmental and social consequences that a future project/intervention might entail. It consists of a multidisciplinary approach, which combines the evaluation of the economic aspects of a project - based on cost-benefit ratios - with the environmental consequences of undertaking the project.

Objective

The purpose of this Terms of Reference (TOR) is to guide the execution of the Environmental and Social Impact Assessment (ESIA). As such, the users of this TOR are expected to use the preliminary risk assessment prepared by the Department of Environment (DoE), on behalf of the Development Control Authority (DCA) of Antigua and Barbuda, to focus the investigations and reports resulting from this ESIA process. Consultants should utilize the appropriate analysis and prepare a report with relevant project specific data, which is informative, compact and, easy to comprehend. Consultants must also undertake this work in a manner required by the Caribbean Development Bank (CDB) Environmental and Social Review Procedures (ESRP). The findings of the assessment, as well as impacts of the development, mitigation and enhancement measures to address such impacts should be documented in an Environmental and Social Impact Statement (ESIS) to be submitted to the Development Control Authority for onward submission to the DoE for review, comments and final recommendations.

Legal Authority of the EIA Process

The preeminent legal guidance addressing the Environmental Impact Assessment (EIA) process in Antigua and Barbuda can be found in the Physical Planning Act (PPA) 2003. Specifically, Section 23 (1), (2) and in Schedule 3 of Physical Planning Act (PPA) 2003 outline those activities that require an EIA.

THIRD SCHEDULE

Section 23

MATTERS FOR WHICH ENVIRONMENTAL IMPACT ASSESSMENT SHALL BE REQUIRED

1. An airport, port or harbour, including yacht marinas.
2. A power plant.
3. A crude oil or refinery facility or a petroleum and natural gas storage and [illegible]
4. An incinerator, sanitary landfill operation, solid waste disposal site, sludge [illegible]
5. A [illegible]
6. An industrial estate development project.
7. An installation for the manufacture, storage or industrial use of [illegible]
8. A drilling, quarrying, sand mining and other mining operations.
9. An operation involving land reclamation, dredging and filling of ponds; and
10. A hotel or resort complex.

Additionally, the Director of the Department of Environment may also require, in consultation with the Chief Town and Country Planner that any matter that is likely to cause any serious social impact, or harm to the environment or to human health to be subject to an environmental impact assessment. Section 23 (1), (2) and Schedule III of the PPA 2003, lists activities and undertakings that require an EIA. All projects undertaken for or on behalf of the DoE are subjected to a screening process, which will signal if an EIA is required.

As a general rule, any proposed developments, undertakings and other activities, which are likely to cause an adverse impact on human health, society, or the environment, should be subject to the EIA process. These generally include:

- proposals that could result in damage to beaches, coastal and/or marine resources.
- proposals that could result in the pollution of marine waters, groundwater, freshwater bodies, or other water resources.
- proposals that would jeopardize the continued existence of a protected, rare, threatened or endangered species or its critical habitat or nesting grounds, and including species recognized as such by international organizations and other nations as well as by the Government of Antigua and Barbuda
- proposals that could harm or destroy important cultural resources including archaeological sites, cemeteries, historic sites and landmarks; and
- proposals that would challenge or contravene customary controls over the use of environmental resources.

Under Section 22 of the PPA, the DCA may so decide to require the project proponent to conduct a public consultation as part of the EIA process. Where such is stipulated it will be at the sole cost of the project proponent.

Under the Line of Credit, the CDB/IDB requires developements that are designated Category B (Projects with limited adverse environmental or social impacts and/or risks)[1] at a minimum to have prepared an ESIA (with an ESMP). The ESIA is similar to the EIA, however, it places additional emphasis reflecting social impacts and provisions for social safeguards, in line with the performance requirements detailed in the ESRP.

Obligations of the ESIA Consultant

The ESIA Consultant, whether an individual or team, is required to conduct the investigation to the highest professional and ethical standards. This means that beyond using the best available tools and methods to conduct the assessment, should the consultant perceive risks beyond those identified in the preliminary assessment conducted by the DOE and the CDB, the consultant is obligated to investigate and report such.

The consultant shall also present the complete findings of the ESIA. Should any part of the ESIA be subcontracted, such an entity shall also be required to uphold these obligations.

Obligations of the Project Proponent/Developer

The proponent of a project is required to implement all aspects of any environment and social management plan, monitoring program, protection plan, or mitigation measure imposed as a condition of an approval of an ESIA. The developer will be required to signal a commitment to pursue the implementation of the final recommendations.

Obligations of the Development Control Authority (and its Agents)

Section 42 of the EPMA specifies that where the DCA instructs a developer to conduct an EIA/ESIA, the Director (of the DoE) shall place a copy of said instructions into an Environment

[1] Caribbean Development Bank Environmental and Social Review Procedures (2014)

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Registry. Said registry shall be open to the public and provide opportunity within a given time frame for written submissions concerning the proposed development.

