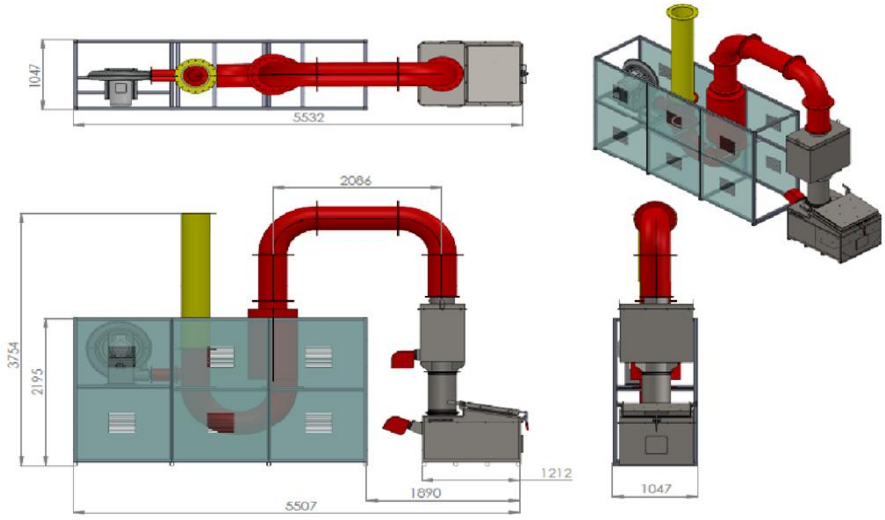
NATIONAL DEPARTMENT OF HEALTH

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT &

ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

for



PROVINCIAL HOSPITALS INCINERATOR INSTALLATION PROJECT

EXECUTIVE SUMMARY

Introduction

The Government of Papua New Guinea (GoPNG) with financing support from the World Bank (WB) is implementing the PNG COVID-19 Emergency Response Project (PNG COVID-19 ERP) through the National Department of Health (NDoH).

The PNG COVID-19 ERP has four components with the overall objective of preventing, detecting, and responding to the threats of COVID-19 and to strengthen national systems for public health preparedness in Papua New Guinea (PNG). The Provincial Hospitals Incinerator Installation Project ('the project') is a sub-activity of Component 2 Health Systems Strengthening, under Sub-Component 2.2 Enhancing Containment and Clinical Management Capacity to improve infection control and waste management in hospitals. Incineration is the preferred technology for health care waste treatment in PNG therefore a i8-M70 model dual chamber 50kg/cycle incinerator with gas scrubber and other accessories will be installed at all the 21 provincial hospitals in PNG under the Project. Also, part of the Project is the provision of training on the operational and maintenance requirements of the incinerators.

The primary rationale for the project is to enhance health care waste management practices in the PNG provincial hospitals. The project is also expected to reduce nuisance caused by such issues as dark smoke and unpleasant odour from current incinerators and operating practices and grievances from the community about air pollution.

The proposed key project activities involve the dismantling of old incinerators, freighting and installation of new incinerators with their gas scrubbing system and a 10-meter stack height fitted to the gas scrubber, construction of incinerator base and shed buildings and waste pits. Additional works will include improvement to plumbing, drainage and electrical works.

Objective of the Environment and Social Impact Assessment

This report has been prepared to present the findings of an Environment and Social Impact Assessment (ESIA) undertaken to support the application for an environment permit for the Project under PNG regulatory requirements administered by the Conservation and Environment Protection Authority (CEPA), and to meet the WB Environmental and Social (E&S) assessment requirements.

Methodology of the ESIA

The methods used in predicting potential risks and impacts of the project phases and their mitigation measures included literature review of the World Bank Environment and Social Framework (ESF)[1] and its related Environment and Social Standards (ESS) and instruments outlined in the PNG COVID 19 ERP ESMF. Other literature reviewed were the WBG Environment, Health and Safety, (EHS) Guidelines[2], WHO Safe Management of Health Care Waste[3], Guidelines for Health Care Waste in PNG[4],related Good International Industry Practice (GIIP) guidelines and PNG regulations. Physical inspection of the incinerator sites and

[1] The World Bank Group ESF can be viewed at ESFFramework.pdf (worldbank.org)

[2] The World Bank Group Environment, Health and Safety Guidelines can be viewed at World Bank Document

[3] Details on Safe Management of Health Care Waste can be viewed here Safe management of wastes from health-care activities, 2nd ed. (who.int)

[4] Guidelines for Health Care Waste Management in PNG can be viewed here DRAFT (sprep.org)

their environment were conducted by NDoH PCU Safeguards Officer, CEPA Environmental Officers and the Health Facility Technical Team facilitated by the PHAs. Engagements and discussions on the proposed Project were also held with the respective PHAs and their stakeholders including representatives of the nearby communities. This report is based on those site inspections and consultations.

Baseline Information

All incinerator sites are within the hospital grounds and have been previously disturbed and therefore do not contain significant populations of rare or endangered flora or fauna species. There are no wetlands or primary forests located at or adjacent to the sites. The proposed sites are alongside built-up areas and nearby receptors include hospital in ward patients and residential communities. All proposed sites are located on State Alienated Land by way of Certificates of Occupancy from the Department of Lands and Physical Planning.

The existing air quality at the proposed incinerator locations varies, however, at most sites the air quality is poor due to smoke and odor from the burning of hospital waste in open pits and use of poorly maintained single-burner incinerators without gas scrubbing systems. This smoke and odor are the subject of community grievances at some locations.

Site visits carried out by an Assessment Team identified issues with the current waste management practices at the hospitals. This included the presence of old dysfunctional incinerators and/or existing incinerators that were operating without gas scrubbers. The old dysfunctional incinerators with scrubbers attached to them also contain slurry waste. General solid waste accumulation around sites from old incinerator parts and medical equipment and in some sites the need for proper plumbing and drainage systems for incinerator sites was identified. Good attempts are being made by many hospitals in upholding good health care waste management pathways, however, it was noted that there are limited resources to support a HCW Color Coding system to complement waste segregation efforts. Weighing of waste and recording of weight was not well practiced across all sites resulting in overloading of incinerators. This was generally identified as one contributing factor to the breakdown of incinerators. It was also identified that the absence of a manual to operate and maintain the incinerator may have contributed to the ineffective management of many incinerators in terms of scheduled service and maintenance amongst other causes causing an early breakdown of incinerators. Occupational health and safety measures for incinerator operators also needed enhancing through issuance of proper Personal Protective Equipment. An Occupational Health and Safety (OHS) Policy, Fire and Life Safety (F&LS) Equipment and signage with instructions are needed in many sites. It was also noted that utility connections for power, water and drains in some sites needed upgrading to required standards.

Health care waste in many hospitals is treated through open burning or taken to engineered dumpsites managed by the town councils in situations where current incinerators are dysfunctional. This practice has been considered a major public health risk by communities and other stakeholders at sites visited. Certain waste dumping sites were observed to lack fencing thus scavenging by animals and people was evident.

Summary of Potential Risks and Impacts

Potential risks and impacts are likely to occur during both the construction and operational phases of the project. Construction phase impacts would relate to movement of heavy machinery such as cranes and trailer operations, hazardous waste from potential oil spills, solid and hazardous waste from incinerator demobilization and site clearance/preparation activities. These impacts are expected to be minor and short term.

The key potential impact associated with the operation of the incinerator is air pollution. Given the current practice of open burning and/or use of incinerators without scrubbers, the project is likely to result in an overall improvement of ambient air quality. Nevertheless, uncontrolled emissions from the incinerator could contribute to air pollution. The proposed incinerators meet good industry practice and therefore will improve the ambient air quality at receptors providing the incinerators are operated and maintained correctly. The key mitigation for managing this potential impact is the preparation and implementation of an Incinerator Operations Manual.

The major socioeconomic impact is found to be positive. Reduced volume of healthcare waste accumulation coupled with improved treatment equipment will have public health benefits for hospitals and surrounding communities.

Mitigation Measures

The key mitigation measures for the construction phase include establishing site specific plans for Occupational Health and Safety, Solid Waste Management (which will include Asbestos Carrying Material and hazardous waste). To manage stakeholder expectations, a Stakeholder Engagement Plan (SEP) and a Grievances Redress Mechanism (GRM) will also be established as part of each project site activities. Contractors will be expected to produce the above site-specific plans for each of the sites. All workers will be required to sign a Code of Conduct as part of their engagement on the project that addresses behavioral expectations, including those relating to prevention of sexual harassment and sexual violence.

For the Operations Phase, the incinerators will be fitted with a gas scrubbing system that allows for cleaner air emissions. The stack height on the incinerators will also be increased to 10 m to ensure gases are dispersed. An Incinerator Operations Manual will be developed and implemented. The manual will be in alignment with good international industry practice (GIIP) guidelines and include incinerator operations, troubleshooting, maintenance requirements (e.g., daily, weekly, fortnightly, etc.), training, ash disposal, record keeping (e.g., waste records, burn temperature, smoke color, fuel usage, etc.) and air emissions monitoring. In addition, a healthcare waste training program will be developed for healthcare personnel to ensure wastes are correctly segregated to ensure that only those wastes requiring incineration are separated from other wastes.

Implementation Arrangements

While different project stakeholders will have designated roles in ensuring successful implementation of the proposed mitigation measures, Provincial Health Authorities (PHA) and Hospital Managements will have to diligently implement their Policies and Standard Operating Procedures (SOP) on Health Care Waste Management (HCWM) ensuring system improvement to mandate color coded receptacles and bin liners, labeling of receptacles, bin liners and wheeler bins, proper segregation of waste at source, proper training of incinerator operators and their supervisors on the importance of correct operation (including not exceeding loading standards), recording of waste weight prior to incineration, proper management of

bottom ash prior to disposal and basic information on impacts of incineration emissions and ash on people and the environment. Monitoring of gas emissions and regular reporting is also captured in the ESMP.

Alternatives

A no project alternative is not the preferred option because no project would increase environmental impacts and pose greater public health risks. While there are other alternatives to incineration as a healthcare waste treatment, incineration has far more preferred advantages. The selection of alternative sites for incinerators is challenged by a number of critical issues which will require time and resources to resolve. They include land ownership and land dispute issues, lack of access to water and electricity at alternative sites, risks of security for the incinerators from vandalism, the model of waste transport vehicles and risks related to transportation of healthcare waste through communities and related costs for establishing the utilities required by the incinerators thus the current sites (in most instances) had been selected to site the new incinerators with appropriate measures to mitigate all potential risks and impacts.

Environment and Social Management and Monitoring

A Project-wide Environmental and Social Management Plan (ESMP) and 21 Subproject-Specific ESMPs were developed taking into consideration the impacts and mitigation measures to be implemented. The ESMPs include implementation, reporting and monitoring requirements. The important elements that require monitoring during the operations phase will be air quality. Community concerns will be monitored and addressed accordingly during the decommissioning, construction and operations phase of the Project.