Once the required report is completed and submitted to the DCA, the Chief Town and Country Planner shall request the Director of the DoE to complete a review within 30 days. During this time the DoE shall make the EIA/ESIA available on its website and at its offices for a period of no less than two weeks. The DoE may consider the issues raised by the public in its review.

Elaboration of the ESIA

Structure of ESIA

Executive Summary
Introduction
Project Description
Methodology
Policy, Legal and Administrative Framework
Environmental Baseline
Anticipated Environmental Impacts and Mitigation Measures
Social and Gender Baseline
Anticipated Social Impacts and Mitigation Measures
Environment and Social Monitoring and Management Plan
Conclusion
References
Annexes

Executive Summary

This section should allow for a clear understanding of the project proposal and summarize the significant results of the ESIA. study, e.g., positive, and negative environmental, social, and economic impacts; options considered; reasons for selection of the proposed options for design and the measures to be implemented to prevent or mitigate negative impacts or capitalize on positive impacts. This section should be reader friendly and include a tabular summary of main impacts and mitigation measures. The use of diagrams, photos and maps to illustrate key findings is encouraged. The ESIA should also include a table that presents the Bank's Performance Requirements with clear indication of which PRs(safeguards) have been triggered, why and how the ESMP addresses these potential impacts. The section should be capable of becoming a standalone section for presentation to policy makers or for public consultations.

1.0 Introduction

This chapter should cover the following:

- Profile of the project proponent, name and contact address, implementing organization, organizational chart, project consultants etc., should be mentioned clearly.

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- Purpose of the project, brief description of the project- name, nature, size, location of the project, its importance to the country.
- Land description - Ownership, extent of the land and provisions for access.
- Description of national and local regulations and standards applicable to area development projects should be discussed.

2.0 Project Description

This chapter should cover the broader details of the basic activities, location, zoning plan and specific site plan as well as implementation schedule of the project.

- Include critical aspects of the social and economic context of the project.
- Type of project - new, expansion, modernization, etc.
- Relevance of the project:
- Use of existing "infrastructure" or lack thereof (e.g. access to fuel, access to water or the lack thereof) etc.
- Estimated cost of development of the project (environmental cost, funding agencies, etc.)
- Resources, manpower, timeframe, etc. – required for project implementation

2.1 Essential Maps/Blueprints to be provided with application

- A map/blueprint of the project area, delineating the major topographical features such as land use, drainage, locations of habitats.
- A map covering aerial distance of the proposed project to sensitive areas
- Site layout plan of the proposed development, original layout and any proposed changes in response to the ESIA.

2.2 Project benefits

This section details the improvements in physical infrastructure and social infrastructure if any. It also details any employment potential and other benefits that are accrued if the project is taken up.

2.3 Analysis of alternatives (Technology & Sites)

The ESIA may find that there is a need to develop alternatives to the original intent of the developer. A clear description of each alternative, summary of the impact – adverse and positive – within the site as well as the cumulative impact when considering other inputs into the environment. Selection of alternatives is to be detailed out.

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3.0 Methodology

The ESIA consultant is expected to outline the process used to collect information and data. The ESIA will investigate socio-economic developmental opportunities and risks related to the execution of the project; and inform mitigation measures to safeguard against risks identified, as well as other measures to support positive social impacts. It will be conducted in a highly participatory, gender-inclusive manner engaging the communities, particularly with representatives of women and men and vulnerable groups such as such as children, youth, elderly, and Persons With Disabilities (PWD). The methodology may include publications, research, interviews, surveys and other research techniques, and could include both present and historical information. The methodology section answers two main questions: How was the data collected or generated? And how was it analysed?

The methodology shall include, but not be limited to, the following:

(a) Review of secondary data from reports, studies, gender assessments, poverty assessments, census reports, labour force surveys, and relevant policy documents such as legislation, regulations, standards and policies in the areas of gender and social development including: vulnerable groups of women, youth, and PWDs.

(b) Collection of primary data through participatory consultations with all categories of stakeholders in order to introduce the project, facilitate feedback, and gauge perception of the project in order to gain and/or strengthen buy-in. Interviews, focus groups and other appropriate differential participatory methodologies may be employed for state and non-state stakeholders directly impacted by the works such as Community-Based Organisations, Non-Governmental Organisations, vulnerable groups (to include elderly, children, youth, men, women and PWDs), private sector entities and relevant public agencies. Where applicable, focus groups may be convened. Facilitation of participation through appropriate timing and any other pertinent requirements should be ensured. Data should be disaggregated by sex, age groups, disability status, and race/ethnicity where feasible.

(c) Execution of site visit exercises to verify, update and fill gaps using community maps, transect walks, snowballing, as well as photographic documentation, and other appropriate participatory approaches.

(d) Computation and analysis of data and information collected.

The provision of this information allows the DoE, DCA and any other interested stakeholder to critically evaluate the ESIA's overall validity and reliability.

4.0 Policy, Legal and Administrative Framework

This chapter shall outline the institutional measures that govern and affect the proposed development. The relevance to the project and provisions in the project to adequately address requirements should be clearly detailed.

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5.0 Environmental Baseline

Collect environmental data to establish a reference point as to the quality of environmental features prior to the execution of the project. Specific areas to be reported on but not limited to:

a) land and ecosystems particularly wetland and coastal features;
b) fresh water resources.
c) climate and microclimate;
d) biological resources terrestrial and marine (birds, bats and other mammals, invertebrates, flora (all types) special reports on invasive species and endemic or indigenous species;
e) Topographic description of the benthic environment (depth, composition of sediment and benthic features)
f) noise;
g) socio-economic environment,
h) roads
i) air quality/ pollution

5.1 Land Environment

Simple description of land use, topography and key land features.

5.2 Air Environment

Climatological data are to be obtained from the nearest Meteorological Department (MD) station for at least one full year. Micro meteorological data key to this ESIA are wind speed, wind direction, rainfall (peak and average daily rainfall), and wind rose patterns, should be collected.

5.3 Noise Environment

Discuss construction and operational noise and any health and safety standard concerns which may result.

5.4 Biological Environment

As the SLBMC is an established institution, which has already altered the biological baseline to be significantly different for the surrounding environment, and the specific project is to conduct development activities within a built space, namely, to replace the incinerator. A comprehensive baseline study of flora and fauna would not be required

6.0 Anticipated Environmental Impact and Mitigation Measures

This chapter should describe the likely impacts of the project on each of the relevant environmental parameters and potential mitigation measures which could be used to minimize, prevent or restore any negative impacts if they do occur. As necessary, these should be organized by (i) Site Preparation Phase (Removal and decommissioning of old incinerator); (ii) Installation Phase; and (iii) Operational Phase. Although the details would have been provided in the

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Methodology chapter, any tools, technologies, models or techniques adopted for assessing the potential impacts and mitigation measures shall be identified to give credence to the findings.

This section should indicate a clear understanding of perceived risks to the environment and should feature a rating matrix (both positive and, or negative) prior to and after proposed mitigation to produce a residual impact rating. Impact risk rating analysis focuses on the severity of the impact and the likelihood of the impact or hazard happening. Alternatively, risk theories establish the theoretical formulla where Risk = Vulnerability x Hazard. The chapter should seek to:

- Identify sources of impacts generated by the proposed development.
- Identify receptors of impacts to include air, nearby residents, ecosystems and water bodies all within the vicinity of the site.
- List stakeholders who may be a major recipient of impacts and host consultations to discuss impacts and mitigation measures. Concerns of stakeholders should be captured and annexed to the final report. A stakeholder engagement plan should also be developed and included in this report.
- Based on the identified impacts and sources, suggest mitigation measures to address these impacts as appropriate; efforts should be made to include ecosystem-based approaches for disaster risk reduction.
- Assessment and mitigation of the direct and indirect impacts during construction and post construction. Impacts should be scaled based on severity – low, medium, and high; and presented in a tabular format. The following table maybe used as a guide (please note that this will also apply to the social and gender risks):

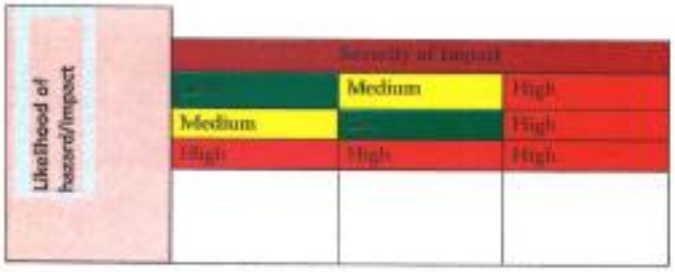

Table 1: Summary assessment and mitigation of environmental impacts

Area of Impact	Brief Description	Risk Significance High/Medium/ Low	Mitigation Measures	Residual risk High/Medium/Low
Water /Hydrology				
Drainage				
Air pollution				
Noise Pollution				
Residents/businesses				
Plants				
Animals				
Aesthetics of the area				

When elaborating mitigation measures, detailed strategies are encouraged utilizing as necessary:

- methods proposed to reduce adverse effects of the project,
- best environmental practices,
- environmental resource management plans;
- pollution control strategy
- disaster management strategy

Table 2: Categories of Impacts

Category	Examples	Mitigation Measures
Land Environment	- Estimation of anticipated impacts of the overall land use plan for the development on the surrounding land use pattern, road network, forests, watersheds, wetlands, beaches and, other environmentally sensitive places etc. in doing this a carrying capacity rating is to be assigned to each zone - Impact of the specific plan for the project on the natural drainage system, sediment attenuation and soil erosion. - Pollution due to improper handling of waste and other substances particularly with regards to the operations of the Wastewater Treatment, Reverse osmosis plant, as well as the power generation facilities if any.	- Soil erosion mitigation. - Improved flood and sediment attenuation mechanisms - Forest and wetland ecosystem conservation zones. - Watershed and biodiversity systems planning and implementation of alternatives. - Waste removal and management.
Air Environment	- Prediction of potential sources of emissions. - Prediction of possible types of pollutants and their impacts on people, flora, fauna (terrestrial and marine), the natural and man-made environment. - Identification of potentially hazardous substances. - Health-related impacts. - Water quality impacts (marine and inland)	• Mitigation measures during construction to reduce the amount and incidence of emissions. • Recommendation of emissions standards. • Greenbelt development and buffer zones. • Dust mitigation. • Estimation of any environmental implications from transportation (road) related emissions associated with the construction and operational phases and suggest suitable options. • Recommended protective gear.