ACRONYMS AND ABBREVIATIONS

ACM	Asbestos Carrying Material
CEPA	Conservation Environment Protection Authority
CESMP	Construction Environment and Social Management Plan
EHO	Environmental Health Officer
EHS	Environment Health and Safety
E&S	Environment and Social
ESIA	Environment and Social Impact Assessment
ESMF	Environment and Social Management Framework
ESMP	Environment and Social Management Plan
ESS	Environment and Social Standard
GBV	Gender-based Violence
GIIP	Good International Industry Practice
GRM	Grievances Redress Mechanism
GoPNG	GoPNG
HCW	Health Care Waste
HCWM	Health Care Waste Management
HCWMF	Health Care Waste Management Facilities
IFC	International Finance Corporation
IPC	Infection Prevention Control
LMP	Labour Management Procedures
NCD	National Capital District
NDoH	National Department of Health
OHS	Occupational Health and Safety
PHA	Provincial Health Authority
PHIIP	Provincial Hospitals Incinerator Installation Project (“the Project”)
PNG	Papua New Guinea
PNG COVID-19 ERP	PNG COVID-19 Emergency Response Project
PPE	Personal Protection Equipment
SEA/H	Sexual exploitation and abuse/ harassment
SEP	Stakeholder Engagement Plan
SMF	Synthetic Mineral Fibres
SOP	Standard Operating Procedure
UNOPS	United National Operations Project Support
VGS	Venturi Gas Scrubbing
WB	World Bank
WBG	World Bank Group
WHO	World Health Organization

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1.0 INTRODUCTION

The Government of Papua New Guinea (GoPNG), with financing support from the World Bank (WB), is implementing the PNG COVID-19 Emergency Response Project (PNG COVID-19 ERP). The objective of the PNG COVID-19 ERP is to prevent, detect and respond to the threat posed by COVID-19 and strengthen national systems for public health preparedness PNG[5]. The PNG COVID-19 ERP includes the installation of incinerators at 21 Provincial Hospitals across PNG for the management of healthcare waste that may be generated from the COVID-19 readiness and response activities supported by the PNG COVID-19 ERP. This scope was included in the PNG COVID-19 ERP as generation of healthcare waste (and lack of suitable disposal options) was a risk identified during planning of the PNG COVID-19 ERP[6]. The installation of the incinerators was delayed and, although the COVID-19 emergency has since passed, this scope is still progressing as it is an opportunity to improve the disposal of healthcare waste across PNG.

This scope is called the Provincial Hospitals Incinerator Installation Project (PHIIP) and is thereby known as the "Project". The proponent and Implementing Agency for the Project is the National Department of Health (NDoH).

This Environment and Social Impact Assessment (ESIA) has been undertaken to meet the WB Environmental and Social (E&S) assessment requirements and to receive a "no objection" from the WB. An earlier version of this document was submitted to the PNG Conservation and Environment Protection Authority (CEPA) in March 2023 to support the application for an environment permit for the Project under PNG regulatory requirements.

This ESIA was disclosed on the NDOH website in September 2024.

1.1 Project Overview

The objective of the Project is to enhance healthcare waste management practices in provincial hospitals across PNG. The status of healthcare waste management varies between hospitals, with some hospitals having functional and operating incinerators; some having functional but not operating incinerators and some having non-functioning incinerators. In the absence of sufficient incineration capacity, hazardous healthcare waste is often burned in the open and/or placed untreated into landfill and pits. The Project is expected to reduce grievances from the community about dark smoke and unpleasant odor from current incinerators and operating practices; and mitigate issues from the disposal of untreated healthcare waste to landfill. At some Provincial Hospitals, current healthcare waste disposal practices will remain alongside use of the new incinerators as the proposed incinerators do not have capacity to treat all of the incinerable healthcare waste generated at the hospital. Nevertheless, the use of the incinerators will reduce reliance on current practices and improve the overall management of healthcare waste.

Autoclaves were considered as an alternative to incineration as they are more efficient and environmentally friendly, however, they are expensive, require complex maintenance that is difficult to source in PNG and are limited as to the types of waste that can be processed (as well as generally only able to process small quantities at a time). Incinerators accept the greatest variety of waste, the volume of waste is significantly reduced through the incineration process, they are simpler to maintain, and the

[5] https://documents.worldbank.org/en/publication/documents-reports/documentdetail/506111587408419959/papua-new-guinea-covid-19-emergency-response-project

[6] https://documents1.worldbank.org/curated/en/605421585914812279/pdf/Appraisal-Environmental-and-Social-Review-Summary-ESRS-Papua-New-Guinea-COVID-19-Emergency-Response-Project-P173834.pdf

device is cheaper to run and maintain. Therefore, incinerators were selected for managing hazardous healthcare waste.

The incinerators will be installed in previously disturbed areas and on land managed by the provincial healthcare authorities. Construction activities will include demolition works, slab base work and installation of sheds, incinerators, gas scrubbers, emission stacks installation and other accessories. Other construction work will include constructing waste pits, improving drainage, plumbing, electrical works and establishing life, fire safety protection equipment and fencing. Operation of the incinerators will involve sorting waste, loading incinerators, emission to air, production of wastewater and refueling.

1.2 Project Proponent and Implementing Agency

The Project Proponent and Implementing Agency is the NDoH. The NDoH is responsible for the implementation of the Project, including overall coordination, results monitoring and communicating with CEPA and the WB on the status of the Project. The Provincial Health Authorities (PHAs) will play a major role in the Project, however, NDoH will still have the overall responsibility for ensuring that:

- environmental and social issues are adequately addressed
- commitments in this ESIA are implemented
- conditions of the environment permit are met.

The United Nations Office for Project Services (UNOPS) have been contracted to manage the design, construction, and commissioning of the incinerators.

1.3 This ESIA

1.3.1 Objective

The objective of this ESIA report and related Environment and Social Management Plan (ESMPs) is to identify potential environment and social (E&S) risks and provide mitigation measures for managing potential risks and impacts associated with the planning and design, construction, and operation of the Project. The potential risks and impacts were determined from investigations carried out on and around the sites proposed for establishment of the healthcare waste incinerators; from consultations made with hospital workers, surrounding communities, other key stakeholders; literature review on healthcare waste management; and from related healthcare waste regulations and guidelines.

1.3.2 Project Category

According to the PNG Environment (Prescribed Activities) Regulation 2002, the proposed Project is Level 2 (B) activity requiring an environmental permit due to the quantity of biomedical waste managed each year (i.e., greater than 10 tonnes per annum). An ESIA and ESMP is required to support a Level 2B environmental permit application. An environmental permit (EP-L2 (938) was granted on 14 January 2024.

According to the WB's Environmental and Social Framework (ESF), this project activity has been classified as 'Moderate" therefore requires an E&S assessment and an ESMP to manage potential environmental and social risks and impacts associated with the Project. The overall PNG COVID-19 ERP E&S risk rating is substantial.

1.3.3 Scoping Process

A scoping process was done to focus planning of the site visits, what should be assessed, who should be consulted at each site, what their concerns and project alternatives might be. The scoping process involved the following:

- Discussions with the NDoH Health Facility Branch, NDoH Environmental Health and Sustainable Development Branch and consultation with relevant officials within CEPA on the scale and scope of the project to determine where the assessment should be focused.
- Verbal interviews with key project beneficiaries and key stakeholders at the various provincial towns.
- Physical investigation of the site and the surrounding areas using a checklist with a view to identify potential environmental, social and safety issues that pertain to the Project.
- Documentary review of the nature of the proposed activities, relevant legal and regulatory framework.

1.3.4 Terms of Reference

Terms of reference for the ESIA were developed by NDOH based on the PNG COVID19 ERP ESMF, the PNG Guideline for Conduct of Environmental Impact Assessment and Preparation of Environmental Impact Statement[7] and other literature from similar projects. The term of reference are as follows:

- The proposed locations of each project.
- A concise description of the national and international environmental legislative and regulatory framework, baseline information and any other relevant information related to the project.
- The objective of the project.
- The technology, procedures and processes to be used in the implementation of the project.
- The products, by- products and waste generated by the project.
- A description of the potentially affected environment.
- Alternative technologies, processes available, and reasons for preferring the chosen technology and processes.
- Stakeholder analysis and consultations.
- Analysis of alternatives including project site, design and technologies and the reasons for preferring the proposed site design and technologies.
- An environmental and social management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment and human populations, including the cost, time frame and responsibility to implement the measures.
- Stakeholder engagement.
- Provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities in the course of carrying out activities
- The measures to prevent health hazards and to ensure security in the working environment for the employees and for the management of emergencies.
- An identification of gaps in knowledge and uncertainties encountered in compiling the information.
- An economic and social analysis of the project.

[7] DEC Publication: GL-Env/02/2004. Issued by Department of Environment and Conservation (now CEPA).

- Whether the environment of any site is likely to be affected and if available alternatives and mitigating measures are required, and other such matters as CEPA may require.

1.3.5 ESIA Report Structure

The ESIA Report is structured in the format outlined in Table 1.

Table 1: Structure of the ESIA

Section	Title	Content
	Executive Summary	Introduces the ESIA; project background and objectives; and summary of impacts and mitigation measures
Chapter 1	Introduction (i.e., this chapter)	Introduces the Project and explains the content and purpose of the ESIA
Chapter 2	Legal and Institutional Framework	Provides details of the national regulatory, legislative and administrative framework; the WB policies and guidelines; and with WHO and other GIIP guidelines the project activities are aligned with
Chapter 3	Project Description	Provides a description of the project locations, design, construction activities and operational activities.
Chapter 4	Environmental and Social Setting	The environmental and social setting of the Project is described, including climate, land use, air quality, etc.
Chapter 5	Stakeholder Consultation	Provides details of the consultation that was undertaken as part of the Project and the feedback/concerns raised by stakeholders and responses provided to them
Chapter 6	Impact Identification and Assessment	Identifies and describes potential environmental and social impacts of the various phases of the project and proposes mitigations measure to minimize impacts. Also provides an assessment of the significance of the potential impacts.
Chapter 7	Analysis of Alternatives	Compares alternatives to the proposed projects site, technology, design and operation including without project situation in terms of potential impacts
Chapter 8	Environment and Social Management Plan	Provides a summary of the mitigation measures identified in Chapter 6 and information on how they will be implemented (e.g., responsibilities, timeframe, verification, etc). Also includes a monitoring plan, details of the implementation arrangements and the grievance redress mechanism.
Chapter 9	Grievance Redress Mechanism	Details of the Project GRM
Chapter 10	Conclusion	Conclusion
Annex 1	Popondetta Provincial Hospital	The annexes are subproject-specific ESMP reports for each of the incinerator locations. They provide the specific project designs for each of the sites, additional site-specific baseline information, identify any site-specific impacts that are not in the main ESIA and provide site-specific mitigations for these, where identified. These reports are designed to be used in conjunction with, and to supplement the main ESIA report.
Annex 2	Kavieng Provincial Hospital	
Annex 3	Alotau Provincial Hospital	
Annex 4	Modilon Provincial Hospital	
Annex 5	Mt Hagen Provincial Hospital	
Annex 6	Kunjip Provincial Hospital	
Annex 7	Daru Provincial Hospital	
Annex 8	Mendi Provincial Hospital	
Annex 9	Wabag Provincial Hospital	
Annex 10	Tari Provincial Hospital	
Annex 11	Angau Provincial Hospital	
Annex 12	Kimbe Provincial Hospital	
Annex 13	Nonga Provincial Hospital	
Annex 14	Kerema Provincial Hospital	
Annex 15	Kwikila Provincial Hospital	
Annex 16	Kundiawa Provincial Hospital	
Annex 17	Goroka Provincial Hospital	
Annex 18	Lorengau Provincial Hospital	
Annex 19	Vanimo Provincial Hospital	
Annex 20	Boram Provincial Hospital	

Annex 21	Buka Provincial Hospital	

2.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

Under the WB's ESF and Environment and Social Standard 1 (ESS1) (Environmental Assessment and Management of Environmental and Social Risks and Impacts), it is a requirement that a project proponent performs an environmental assessment prior to the commencement of any works that might have substantial environmental impacts. In addition, CEPA in compliance with the *Environmental Act 2000*, is responsible for ensuring that assessment of potential environmental and social impacts for Level 2 activities are completed, as is the case for this project. This completed ESIA report identifies potential positive and negative impacts associated with the proposed Project. Mitigation measures for potential negative impacts are outlined in the ESMP and will be applied.