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Noise Environment	– Noise due to demolition / construction activities. – Impact due to present and future transportation activities. – Operation of Diesel Generator (DG) sets. – Impact of noise due to work at night. – Impacts on biodiversity.	– Land use Zone noise levels. – Recommend noise reducing technologies. – Recommend noisy activities take place at times less likely to affect others especially the patients at the hospital.
Water Environment	– Impact on water sources due to shifting of watercourses, if any as well as the alteration of wetlands. – Impact of water withdrawal on surface water / ground water resources. – Impact on exploitation of surface/ground water. – Water contamination. – Wastewater generation. – Information regarding how the wastewater is to be disposed of.	– Water conservation. – Rainwater harvesting. – Pollution prevention techniques and technologies. – Adequate measures to be adopted for water conservation during construction and operation stages.
Biological Environment	– Impact of construction and operational activity on fauna and flora (Marine and Terrestrial). – Pre- and post- topography, soil and parent material conditions and their contribution to flora and fauna, and – Aquatic (fresh water and marine) and terrestrial ecosystem diversity.	– Mitigating measures to compensate the loss of vegetation cover / providing green belt development, – Mitigating measures to prevent damage and, loss of ecosystem functionality in wetland ecosystems. – Regeneration/Restoration of rare plants of economic importance including medicinal plants species which require protection and conservation – Biodiversity management plan for the operational phase of the project

6.1 Specialized Studies and plans

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There are a number of specialized studies and plans that take into consideration cross-cutting impacts and mitigation measures that would guide workers on the site. The DoE would likely have referred to such specialized studies in its risk assessment of the project.

Pollution Control and Waste Disposal

One of the key areas of concern with any development, is the possibility of pollution being released into the environment. Pollution can occur in a number of ways. These are:

- ✓ Site preparation- during site preparation the excavation of substrate to facilitate the placing of pilings may cause the spread of loose soil, damage to the outflow pipe or some form of chemical contamination;
- ✓ Construction- pollution from construction activities can be similar to those experienced during site preparation but of increased magnitude;
- ✓ Operations- pollution during the operations can occur from poor waste disposal practices, leaks from pipes etc.
- ✓ Spills
- ✓ Accidental discharges

Bearing all these in mind the developer should have a pollution response strategy.

There are various types of waste that are generated at the various stages of development. The project proponent is expected to anticipate such and have appropriate storage and disposal mechanisms in place.

Details of authorized municipal solid waste facilities in the area should be included.

Anticipated impacts:

Impact of the project during construction and operational phases for generation of waste is to be assessed.

Mitigation measures:

Mitigation measures to reduce adverse effects. Options for minimization of solid waste and environmentally compactable disposal are to be given. Management and disposal of temporary structures, made during construction phase are to be addressed. Recycling waste materials due to the project activity in the construction and operational phase of the project is to be discussed.

7.0 Socio Economic & Health Environment Assessment

Baseline data should include the demography, nearest settlements, and existing infrastructure facilities in the proposed area. The present employment and livelihood of these populations and awareness of the population about the proposed activity should also be included. Vulnerable groups and gender analysis is also required. If there are cultural practices or norms which may affect the environment or be affected by the environment it should also be mentioned. This section should include and not be limited to:

Social and Gender Safeguards Headings:

a) Compliance with National, Regional and International Law
b) Confidentiality
c) Directly Affected Communities (Project Affected Persons)
d) Marginalized and Vulnerable Groups
e) Access and Equity
f) Human Rights

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g) Gender Equity and Women's Empowerment
h) Involuntary Resettlement/Relocation
i) Worker and Community Health and Safety
j) Core Labour Rights

There should be adequate stakeholder consultation, and a report to include:

a) A sex-disaggregated demographic profile of communities in the project areas including socio-economic, poverty status, individual and community characteristics including disability status, crime, gender-based violence, and health issues.
b) The identification of key livelihood activities in the communities with clear identification of any opportunities to reduce poverty and promote equitable, inclusive employment through the implementation and operational phases of the project.
c) A clear identification of any potential adverse social impacts or benefits of the project.
d) The identification of risks and vulnerabilities during implementation and operation, in the following areas including, *inter alia*: economic activities; employment opportunities; livelihoods; labour force participation; security and violence (including gender-based) and health.
e) The identification of gender-specific risks and vulnerabilities and gender-specific coping mechanisms.
f) A robust analysis of both qualitative and quantitative socio-economic benefits; to include women and men equally as well as stakeholders representing the various groups including women, youth, and persons with disabilities.

8.0 Anticipated Social Impacts and Mitigation Measures

When elaborating mitigation or enhancement measures detailed strategies are encouraged utilizing as necessary:

- methods proposed to reduce adverse effects of the project,
- best practices,
- social safeguard strategies

Socio-Economic	Predicted impact on the communities (and various groups therein) of the proposed activity is to be given. Impact on surroundings on socio-economic status is to be detailed. Present status of housing, public utilities, commercial structures and transportation. Impact of the project in construction and operational phases on socio-cultural aspects is to be assessed.	Mitigation measures to reduce adverse effects are to be given. Enhancement measures to capitalise on potential positive effects should be included.

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9.0 Environmental and Social Monitoring and Management Plan (ESMMP)

A draft environmental and social monitoring and management plan must be developed which will detail the monitoring requirements for pre-, during- and post- construction and during the operational phases of the project. This will include recommendations to ensure the documented implementation of mitigation measures and long-term minimization of negative impacts and maximization of positive impacts.

The environmental/social consultant is also expected to include a proposed estimate for such services. The DCA may require the project proponent to engage the services of an independent consultant to conduct monitoring of the project if the application is approved. Regular written reports are to be submitted to the developer, DCA and any agents whom the DCA feels are competent to provide sufficient scientific and technical review. The consultant is also expected to advise the developer of any imminent and actual breaches of the environment and supervise and direct any mitigation measures as may be required. It is possible to use the same consultant to prepare and implement the monitoring programme.

For the construction phase the following is required:

- Frequency, location, parameters of monitoring.
- Summary matrix of environmental, social and health monitoring, during construction and operation stage.
- Requirement of monitoring facilities.
- Compilation and analysis of data and reporting system
- Detailed parameters should be extracted from the ESIA findings.

For the operational phase the following is required

- Administrative and technical set-up for management of the environment and stakeholder engagement and grievance redress.
- In-built mechanism of self-monitoring of compliance of environmental regulations.
- Institutional arrangements proposed with other organizations/ Govt. authorities for effective implementation of environmental and social measures proposed in the ESIA.
- Safeguards/mechanism to continue the assumptions/field conditions made in the ESIA, for arriving the site suitability.

Detailed ESMMP will be formulated to mitigate the impacts. Budgeting of the ESMMP is to be included in the ESIA.

10.0 Summary & Conclusion

This section should summarize the significant findings of the ESIA report. The summary must describe each significant environmental and social issue and its resolution in sufficient detail so that its importance and scope, as well as the appropriateness of the approach taken to resolve it are well understood. Wherever possible, the summary should make use of base maps, tables and figures given in the report.

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ANNEX 1 Disclosure of consultants engaged

This attachment shall include the names of the consultants engaged with their brief resume and nature of consultancy rendered.

ANNEX 2 Declaration of Completeness and authenticity

This section is to be in the form of a letter from the ESIA consultant containing an indication of the completeness of the work and the authenticity of the information reported.

ANNEX 3 Enclosures

Conceptual plan / Questionnaire / Photos/ Maps/ Full Technical studies/ report of public consultation

Annex 2

Date Printed 08/05/2019 Page Number 1

Therm Tec Inc.

Updated :
July 15, 1999

SPECIFICATIONS : " G-20-P " MODEL

MAIN CHAMBER (Primary Chamber)

	Model No.->	G-20-P
Volume Of Chamber	Cu. Ft.	123.8
Ignition Burner	Btu's Hr.	1,300,000
Burner Control Hi-Low-Off	Pyrometer	On-Off
Diameter - Outside	Inches	66
Diameter - Inside	Inches	53
Length - Outside	Inches	108
Length - Inside	Inches	97
Load Door Opening Size-O.D.	Inches	66
Preheated Comb. Air Surface	Sq. Ft.	71.25
Hearth Area	Sq. Ft.	36.63
Metal Thickness	Plate	0.25
Refractory Thickness	Inches	4.5
Refractory Rating @	Deg. F	2600
Insulation Thickness	Inches	2
Insulation Rating @	Deg. F	1900
Weight	Pounds	17837

AFTERBURNER (Secondary Chamber)

		G-20-P
Burner (s)	Btu's Hr.	1,600,000
Burner Control High-Low Fire	Pyrometer	Hi-Low
Length Used In Section	Inches	104
Diameter - Outside	Inches	38
Diameter - Inside	Inches	28
Volume Of Chamber	Cu. Ft.	37
Preheated Comb. Air Surface	Sq. Ft.	23.74
Metal Thickness	Plate	0.1875
Refractory Thickness	Inches	3
Refractory Rating @	Deg. F	3200
Weight	Pounds	1223

STACK SECTIONS - REFRACTORY LINED

		G-20-P
Number Of Stacks - 72"	Sections	3
Metal Thickness	Sheet	0.1345
Stack Diameter -Outside	Inches	34
Stack Diameter -Inside	Inches	28
Refractory Thickness	Inches	3
Refractory Rating @	Deg. F	2300
Weight Each Section	Pounds	1570
Total Weight Of Stacks	Pounds	4710

SPEC-G-20-P Specifications Subject To Change Or Modification

Therm Tec Inc.