The proposed project has triggered WB's ESS1 on Assessment and Management of Environment and Social Risks and Impact. This Standard is key to prevention and mitigating of undue harm to people and their environment in the development process. Proponents of projects requiring financing from the WB shall therefore be responsible for carrying out environmental and social impact assessments on all project activities that are likely to have a significant adverse effect on the biophysical and socio-economic environment and propose mitigation measures to control adversity of the risks and impacts of the project.

This project also complies with requirements of the ESS1 thus the ESIA and ESMP are completed. The NDoH will therefore be required to comply with both CEPA and WB requirements in mitigating risks and impacts associated with the Project as outlined in the ESMP.

This chapter provides an overview of the policy, legal and institutional frameworks for the project.

2.1 Policy Framework

2.1.1 PNG Vision 2050

Environmental Sustainability and Climate Change is one of the 8 pillars outlined in 'The Vision 2050'[8]. The development focus of this pillar aims to reduce greenhouse emissions and conserve biodiversity. Environmental benefits enjoyed by the present generation will be an investment for future generations. A sustainable development strategy promotes a 'wise use' principle where proper environmental management is required.

This proposed project will apply mitigation measures to ensure protection of the environment within which the incinerators are located

2.1.2 PNG National Health Care Waste Management Guidelines (Draft)

The PNG National Health Care Waste Management Guidelines is for use by health-care facilities where healthcare waste is generated and consists of two parts.

Part 1 provides a practical action plan for the development and implementation of waste management policies plans with specific requirements for appropriate segregation, collection, storage, handling, transport and disposal of all categories of wastes generated from health-care facilities in PNG including reviews of the relevant laws and legislation for the management of health-care wastes in PNG.

[8] https://png-data.sprep.org/dataset/papua-new-guinea-vision-2050

Part 2 provides the detailed technical guidance and procedures for essential aspects of health-care waste management in PNG. The aspects include health-care waste categorization; waste segregation, handling and storage in health-care establishments; treatment and disposal of health-care waste; transport of waste outside the health-care establishment; and emergency procedures to deal with accidents and incidents. The technical guidelines also provide the training mechanisms of all related personnel involved in health-care waste management, either directly or indirectly.

This document also includes a suggested management option for the wastewater generated from use of wet scrubbers.

This document provides viable options for addressing the challenges encountered in planning for health care waste management in PNG and it is the basis for mitigation measures on Standard Operating Procedures (SOPs) related to the operations of the incinerators for this project.

2.1.3 PNG Infection Prevention and Control Policy 2020

The intent of the Infection Prevention and Control Policy is to protect health workers, patients and the community from the transmission of infectious agents and provides for safe and quality health care environments in PNG both in clinical and non-clinical settings and to contribute strengthening compliance to National Infection Prevention and Control Guidelines.

This document outlines Healthcare Waste Management (HCWM) SOPs related training, supervision, and advocacy as a mitigation measure requirement for operating the incinerators. The proposed project ensures compliance with this Infection Prevention Control Policy.

2.1.4 National Guidelines on Infection Prevention and Control in the Context of COVID-19 in Healthcare Settings 2020

The guideline is for use by public health and infection prevention and control (IPC) teams, healthcare managers, healthcare facility and community-based health workers throughout PNG. It provides guidance on infection, prevention and control requirements for the managing patients with suspected, probable, or confirmed COVID-19 based on current evidence. The document also provides guidance on how to limit transmission into and throughout healthcare facilities. Emphasis is on hand hygiene, staff wearing of Personal Protection Equipment (PPE) and appropriate training.

Mitigation measures for this project takes into consideration the spread of COVID-19 to workers from contaminated health care waste in the incinerator facility. Hand hygiene, proper training and correct PPE usage for incinerator operators are captured as mitigation measure in the ESMP.

2.1.5 National Capital District Waste Management Policy

The National Capital District (NCD) Waste Management Policy provides a framework for effective management of municipal waste including household hazardous wastes in the NCD. The framework includes management of solid waste generation, storage, collection, transportation, treatment and disposal with an overall goal of protecting public health and the environment from adverse impacts from unmanaged solid wastes.

The provinces do not currently have waste management policies and therefore this policy provides guidance for this Project. The Project will be generating solid wastes during construction and during its operational phase. During the construction phase, contractors will be working with the Town Councils on appropriate disposal sites for solid waste.

2.2 Legal Framework

Discussed in the following sections are key national laws that govern the management of environmental resources in PNG.

2.2.1 The PNG National Constitution

The National Goal and Directive Principle 4 of the PNG Constitution declares that Papua New Guinea's natural resources and environment be conserved and used for the collective benefit of all in the current and replenished for future generation and to take all steps necessary to protect the environment including birds, animals, insects, plants and trees.

The design of the proposed Project will ensure protection for the environment around the Project sites.

2.2.2 *Environment Act 2000*

The *Environment Act 2000* Part 2 Section 4 (Objects) outlines responsibilities for protection of the environment while allowing development in ways that improve quality of life but also maintain ecological processes on which life depends. The other objects also highlight the same where environmental protection prioritized.

According to Section 6 (d) in Part 2 of the Act, an Environmental Impact Assessment study needs to be carried out on activities specified in the second schedule of the Act that are likely to have a significant impact on the environment (i.e., Level 2 and Level 3 activities).

It is in line with this provision in the Act mentioned that the NDoH has carried out a preliminary environmental and social assessment of each incinerator site at each provincial hospital and this ESIA Report is a project report in respect of the proposed development.

2.2.3 Environment (Prescribed Activities) Regulation 2002

The Environment (Prescribed Activities) Regulation 2002 defines the Level 1 and Level 2 activities mentioned in the Act and therefore require an Environment Permit.

CEPA, in a letter dated February 02, 2021, confirmed that the project identifies under Level 2 Activities according to Category B. 11 - Waste Management and Sub-Category 11.4 - incineration, reprocessing, treatment or disposal of industrial or biomedical waste of a capacity greater than 10 tonnes per year.

According to a preliminary assessment conducted by the Assessment Team that went to each site, all provincial hospitals will generate over 10 tons of waste annually, most of which is planned to be incinerated once the Project is operational. The burden of a pandemic would only add additional waste tonnage. Confirmation of the actual amounts of waste will be made during project implementation.

According to Section 6 (d) in Part 2 of the Act, an Environmental Impact Assessment study needs to be carried out on projects specified in the second schedule of the Act that are likely to have a significant impact on the environment.

The NDoH has therefore conducted an environmental and social assessment of individual incinerator sites in each of the Provincial Hospitals to meet this requirement of the Act. The Environment Permit covering all 21 incinerator sites was issued by CEPA 2024. The conditions of approval include implementation of the mitigations and other commitments in the ESIA and ESMPs; and record keeping and reporting requirements.

2.2.4 Environmental Code of Practice for Sanitary Landfill Sites (2001)

The Environmental Code of Practice (COP) for Sanitary Landfill Sites applies to such facilities on public and private land. CEPA administers this COP. The COP identifies three (3) different Classes of Site.

- Class 1 sites refers to municipal facilities that are mechanized, receive greater than 1,000 tons per day, serve towns with populations of greater than 20,000 people and have the capacity to receive and treat special waste.
- Class 2 sites are manually operated municipal facilities (do not use compactors or graders), do not have special capacity to treat or dispose of special wastes, treat less than 1,000 tons per day and serve towns of between 4,000 to 20,000 people.
- Class 3 sites are not serviced by municipal authorities but instead are managed privately by institutions, companies or individuals and are manually operated.

Class 1 and Class 2 landfill sites require preparation of an environmental impact assessment and grant of a landfill license.

This code of practice is significant for the Provincial Hospitals and the PHAs because in the absence of incinerators, healthcare waste has been disposed in public land fills operated by Town Councils or at privately operated landfills.

To ensure compliance with this COP, the PHAs collaborate with Town Authorities to determine which class of site is suitable for their hospital and apply the COP accordingly. This COP is essential for managing risks associated with breakdown of incinerators during the operations phase of the project and is being captured as a mitigation measure in the ESMP.

2.2.5 Other PNG National Legislation applicable to the project

Other legislation that are significant for compliance during implementation of the Project include the following:

- *Public Health Act (1973)*
- *National Health Administration Act (1997)*
- *Provincial Health Authorities Act (2007)*
- *National Water Supply and Sanitation Act (2016)*
- Public Health (Sanitation and General) Regulation (1973)
- Customary Laws Governing Burial Areas
- *Physical Planning Act (1989)*
- Building Regulation (1994)
- *Electricity Industry Act 2000 (Chp78)*

2.3 Institutional Framework

2.3.1 Conservation and Environment Protection Authority

The responsibility of CEPA is to exercise its powers to supervise and co-ordinate over all matters relating to the environment and to be the principal instrument of government in the implementation of policies relating to the environment.

The Authority has registered environmental assessment experts who conduct environmental assessment of proposed projects on its behalf to assess potential negative and positive impacts and develop mitigation measures of projects. Therefore, it shall be the responsibility of the Authority to ensure that an ESIA for the

proposed Project is conducted and that an environment permit is issued before the Project can commence. CEPA will also provide feedback to stakeholders after their review of the ESIA Report.

2.3.2 National Department of Health

The proposed project is under the NDoH and it shall be the primary role of the NDoH to monitor and measure the progress of implementation of the social and environmental safeguards. During project implementation, it shall undertake site inspections to verify compliance to the Environmental Permit Conditions and the ESMP and measure progress toward the Project's expected outcomes.

The NDoH and the PHAs shall then prepare periodic reports, which shall be submitted to CEPA for review. These reports will be Environmental and Social compliance reports based on the Environmental Permit Conditions.

2.3.3 Provincial Health Authorities

There is a PHA in each of the 21 provinces. The PHAs have powers under the *Provincial Health Authorities Act* that provides for integral human development particularly for improvement in the standard of public health to enable all people attain self-fulfilment through provincial health partnerships and establishment of provincial health authorities. The Act also defines powers, functions, and other related purposes of the PHAs.

The PHAs oversee the running of the provincial hospitals and will apply their powers and functions in ensuring that the operation of the incinerators follow the requirements in the ESMP and meet any Environmental Permit conditions that may be issued by CEPA.

2.4 World Bank Environment and Social Framework

The WB's ESF provides an overall framework for guiding borrowers to manage any environmental and social risks to their project during project development and implementation. The ESF sets out the 'World Bank's commitment to sustainable development, through a Bank Policy and a set of ESS that are designed to support Borrowers' projects, with the aim of ending extreme poverty and promoting shared prosperity'. The framework became effective on 1 October, 2018 and applies to all Investment Project Financing initiated after this date. The framework consists of three parts:

1. A Vision for Sustainable Development - the Bank's aspirations regarding environmental and social sustainability.
2. The World Bank Environmental and Social Policy for Investment Project Financing - requirements that apply to the Bank.
3. The ESS requirements that apply to the Borrower and projects.

2.5 World Bank Environment and Social Standards

There are ten ESSs under the WB ESF, six of which have been screened as relevant to this Project. The other four are not relevant. Detailed information on the ESF is available at: https://www.worldbank.org/en/projects-operations/environmental-and-social-framework.

Table 2 provides descriptions on the relevance of the individual ESSs to this project.

Table 2 ESSs triggered by the Project

ESS No.	Environment and Social Standard	Relevance to Project
ESS 1	Assessment and Management of Environment and Social Risks and Impacts	An E&S assessment in accordance with ESS1 and an ESMP has been developed to manage any potential risks or impacts brought about by this project (i.e., this document)
ESS 2	Labor and Working Conditions	This ESS has relevance for the project. The Labour Management Plan (LMP) developed for the wider PNG COVID-19 ERP will provide guidance for labor and working conditions related to the project.
ESS 3	Resource Efficiency and Pollution Prevention and Management	This ESS is triggered by the Project and the installation and operation of the incinerator. This report details potential risks and impacts and their associated mitigation measures relating to resource efficiency and pollution prevention and management.
ESS 4	Community Health and Safety	Mitigation and control measures for preventing potential risks and impacts on community members health and safety are considered in this ESIA/ESMP.
ESS 5	Indigenous Peoples/ Sub-Saharan African Historically Underserved Traditional Local Communities	Indigenous people, particularly communities living around the incinerator sites, are considered as important stakeholders and their views and concerns regarding the project will be managed through a Stakeholder Engagement Plan (SEP) and a Grievance Redress Mechanism (GRM) process during project implementation. As most of PNG's population is indigenous, separate planning for indigenous people is not proposed.
ESS10	Stakeholder Engagement	The overall project PNG COVID-19 ERP documentation has been updated, disclosed and adopted. A site-specific SEP and GRM process will be implemented to manage any project activity related grievances.

Note: PNG COVID-19 ERP documents can be found at https://projects.worldbank.org/en/projects-operations/document-detail/P173834?type=projects

2.6 World Bank Group Environmental, Health and Safety Guidelines

The WB Group's Environmental, Health and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP) and are referred to in the WB's ESF and in the International Finance Corporation's (IFC) Performance Standards. The EHS Guidelines contain performance levels and measures that are normally acceptable to the WB Group and are generally considered to be achievable in new facilities at reasonable costs by existing technology. The EHS Guidelines are comprised of General Guidelines which are organised by themes (environmental; occupational health and safety; community health and safety; construction and decommissioning) and industry-specific guidelines that cover over 60 specific industries relating to agribusiness and food production; chemicals; forestry; general manufacturing; infrastructure; mining; oil and gas; and power.

The WB Group requires borrowers/clients to apply the relevant levels or measures of the EHS Guidelines. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects will be required to achieve whichever is more stringent.

The following EHS guidelines are relevant to the project:

- General EHS Guidelines: Environmental (including management air quality, waste management, noise)
- General EHS Guidelines: Occupational Health and Safety
- General EHS Guidelines: Community Health and Safety
- General EHS Guidelines: Construction and Decommissioning
- EHS Guidelines for Health Care Facilities
- EHS Guidelines for Waste Management Facilities

2.6.1 General EHS Guidelines: Environmental

Air Emissions and Ambient Air Quality

These guidelines are meant for all types of projects with "significant" emissions, sources of air emissions, and potential for impacts from ambient air quality. Guidance is provided to prevent or minimize impacts by ensuring that emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality limits. WB Group Air Quality Guidelines could also be used where national guidelines are non-existent.

In this project, fugitive air emissions are expected mostly during the operation phases of the project. These guidelines are useful as they provide control measures used in ensuring emission control is applied at point source. Emissions monitoring will be undertaken through the Project's operations phase (see Chapter 8) and as per the Environmental Permit conditions.

Waste Management

The guidelines apply to the management of non-hazardous and hazardous waste. This project will generate both hazardous and non-hazardous waste. These guidelines provide categories of various wastes and a summary of treatment and disposal options. These guidelines provide appropriate guidance on on-site waste handling, collection, treatment and disposal for both the proponent and the contractors during decommissioning, construction and operation phases respectively.

Notes from this guideline has provided guidance for formulating mitigation measures for the project ESMP on both hazardous and non-hazardous waste management.

Noise

This section addresses impacts of noise beyond the property boundary of the facilities. These guidelines will be applicable during all project phases whereby construction equipment and activities as well as operation of the incinerators are expected to emit noise.

Control measures for noise in this project are reflective of this guideline on noise control and captured in the ESMP.

2.6.2 General EHS Guidelines: Occupational Safety and Health

These guidelines provide guidance for employers and supervisors in fulfilling their obligation towards implementing reasonable precautions towards protecting the health and safety of workers and in managing principal risks to occupational health and safety. Although the focus is placed on the operational phase of projects, much of the guidance also applies to construction and decommissioning activities. The guidelines also describe how facility design considerations include prevention of occupational health and safety risks and hazards.

The guidelines in WB Group General EHS Guideline April 2007 p34 and p71 also provide guidelines on handling chemical hazards as in asbestos containing materials. WBG Good Practice Note on Asbestos Occupational Health and Safety also provides guidelines on handling asbestos containing material.

This good practice note is relevant for the Construction phase of this project for sites where dysfunctional incinerators will be dismantled and disposed.

Measures to control potential risks and impacts in relation to workers occupational health and safety is captured in the ESMP for all phases of the project.

2.6.3 General EHS Guidelines: Construction and Decommissioning.

These guidelines provide guidance on prevention and control of environmental, social and OHS impacts that may occur during new project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities.

2.6.4 General EHS Guidelines: Community Safety and Health

These guidelines provide guidance on prevention and control of community health and safety risks and impacts that may occur during new project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities.

2.6.5 EHS Guidelines for Health Care Facilities

These guidelines provide guidance on the management of health facilities and incorporate the measures contained in the general EHS guidelines that are applicable to heath care facilities and provide examples of how these apply to heath care facilities. These guidelines also provide 'Air Emission Levels for Hospital Waste Incineration Facilities', along with management techniques for the wastewater generated from the use of scrubbers. Effluent guidelines are also provided.

2.6.6 EHS Guidelines for Waste Management Facilities

These guidelines provide guidance on the management of waste management facilities and incorporate the measures contained in the general EHS guidelines that are applicable to waste management facilities and provide examples of how these apply to waste management facilities.

2.7 Other Relevant GIIP Guidelines

2.7.1 WHO National Guidelines on Safe Disposal of Pharmaceutical Waste (In and after emergencies), 2001.

These guidelines are provided by the World Health Organization (WHO). The provisions of these guidelines describe a series of steps that need to be followed to safely dispose of waste and/or expired pharmaceuticals. The steps required include identification of pharmaceutical waste, sorting of pharmaceutical waste by category, filling the relevant forms to seek authority from the authorities in charge of disposing of such waste. Upon obtaining all the relevant approvals, the disposal of the

pharmaceutical waste shall take effect under the supervision of the local pharmaceutical waste disposal team or the Waste Management Team.

The recommended methods for disposing of unwanted pharmaceuticals include:

- Use of either medium temperature incineration at a minimum of 850 degrees Celsius or high temperature incineration exceeding 1200 degrees Celsius with two chamber incinerator for solids, semisolids and powders for controlled substances e.g. anti-neoplastic.
- Engineered sanitary landfill to be used for disposal of expired or unwanted pharmaceuticals.

These guidelines are relevant for PHAs in informing safe disposal of pharmaceutical wastes.

2.7.2 WHO Safe Management of Waste from Health Care Facilities 2nd Edition

This handbook has been prepared as a practical response to the need for improved health-care waste management.

2.7.3 Pacific Regional Solid Waste Management Strategy 2010-2015

PNG was one of several Pacific island countries to adopt the Pacific Regional Solid Waste Management Strategy, initiated by SPREP, and adopted by member countries in 2009.

2.7.4 Stockholm Convention for Persistent Organic Pollutants

The Stockholm Convention on Persistent Organic Pollutants (POP) is an international environmental treaty, signed in 2001 and effective from May 2004, that aims to eliminate or restrict the production and use of persistent organic pollutants (POPs). This convention entered into force in PNG in May 2004 and requires parties to take measures to eliminate or reduce release of POP into the environment with the main objective of protecting human health and the environment and promotes best practice techniques for preventing release of POP into the environment.

It is expected that this project operating at a high temperature will minimise the potential formation of dioxins which is considered a POP.

Operators of the Incinerators will be provided with training on the operational requirements of the incinerator. The scrubbers will purposely function as mitigation for preventing POP into the environment.

2.7.5 Basel Convention

The Basel Convention is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries. In addition, the convention obliges its parties to ensure that hazardous and other wastes are managed and disposed of in an environmentally sound manner. In this context, other waste includes household waste and incinerator ash.

Incinerator bottom ash generated during the operation of the incinerator will be managed in-country in an environmentally sound manner and maintained within national boundaries.

2.7.6 Waigani Convention on Hazardous Waste

The 1995 Waigani Convention is a treaty that bans the exporting of hazardous or radioactive waste to Pacific Islands Forum countries and prohibits Forum Island countries from importing such waste. The convention has been ratified by PNG.

2.8 Alignment of the World Bank Policies and PNG Regulations

The WB ESS and PNG environmental regulations are generally aligned in principle and objective:

- Both require environmental assessment before project design and implementation (which also includes an assessment of social impacts).
- Both require public disclosure of ESIA reports and stakeholder consultation during project preparation.
- While WB ESS1 stipulates different scales of ESIA for different category of projects, the *Environment Act 2000* requires an ESIA for Level 2 and Level 3 projects to be scoped as applicable.
- The *Environment Act 2000* recognizes other sectorial laws while WBG ESF has safeguards for specific thematic areas.
- The WB requires that stakeholder consultation be undertaken during planning, implementation, and operation phases of the Project which aligns with the *Environment Act 2000* requirements
- Statutory annual environmental audits are required by the *Environmental Act 2000*.
- It is a mandatory requirement under the Environment (Prescribed Activities) Regulation 2002 and Statutory Instrument No.27 of 2002 Environment (Permits) Regulation 2002 for all Level 2B Activities to be preceded by an ESIA. Thus, an environmental assessment is fully mainstreamed in all development processes consistent with World Bank policies.
- There are no regulations in PNG specifying criteria for emissions to air. Therefore, GIIP will be applied to the project with respect to emissions to air (e.g., EHS Guidelines for Health Care Facilities).
- There are no regulations in PNG specifying criteria for discharge of effluent to a drainage channel or absorption pit – the PNG water quality regulations apply to a mixing zone boundary (e.g., where effluent is discharged into a water body). Therefore, GIIP will be applied to the project with respect to discharge of effluent (e.g., EHS Guidelines for Health Care Facilities.)