Updated :
July 15, 1999

SPECIFICATIONS : " G-20-P " MODEL

OVERALL DIMENSIONS AND WEIGHT OF UNITS :

		G-20-P
Width	Inches	83
Length With Door Closed	Inches	138
Length With Door Open -90 Deg.	Inches	204
Height To Top Of A/B	Inches	108
Height To Top Of Stacks	Inches	324
Total Weight Of System	Pounds	23,770

UTILITY Connection To Unit :

Natural Gas	1 1/4" NTP Single Point Connection To Gas Regulator, Supplied With Unit
Oil Units (Two Line System)	1/2" NPT Input Line - To Filter,Regulator & Gauge, Supplied With Oil Burner Systems 1/2" NPT Return Line - Return To Source
Electrical	3 Wire To Control Panel Terminal Strip (4 Wire If 3 Phase)
Water	1/2" Supply For Housekeeping Only (Optional)

UTILITY REQUIRMENTS

Fuel :			G-20-P
	For Gas Burners		
	Natural Gas Max.	CFH	2900
	Delivered @	Pounds	2-5
	Operating @	W.C.	14"
	For Oil Burners		
	# 2 Oil	GPH	20.00
Electrical For Natural Gas Units :			
	Volts		* 220
	Amps.		40
	Phase		1
	Wires		4
Electrical For # 2 Oil Units :			
	Volts		* 220
	Amps.		50
	Phase		1
	Wires		4
	* 208 Or 230 Volts Can Be Substituted @ 3 Phase Power		
Water : Housekeeping Only		GPD	20

Horsepower Requirements For Units :

			G-20-P
Natural Gas Units :			
Burner	Primary	H.P.	1/2
Burner	Secondar	H.P.	1/20
	Secondar	H.P.	1/20
Combustion Air Fan H.P.		H.P.	1
Combustion Air Fan H.P.		H.P.	1/2
Control Power		Watts	200
Oil # 2 Units :			G-20
Burner	Primary	H.P.	1/3
Burner	Secondar	H.P.	1/3
	Secondar	H.P.	1/3

SPEC-G-20-P Specifications Subject To Change Or Modification

Therm Tec Inc.

Updated:
July 15, 1999

SPECIFICATIONS : " G-20-P " MODEL

CONTROLS PROVIDED WITH MODELS :

All Controls And Parts Are : U.L. Listed And C.S.A. Listed. Control Panel is UL 508-A

Enclosure	NEMA 12
Switch, On - Off	Power To Computer
PLC Control	Touch Screen Display With Graphics For Operator Control
Cycle Time	Adjustable
Temperature Controller	Primary Chamber Indication on Screen 0 to 2500 Deg "F"
Temperature Controller	Afterburner Chamber Indication on Screen 0 to 2500 Deg "F"
Combustion Air Fan	Full Modulation (4 /20 ma.)
	Lock Out Of System Until Pre-Heat Is Obtained In Afterburner Chamber
Screen, Indication	Main Chamber Burner Operation
Screen, Indication	Afterburner Chamber Operation
Screen, Indication	Pre-Heat Of Afterburner Operation
Switch, Limit	Main Load Door Safety Switch, Burner & Combustion Air Control
Plaque	Operation Procedure On Control Panel
Operation & Maintenance Manuals	Two (2) Sets

Mechanical Controls On System :

Combustion Air Supply To System - Primary Chamber- 2 Each - Indicators
Combustion Air Supply To System - Afterburner Chamber- 2 Each - Indicators
Air Supply Ports To Main Chamber, Flip Cap Type For Cleaning Air Ports To Main Chamber

SINGLE BATCH LOAD CAPACITY

	G-20-P
Animal Cremation	
Weight Per Cubic Foot Apx. 35 Lbs	
Batch Loaded Once Per Day	SingleBatch load 2500 lb
Batch Loaded Up To 2 Loads Per Day	Per Batch load 1500 lb