3.0 PROJECT DESCRIPTION

This chapter provides a description of the proposed Project including location, design, construction activities and operational activities.

3.1 Subproject Locations

The Project proposes to install an incinerator at each of the Provincial Hospitals described in Table 2 and shown on Figure 1. The Angau Memorial Provincial Hospital in Lae is proposed to receive two incinerators due to the volume of waste produced at this hospital. Most of the hospitals are located within the administrative capital of the Provincial Government. The Nonga Provincial Hospital is in Rabaul, a short distance from the East New Britain provincial capital of Kokopo. The recently created Jiwaka Province, where the Kudjip Provincial Hospital is located, is yet to formally decide on a provincial capital.

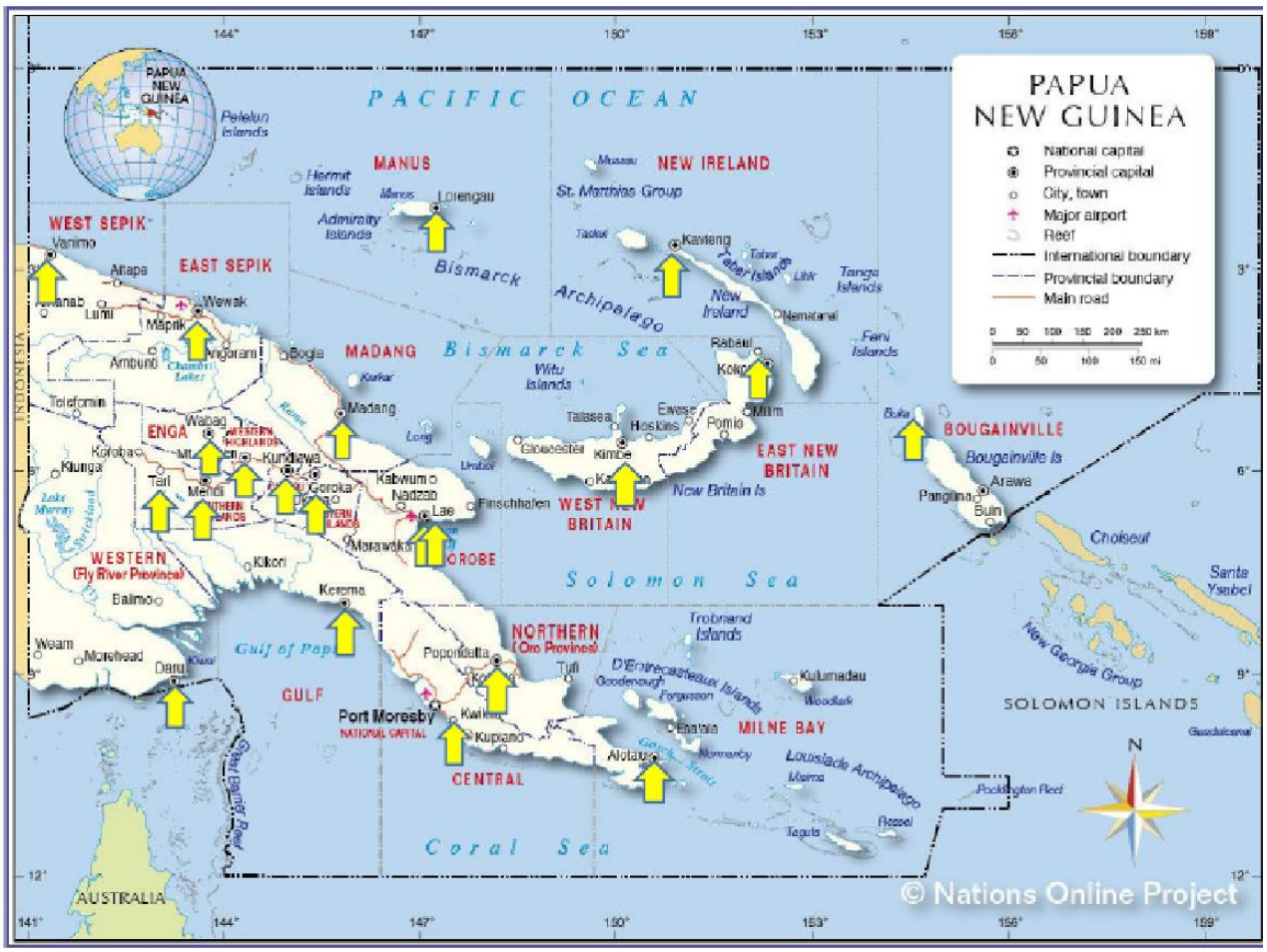
Most of the proposed incinerators will be situated within the hospital premises at the locations where the current incinerators are located. Incinerators for the Alotau Provincial Hospital and Kerema Provincial Hospital are proposed to be away from the current waste management areas but still within areas controlled by the PHAs. Relocating the waste management areas away from land currently controlled by the PHAs would require long term planning by the PHAs, the Provincial Government and the Town Authorities; and this is beyond the scope (and timeframe) of this Project. The current sites are also preferred as they mitigate issues around security of the equipment, distance and transportation risks associated with transporting infectious waste and have connections for water and electricity.

Table 2: Project locations

Hospital	Province	Level of Hospital*
1. Popondetta Provincial Hospital	Oro (Northern)	5
2. Kavieng Provincial Hospital	New Ireland	5
3. Alotau Provincial Hospital	Milne Bay	5
4. Modilon Provincial Hospital (Madang)	Madang	5
5. Mt Hagen Provincial Hospital	Western Highlands	6
6. Kudjip Provincial Hospital	Jiwaka	4
7. Daru Provincial Hospital	Western	5
8. Mendi Provincial Hospital	Southern Highlands	5
9. Wabag Provincial Hospital	Enga	5
10. Tari Provincial Hospital	Hela	4
11. Angau Memorial Provincial Hospital (Lae)	Morobe	6
12. Kimbe Provincial Hospital	West New Britain	5
13. Nonga Provincial Hospital (Rabaul)	East New Britain	5

14. Kerema Provincial Hospital	Gulf	5
15. Kwikila Provincial Hospital	Central	3
16. Kundiawa Provincial Hospital	Simbu	5
17. Goroka Provincial Hospital	Eastern Highlands	5
18. Lorengau Provincial Hospital	Manus	4
19. Vanimo Provincial Hospital	Sandaun	4
20. Boram Provincial Hospital (Wewak)	East Sepik	5
21. Buka Provincial Hospital	Autonomous Region of Bougainville	5

*The level of hospital denotes the level of services delivered, with 1 being least (i.e., aid post) and 7 being the most (i.e., national referral hospital).



Source: Nations Online Project

Figure 1: Map of PNG showing Project locations

3.2 Project Design

3.2.1 Proposed Standard Health Care Waste Management Facility

The incinerators will be part of the healthcare waste management facilities (HCWMF) at each hospital. The infrastructure at the HCWMF will typically include:

- Fencing – to prevent access by unauthorized personal and animals such as dogs
- Drainage system – to capture stormwater
- Incinerator – for the incineration of waste
- Fuel tank on hardstand – for storage of fuel to run the incinerator
- Grease trap
- Slurry (wastewater) treatment and disposal system – to treat and dispose of the wastewater from scrubber
- Shredder machine – to shred waste
- Shredder pit – to dispose of shredded waste
- Sharps pit - to dispose of sharps waste
- Concrete-lined ash pit - to dispose of ash from the incinerator
- Placenta pit – to dispose of placentas
- Undercover area – for receiving, sorting and storing waste

The HCWMFs housing the new incinerators will need upgrading to accommodate the new incinerators and to provide a more functional facility. The NDoH Health Facility Branch (HFB) Team prepared an example concept layout for the HCWMFs and this is shown in Figure 2. The detailed designs specific to each site are provided in Annex 1 to Annex 21 and show the HCWMF dimensions, where they will be sited and that there is the spacing available for the HCWMF.

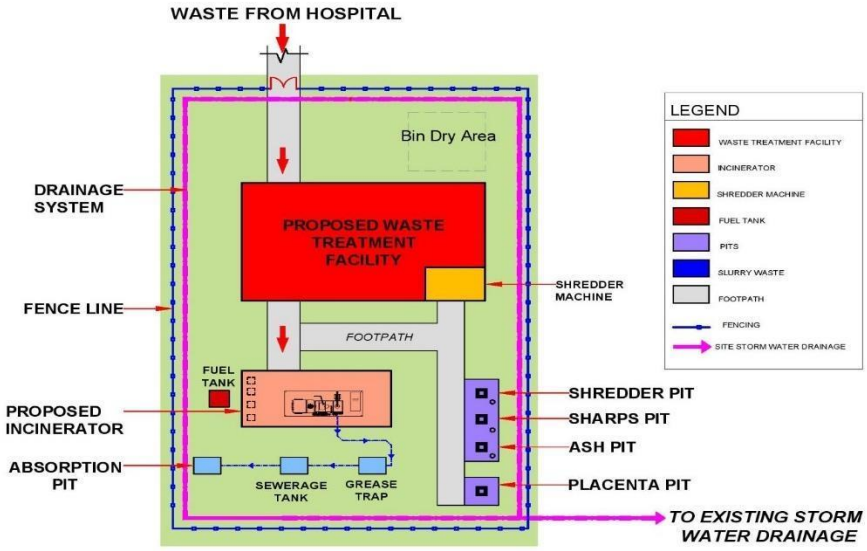


Figure 2: Example concept layout of a healthcare waste management facility

Key considerations in the design of the HCWMF include:

- Minimize adverse impacts to the surrounding environment and community.
- Infection prevention and control and as such, careful attention will be made to include consistent water supply to support hand hygiene, sanitation and bin cleaning and storage space for waste bins and bags before incineration.
- Proper processing of health care waste after segregation, storage, collection, transportation from the points of generation.
- Considerations for Occupational Health and Safety (OHS) of operators taken into the waste facility design to ensure there is enough ventilation and space for moving while working.
- Electrical, plumbing, drainage and fire safety measures, including fire detection and alarm; means of egress; fire control and suppression; smoke control (in alignment with IFC's Good Practice Note on Life and Fire Safety: hospitals[9])
- Community health, safety, and biophysical impacts on the environment, thus design includes concrete-lined pits for incinerator slurry and ash waste, placentas and shredder waste.
- Ambient air quality, thus gas scrubbing systems and extended chimney stack are essential design elements of the incinerator.

The design of the HCWMF also followed advice provided by WHO and the CDC on COVID-19 Management and infection control, including:

- WHO technical brief water, sanitation, hygiene and waste management for COVID-19;
- WHO guidance on infection prevention and control at health care facilities (with a focus on settings with limited resources);
- CDC guidelines for environmental infection control in healthcare facilities.
- Hand washing facilities should be provided at the entrances to health care facilities in line with Recommendations to Member States to Improve Hygiene Practices

3.2.2 Incinerator Shed

An incinerator shed will house each incinerator unit. The incinerator shed will be installed on a cleared and leveled site. It will consist of prefabricated material for the shed wall and roof, and a concrete base. The selection of shed material will also be considerate of environmental conditions and risks of corrosion especially for coastal regions in PNG. The main structures of the Incinerator Shed are provided in Table 3. Detailed plans (e.g., Architectural Drawings, Geotechnical and Structural Designs, Mechanical Drawings, Civil Drawings [Drainage] and Electrical Drawings) were prepared for each site by Minconsult.

Table 3: Main Structures of the Incinerator Shed

No.	Structure	Purpose
1	Base	For the incinerator and shed to sit on to minimize the risk of movement
2	Walls	To prevent the Incinerator from being tampered with from unauthorized people and also to protect it from weather conditions
3	Roof	To protect incinerator from weather conditions
4	Chimney Stack brace	The chimney stack is fitted with a dispersion cap and is a part of the incinerator. The height of the chimney will be 10 m and will therefore be supported with chimney braces

[9] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_gpn_lfs-hospitals

5	Internal Storage Space	Extra space within the shed will be required for storage of not only wastes but operating equipment

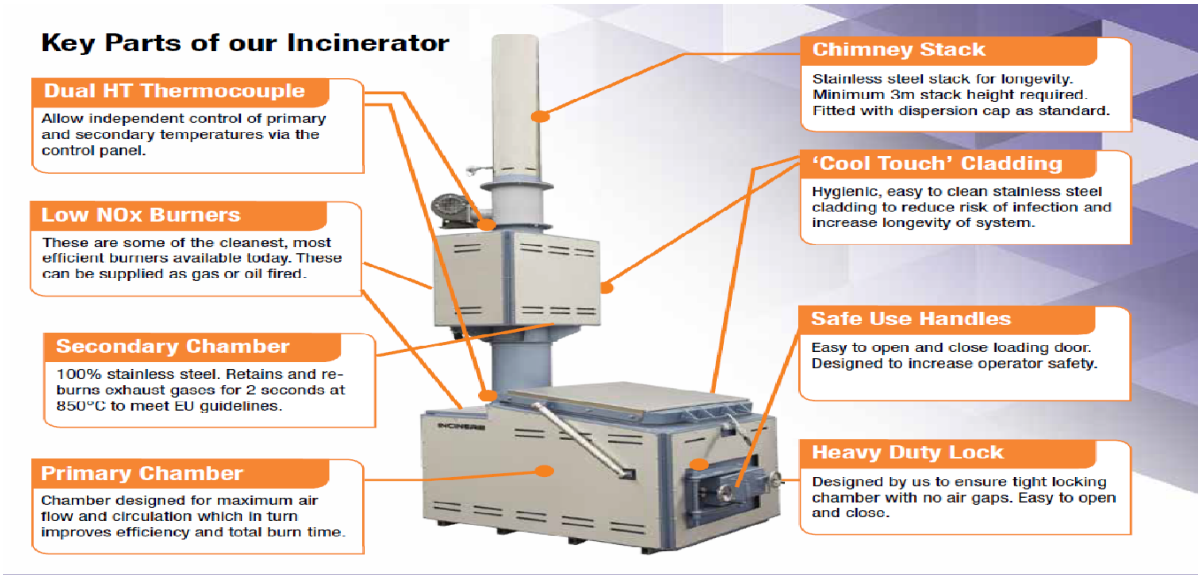
Additional structures for utilities such as water, power and drainage will also be constructed as (and if) required at each site. The existing utilities at each site were assessed by the Assessment Team during the site visits and considered in the design. Details for each site are provided in Annex 1 to Annex 21.

The incinerators use fuel (diesel) for their operation and therefore a fuel storage area is also considered as part of the incinerator shed design. The fuel tanks are 650L and located above ground on a hard stand area that drains to an oily-water separator.

3.2.3 Incinerator Unit and Scrubbing System

The incinerator unit was chosen following a due diligence assessment to ensure the type of incinerator selected was fit-for-purpose and met PNG standards. The WB and CEPA also reviewed and provided input on incinerator specifications during the project preparation in 2020 .

The incinerators selected for the Project are the iNCINER8 Model 18-M70 Incinerator. These are a modern waste disposal unit, designed to thermally treat medical waste in a clean and environmentally efficient manner. The prescribed incinerator units are designed with a temperature-based logic control system to provide optimum control of its operating conditions. The primary chamber is top loading to allow for easy loading and effective spreading of waste. To ensure effective destruction of the combustion products, the units are equipped with a high-capacity thermal oxidizing secondary chamber with an after burner to allow for re-burn of emissions. The operational temperature is 850^{o}C in the secondary chamber. The incinerators functions at a maximum 50 kg per hour burn rate. A diagram of the 18-M70 Model incinerator and description of its parts is provided as Figure 3 and technical specification provided in Table 4.



Source: iNCINER8 accessible at https://www.inciner8.com/

Figure 3: 18-M70 Model Incinerator and Description of its Parts

Table 4: Technical Specifications of the i8-M70 Incinerator Model

Combustion Chamber Volume (m3)	0.75m^3	**Shipping Weight**	2,450kg
Metal Thickness	3mm	**Dimensions (l,w,h)**	1.61m x 1.19m x 4.68m
Burn Rate	Up to 50kg per hour	**Door Size (m)**	0.99m x 0.91m
Operation Temperature	>850°C (in secondary chamber)	**Fuel Consumption**	10-15 litres per hour
Gas Retention	2 seconds	**Fuel Type**	Light Oil, Diesel, Kerosene, Gas, LPG
Average Ash Residue (%)	3%	**Max Sound Output**	65dB
Thermostatic Device	Yes (x2)	**Max Electricity Consumption**	0.115kW

Note: Actual burn rates and emissions will depend on a number of factors including waste type, volume of waste, moisture content, fuel used and local environmental conditions.

Source: iNCINER8

Use of the incinerator will result in emissions to air. Results of measured emissions (i.e., from the stack) compared to EU standards were provided by the incinerator vendor and are provided in Table 5. PNG does not have air emissions standards; however, the Draft Guidelines for Health-Care Waste Management in PNG[10] refers to EU standards as an example for application to small medical waste incinerators. The WBG EHS Guidelines for Health Care Facilities[11] also provide emissions targets for small incinerators and these have been provided in the table. Most of the parameters provided in these guidelines differ slightly from the monitoring data provided by the vendor so direct comparison cannot be undertaken for most parameters. According to iNCER8, these figures are guidelines only and actual emissions depend on several factors including waste type, volume of waste, moisture content, fuel used and local environmental conditions. To further reduce the emissions from the incinerators, the Project is installing scrubbing systems. Therefore, the emissions data provided in Table 5 is highly conservative and the actual emissions will be lower with the scrubbing system in place. Routine monitoring of emissions will be required during operations to check that the incinerator and scrubber are operating as expected (and this is described in Section 8.6.2).

Table 5: Average emissions (on basic incinerator with secondary chamber without scrubbing system)

Parameter	**Measured***	**European Union Standard****			**EHS Guidelines for Health Care Facilities*****
Averaging time	**1/2 hour**	**Daily**	**Hourly**	**4 hours**	**Not specified**
Unit	**mg/m^3**	**mg/m^3**	**mg/m^3**	**mg/m^3**	**mg/m^3**
Total Dust	12	5	10	NS	-
Total Particulate Matter	NS	NS	NS	NS	10
Total organic carbon	5	5	10	NS	10
Chlorine compounds	NS	5	10	NS	NS
Hydrogen chlorine	NS	NS	NS	NS	10
Fluorine compounds	NS	1	2	NS	NS
Hydrogen fluoride	NS	NS	NS	NS	1

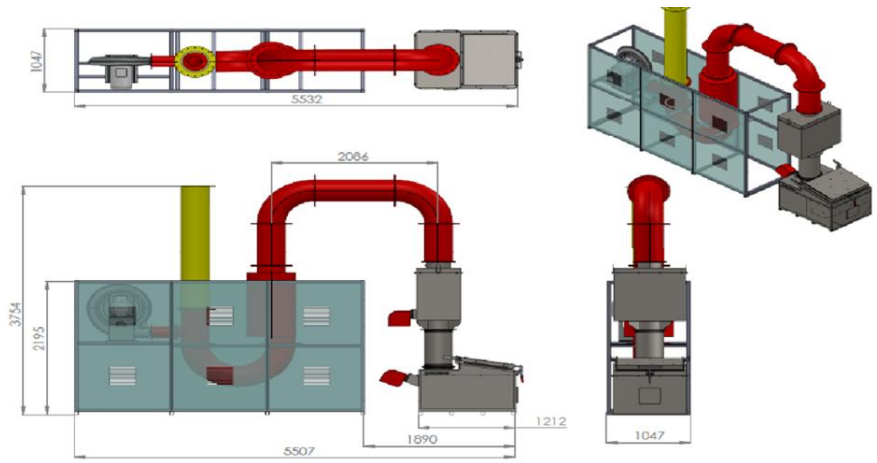
[10] https://www.sprep.org/att/irc/ecopies/countries/papua_new_guinea/34.pdf

[11] https://www.ifc.org/wps/wcm/connect/960ef524-1fa5-4696-8db3-82c60edf5367/Final%2B-%2BHealth%2BCare%2BFacilities.pdf?MOD=AJPERES&CVID=nPtgRx5&id=1323161961169

Sulphur dioxide	2.4	25	50	NS	50
Nitrogen dioxide	60	100	200	NS	-
NOx	NS	NS	NS	NS	400
Carbon monoxide	78.3	50	100	NS	50
Mercury	NS	NS	NS	0.05	0.05
Cadmium and thallium	NS	NS	NS	0.05	0.05
Lead, chromium, copper, and Manganese	NS	NS	NS	0.5	0.5 (excluding tin)
Nickel and arsenic	NS	NS	NS	0.5	
Antimony, cobalt, vanadium and tin	NS	NS	NS	0.5	
Dioxins and furans	NS	NS	NS	0.1 ng/Nm^{3}TEQ	0.1 ng/Nm^{3}TEQ
Oxygen content	NS	At least 6%			At least 7%

** Source: iNCER8; ** Source: Draft Guidelines for Health-Care Waste Management in PNG; ***Source: WBG EHS Guidelines for Health Care Facilities; NS = Not Specified*