Burn Rate Is Dependent Upon - Btu Of Material, Load Rate And Density

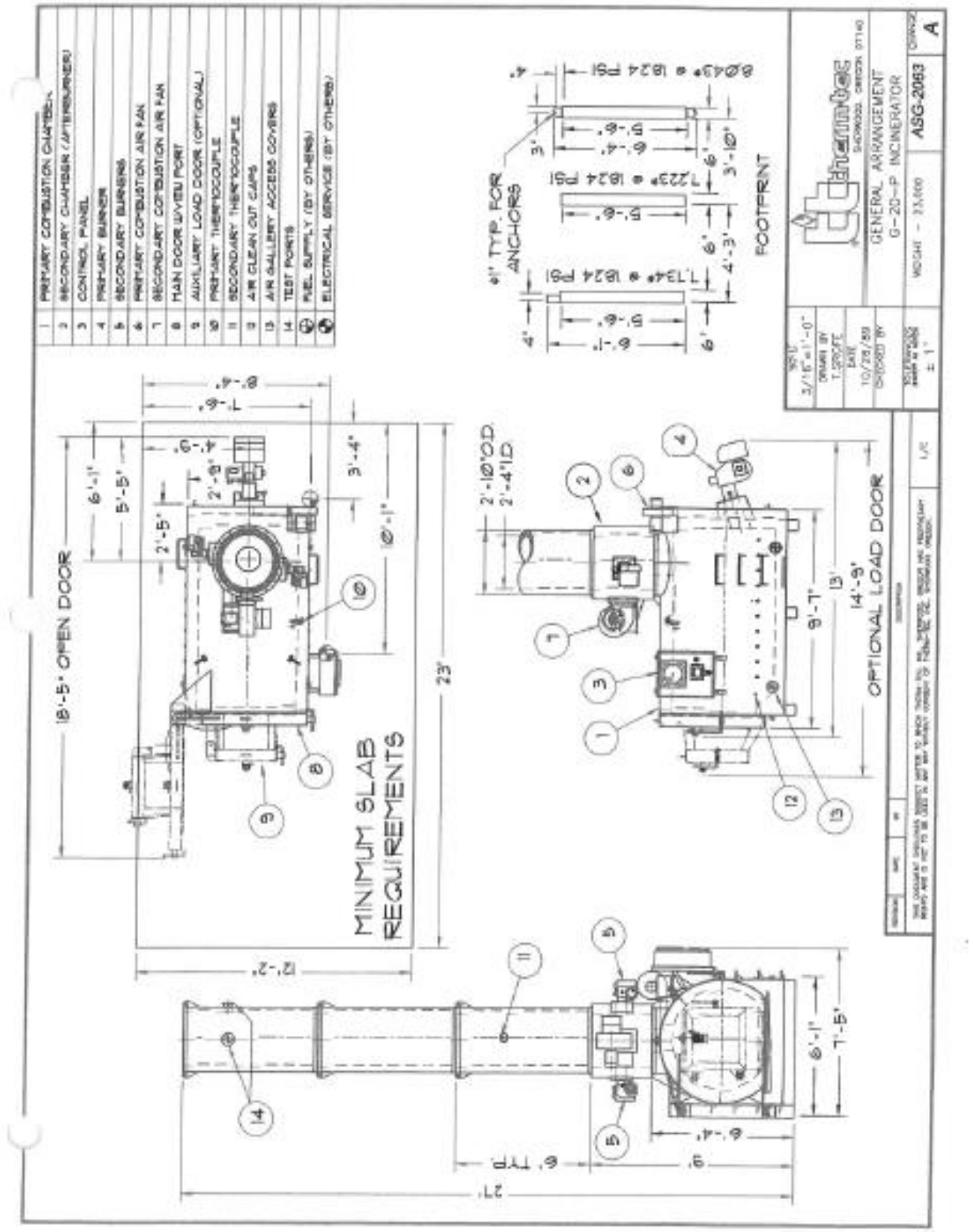
Therm Tec Inc.