The scrubbing system proposed is the Venturi Gas Scrubbing (VGS) System. It will be fitted on to all incinerators to control air pollutants. A VGS System is shown Figure 4 and the technical specifications for the model that will be used on the Project provided in Table 6. The VGS system works by filtering the flue gases exiting from the secondary chamber of the incinerator by using pressurized liquid to clean the flue gases, as the gases enter the venturi chamber, they converge with a high-pressure misting device which disperses the liquid subsequently cooling the flue gases and neutralizing acid gases such as hydrogen chloride and sulfur dioxide. The VGS acts as a wet scrubber combined with a high-powered fan to ensure continuous flow through the Venturi chamber and exiting the flue gas to the atmosphere. This process is shown on Figure 5



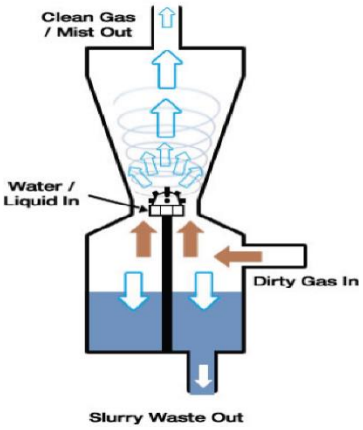
Source: iNCINER8
Figure 4: Venturi Gas Scrubbing System

Table 6: Technical Specifications for the Venturi Gas Scrubber (i8-VGS - SML)

Housing	3620mm x 1045mm x 2050mm	**Liquid Type**
Venturi Chamber	Height: 1480mm Dia:610mm	Continuous water supply with the option with alkaline carbon or lime dosing depending on the waste type.
Chamber Material	Stainless Steel	
ID Fan Power Rating	7.5 Kw	
Voltage/Power Consumption	3-phase 400V*50/60Hz	
Water Inlet	1”BSP	

Water Discharge	3" outlet (heavy duty ball valve)	
Misting Pump	4.3 litres per minute@70PSI	
Misting Ball	Stainless Steel – 15 micro nozzles	
Liquid Lead Requirements	Water Mains Connection	

Source: iNCER8 i8-VGS-SML Venturi Gas Scrubber Brochure



Source: iNCER8 i8-VGS-SML Venturi Gas Scrubber Brochure

Figure 5: Illustration of how the VGS works

The scrubbing system produces wastewater as part of its operation. The volume of wastewater produced will be approximately 50 L per hour operation, plus an additional 50 L per day for washdown. It will be acidic and contain some fine solid matter (ash) and other contaminants that have been removed from the flue gases. As such, the wastewater is considered hazardous and will be treated to neutralize the pH and remove the solids. This involves passing the water through a neutralizing tank ('Neuratank') containing neutralizing media (such as limestone) and allowing solids to settle. The neutralization of the wastewater causes the dissolved contaminants to precipitate and settle with the other solids. Solids and spent neutralizing media will be regularly cleaned out of the Neuratank and disposed of with the ash from the incinerator. The treated wastewater will be disposed of via absorption pits or to existing drainage systems.

This process is consistent with the 'Draft PNG National Health Care Waste Management Guidelines' and 'WGB EHS Guidelines for Healthcare Facilities' which both recommend treating scrubber wastewater through neutralization and removal of solids. Routine monitoring of treated wastewater will be required during operations to check that it meets the effluent guidelines in the 'WBG EHS Guidelines for Healthcare Facilities' (and this is described in Section 8.6.2). PNG does not have effluent quality criteria.

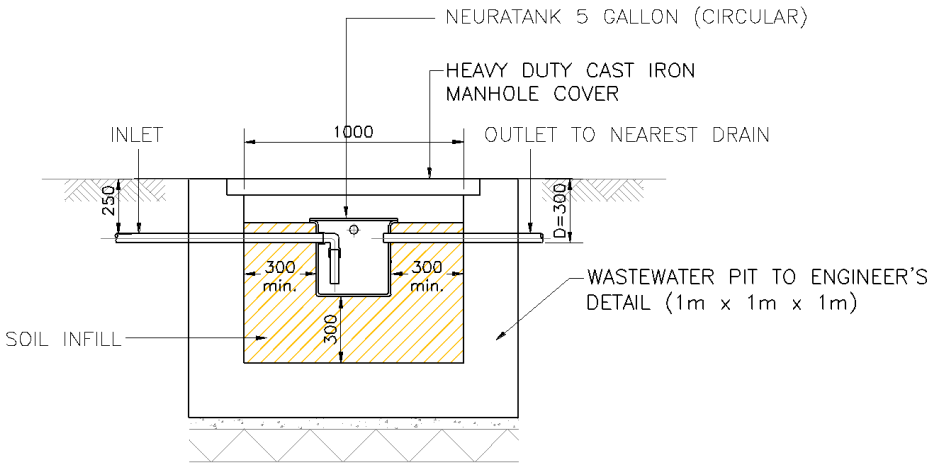


Figure 6: Proposed scrubber wastewater (slurry) treatment system

3.3 Construction Activities

Construction activities include minor civil works, installation works and capacity building training on operational requirements of the incinerators. Project activity monitoring also forms part of the activities.

3.3.1 Minor Civil Works

The minor civil works include dismantling of old incinerators and incinerator sheds (at Popondetta, Angau, Modilon and Kundiawa hospitals only), site excavation, construction of base incinerator slabs, construction of waste disposal systems for both solid and liquid waste and connections to service facilities for electricity, water supply and sewer lines.

3.3.2 Installation Work

Installation work will include mounting of incinerators on the concrete slabs, installation of control panels, and installation of gas scrubbers including fire and safety equipment and signage.

3.3.3 Capacity Building Training

Capacity building training on the operational requirements of the incinerators will be provided to incinerator operators and key officials in the hospital's health care waste management chain. The operational requirements are based on manufacturer instructions. Other topics that should be covered in the training would include instructions on how to use the air emissions monitoring equipment, basic infection control in medical waste management and environmental impacts from inappropriate operation and management of incineration residues.

3.3.4 Construction Material Sources and Management

The Contractors who will be constructing the incinerator facilities will ensure careful due diligence on materials such as sand, stones, cement, quarry chips etc., are purchased locally (where practicable) from licensed/permitted facilities only and stored on site. Construction materials cannot be sourced from the seabed or riverbed. To avoid material accumulation with potential for impeding site activities, inducing safety hazards and creating a nuisance in the neighborhood, the main contractor may consider having materials delivered to the site in small quantities. Use of ready-made pre-fabricated materials is considered. Selection of the pre-fabricated material for the incinerator shed will include due diligence in ensuring that non-corrosive material is procured for incinerators located in coastal areas.

Since the project sites will already be within hospital grounds, water needed for construction and operation of the incinerators will be sourced from existing water sources. Should water supply within the hospital is not sufficient for construction works, alternative water supply arrangements will be made by the contractors.

3.3.5 Labour for Construction

UNOPS has been contracted by NDoH to construct the new incinerators. UNOPS will be engaging and supervising sub-contractors to carry out all construction works.

The level of site development work will vary from site to site. Considering the small size of the new incinerators, prefabricate material will be used for the shed and as such a small team will be engaged in each site for the construction activities. It is expected that the small team of semi-skilled workers will be sourced from the local communities by the sub-contractors.

3.4 Operation of the Incinerators

The incinerators will be operated by dedicated and trained staff at the Provincial Hospitals and fall under the overall management of the PHAs. Operational activities will include:

- Weighing and sorting waste
- Loading the incinerator
- Operating the incinerator, which will result in emissions to air
- Removing and disposing of bottom ash generated from the incineration process
- Maintenance of the incinerator
- Treatment of wastewater from the scrubber and disposal of solids removed during treatment process
- Refuelling the fuel tank
- Environmental monitoring (stack emissions and wastewater quality)

The operational activities will be documented in an Incinerator Operations Manual that will be prepared by UNOPS prior to commissioning.

3.5 Kudjip Provincial Hospital Update

The hospital management at the Kudjip Provincial Hospital arranged for installation and commissioning of the Project incinerator ahead of finalisation of the ESIA without the knowledge of the PHA or NDOH. The installation and commissioning were undertaken by a team of local contractors. Once UNOPS commence construction of the incinerators at other sites, the UNOPS team will check the installation of the incinerator at Kudjip Provincial Hospital to ensure it is installed and commissioned correctly in line with the requirements of the ESMP, and provide guidance and training to the incinerator operators as required. Further details are provided in the Kudjip ESMP.

4.0 ENVIRONMENTAL AND SOCIAL SETTING

This chapter provides an overview of the environmental and social setting of the Project. More detailed subproject-specific baseline information is provided in Annex 1 to Annex 21.

Information in this chapter was sourced from literature reviews, Google Earth imagery and from site visits undertaken in 2021 and 2023 (Table 7). Most of the site visits were conducted by NDoH Project Coordination Unit (PCU) Safeguards Officer, CEPA Environmental Officers and the Health Facility Technical Team and facilitated by the PHAs. Engagements and discussions on the proposed Project were also held with the respective PHAs and their stakeholders including representatives of the nearby communities. For Buka Provincial Hospital, the visit was done in March 2023 by a team member of the Health Facility Technical Team as well as the Environment Specialist assisting NDOH.

Table 7: Site visit dates

Site (Provincial Hospital)	Site Visit Dates	Site (Provincial Hospital)	Site Visit Dates
Popondetta Provincial Hospital	11 to 13 February 2021	Angau Memorial Provincial Hospital	5 to 7 May 2021
Kavieng Provincial Hospital	3 to 5 March 2021	Kimbe Provincial Hospital	10 to 13 May 2021
Alotau Provincial Hospital	15 to 16 March 2021 & 6 to 8 February 2023	Nonga Provincial Hospital	13 to 14 May 2021
Modilon Provincial Hospital	6 to 8 April 2021	Kerema Provincial Hospital	18 to 20 May 2021
Mt Hagen Provincial Hospital	12 to 14 April 2021	Kwikila Provincial Hospital	24 May 2021
Kunjip Provincial Hospital	14 to 15 April 2021	Kundiawa Provincial Hospital	31 May to 2 June 2021
Daru Provincial Hospital	19 to 21 April 2021	Goroka Provincial Hospital	2 to 4 June 2021
Mendi Provincial Hospital	25 to 27 April 2021	Lorengau Provincial Hospital	24 to 26 June 2021
Wabag Provincial Hospital	28 to 30 April 2021	Vanimo Provincial Hospital	29 June to 2 July 2021
Tari Provincial Hospital	2 to 4 May 2021	Boram Provincial Hospital	5 to 7 July 2021
Buka Provincial Hospital	1 to 2 March 2023		

4.1 Project Locations, Site Selection and Accessibility

The subproject sites are located at the Provincial Hospitals within (or near) towns which are the main government administrative and commercial centres for each of the provinces. The Provincial Hospitals are accessible by road links within the main provincial towns.

The Provincial Hospitals in the highlands area (i.e., Tari, Mendi, Wabag, Kundiawa, Kudjip, Mt Hagen and Goroka) are accessible by road from the main Highlands Highway (also known as the Okuk Highway) that links the highlands provinces with Lae and Madang, which are located on the north-east coast of PNG. The highlands provinces are accessed also by airports located in each of the towns. The Provincial Hospitals in coastal areas (i.e., Popondetta, Alotau, Kerema, Lae, Madang, Wewak, Vanimo, Daru, Lorengau, Kavieng, Nonga, Kimbe and Buka) are accessible by sea routes. The coastal provinces are accessed also by airports located in each of the towns. Kwikila Provincial Hospital is a short drive from Port Moresby.