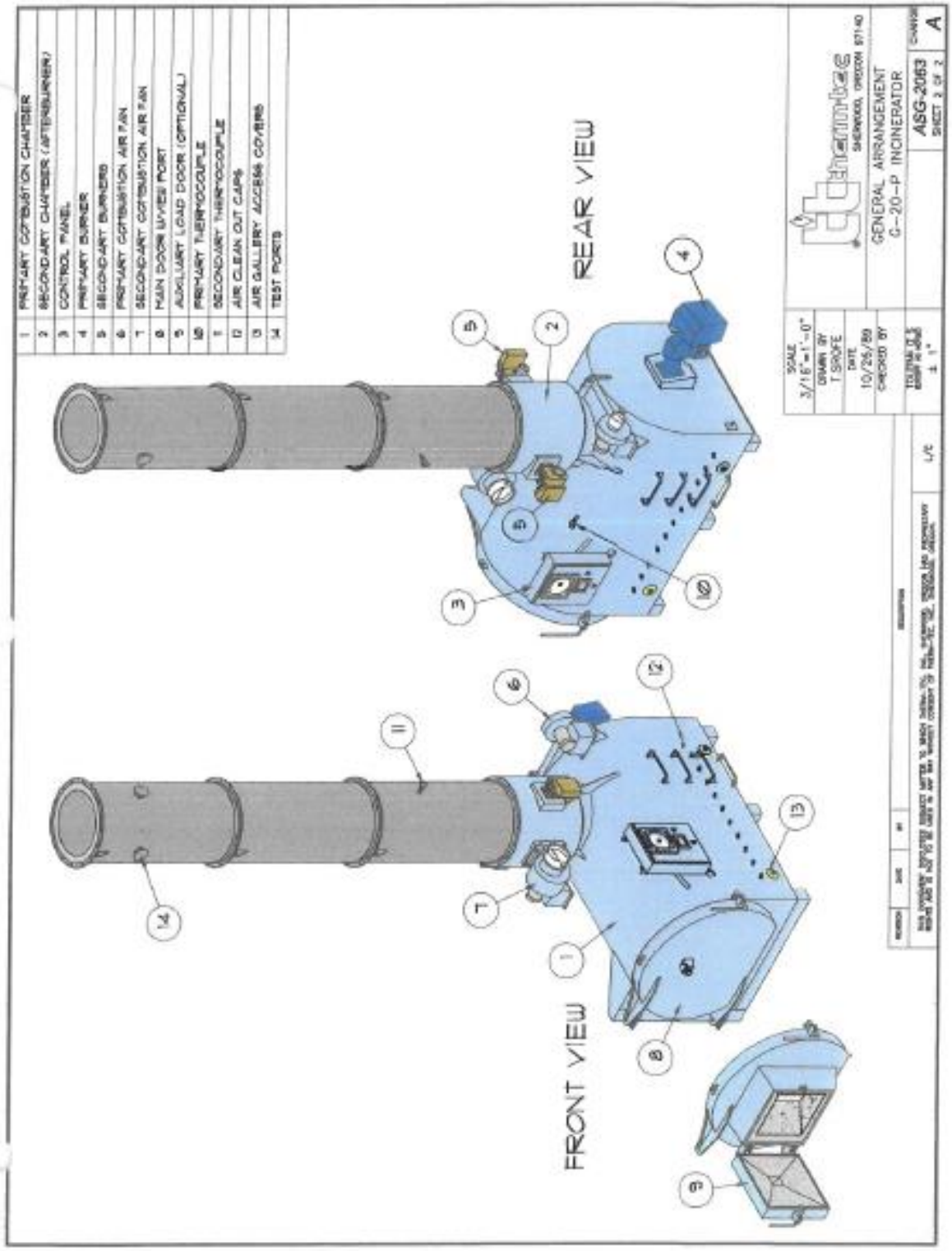
Updated:
July 15, 1999

SPECIFICATIONS : " G-20-P " MODEL

OPTIONS AVAILABLE AT ADDITIONAL COST

Temperature Recorders, (Continuous, 7 Day / 24 Hours) Single Pen Or 2 Pen Points
Door Swing, Main Load Door - Right Or Left
Primary Burner Placement (Standard On Back Of Unit) - OR - On Right Side Or Left Side Of Unit)
" F.M." Control For Burners(s)
Magnetic Door Lock (Lock Out System Required By Some A.P.Agencies)
Auxiliary Load Door On Main Door
1/2 Yard Pneumatic Ram Feeder G-12 and Up (Hospital And General Units)
Large Animal Winch For Loading
Large Animal Load Ramp
Spark Arrestors
Additional Stack Sections
Stack Base For Remote Stack Systems
Special Stack Shapes - Elbows, 90 Deg., 45 Deg. And Breech Sections
Burner Covers (For Outside Installations)
Remote Control Panels
Extra Operational and Maintenance Manuals
Horizonal Afterburner Configuration (Special Engineering)
Custom Engineering For Special Installation Conditions


1 PRIMARY COMBUSTION CHAMBER
2 SECONDARY CHAMBER (AFTERBURNER)
3 CONTROL PANEL
4 PRIMARY BURNER
5 SECONDARY BURNERS
6 PRIMARY COMBUSTION AIR FAN
7 SECONDARY COMBUSTION AIR FAN
8 MAIN DOOR W/VIEW PORT
9 AUXILIARY LOAD DOOR (OPTIONAL)
10 PRIMARY THERMOCOUPLE
11 SECONDARY THERMOCOUPLE
12 AIR CLEAN OUT CAPS
13 AIR GALLERY ACCESS COVERS
14 TEST PORTS
FUEL SUPPLY (BY OTHERS)
ELECTRICAL SERVICE (BY OTHERS)
4" TYP. FOR ANCHORS
FOOTPRINT
18'-5" OPEN DOOR
MINIMUM SLAB REQUIREMENTS
OPTIONAL LOAD DOOR
2'-10"OD
2'-4"ID
GENERAL ARRANGEMENT
G-20-P INCINERATOR
ASG-2063
A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8 MAIN DOOR W/VIEW PORT
9 AUXILIARY LOAD DOOR (OPTIONAL)
10 PRIMARY THERMOCOUPLE
11 SECONDARY THERMOCOUPLE
12 AIR CLEAN OUT CAPS
13 AIR GALLERY ACCESS COVERS
14 TEST PORTS
REAR VIEW
FRONT VIEW
GENERAL ARRANGEMENT
C-20-P INCINERATOR
ASG-2063
SCALE 3/16"=1'-0"
DRAWN BY T.SHAFE
DATE 10/25/89
CHECKED BY
A