The specific sites for the incinerators were selected by the Health Branch of the NDoH. The following are the reasons for selecting sites:

- Almost all the sites are within the Provincial Hospital grounds, are fenced and isolated from traffic and the public. The Boram Provincial Hospital incinerator site is adjacent to a track used by nearby residents. The new incinerator site will be fenced off and safety of track maintained for its users.

- Access to the site by the heath care waste handlers or hygiene staff is made easier where the sites are near or within hospital grounds, and the infectious waste can be moved with ease in short distance.

Ideally the incinerators would be located away from sensitive receptors such as recreation facilities, wards or residential areas, however, most of the hospitals are located in built-up areas. As discussed in Section 3.1, relocating the waste management areas away from land currently controlled by the PHAs would require long term planning by the PHAs, the Provincial Government and the Town Authorities; and this was beyond the scope (and timeframe) of this Project.

Subproject locations and surrounding areas are shown on following aerial images (Figure 7 to Figure 27).

Figure 7: Popondetta Provincial Hospital Incinerator Site

Figure 8: Kavieng Provincial Hospital Incinerator Site

Figure 9: Alotau Provincial Hospital Incinerator Site (at the Gurney Health Centre)

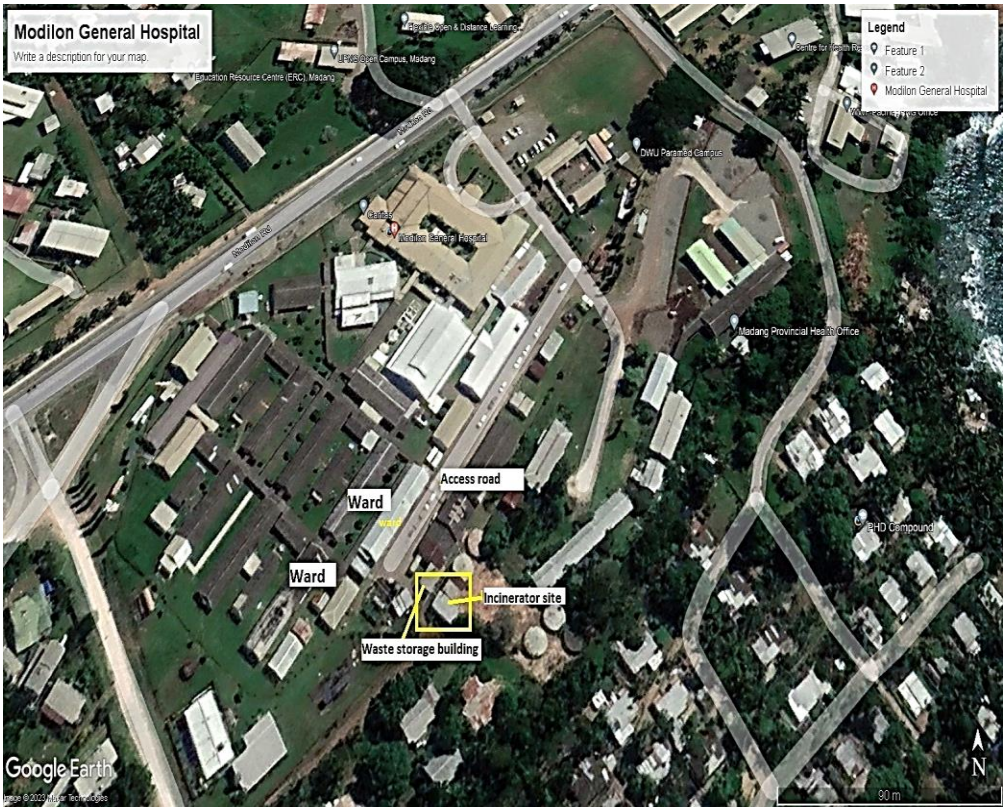


Figure 10: Modilon Provincial Hospital Incinerator Site

Figure 11: Mt Hagen Provincial Hospital Incinerator Site

Figure 12: Kudjip Provincial Hospital Incinerator Site

Figure 13: Daru Provincial Hospital Incinerator Site

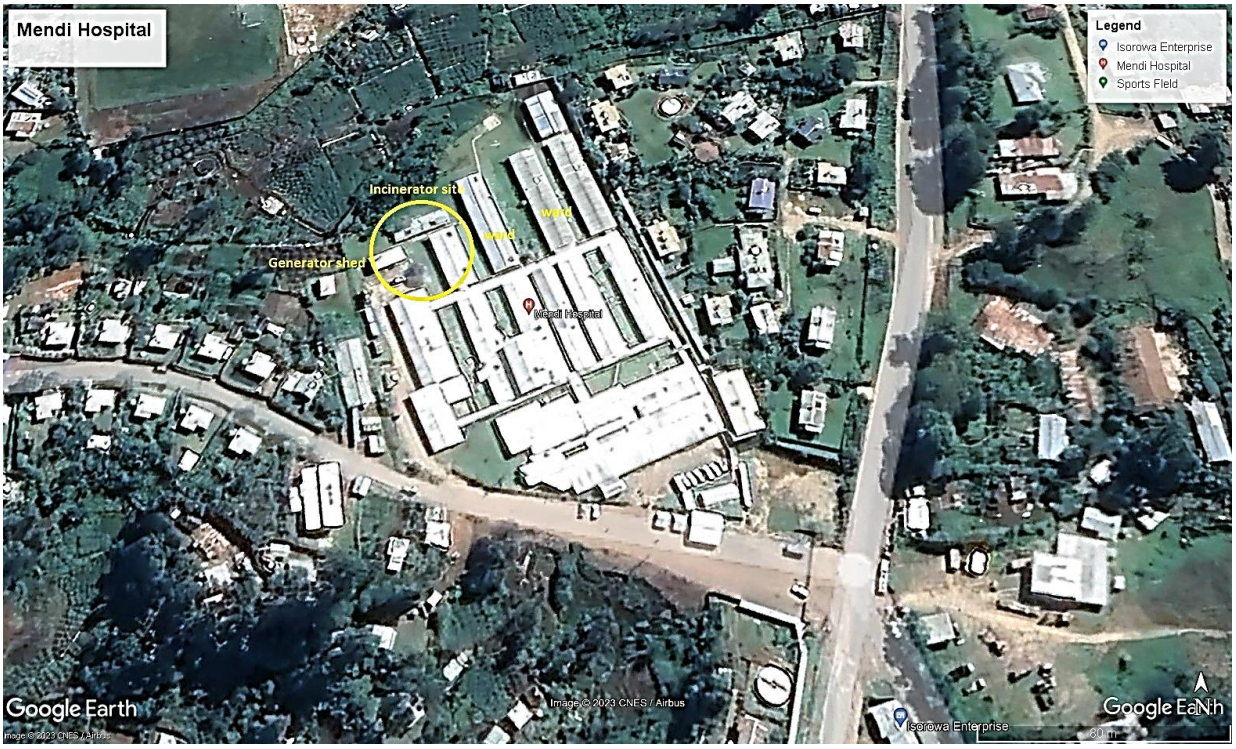


Figure 14: Mendi Provincial Hospital Incinerator Site

Figure 15: Wabag Provincial Hospital Incinerator Site

Figure 16: Tari Provincial Hospital Incinerator Site

Figure 17: Angau Memorial Provincial Hospital Incinerator Site

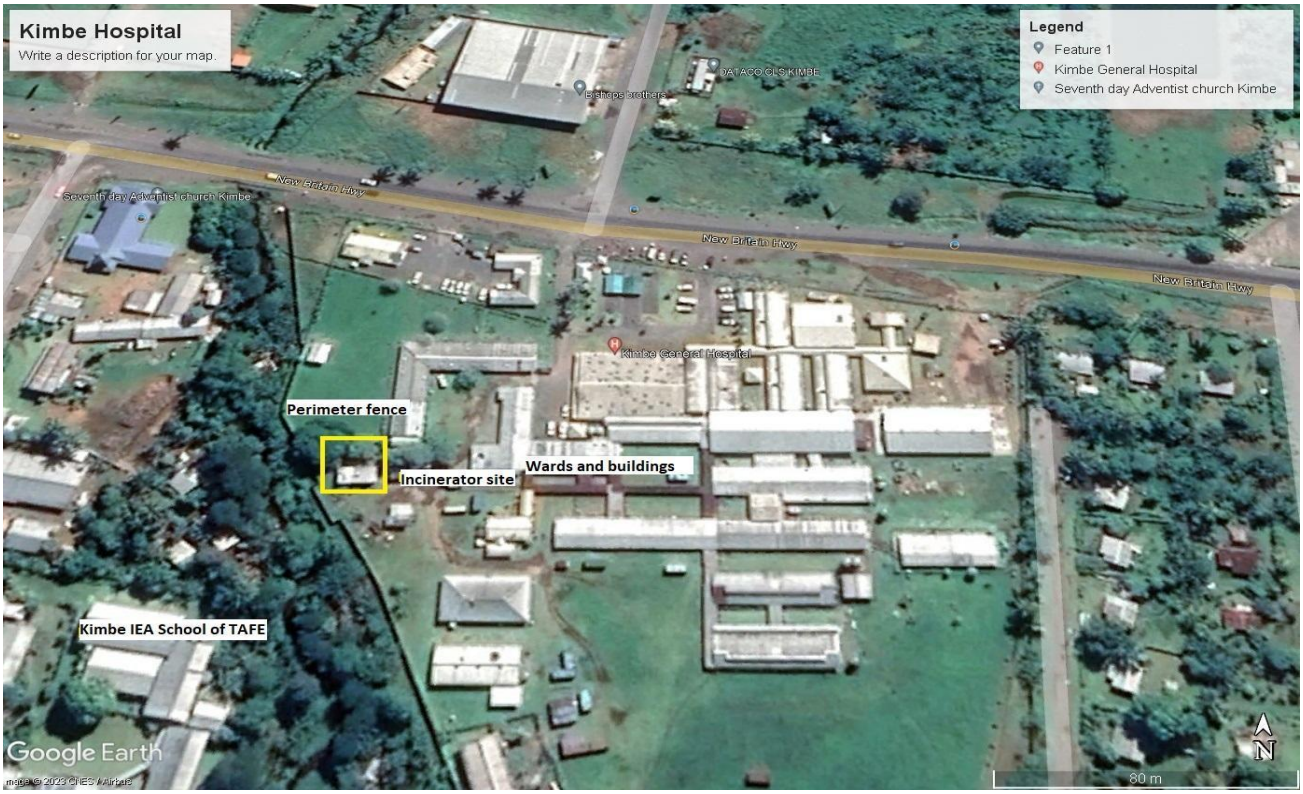


Figure 18: Kimbe Provincial Hospital Incinerator Site

Figure 19: Nonga Provincial Hospital Incinerator Site

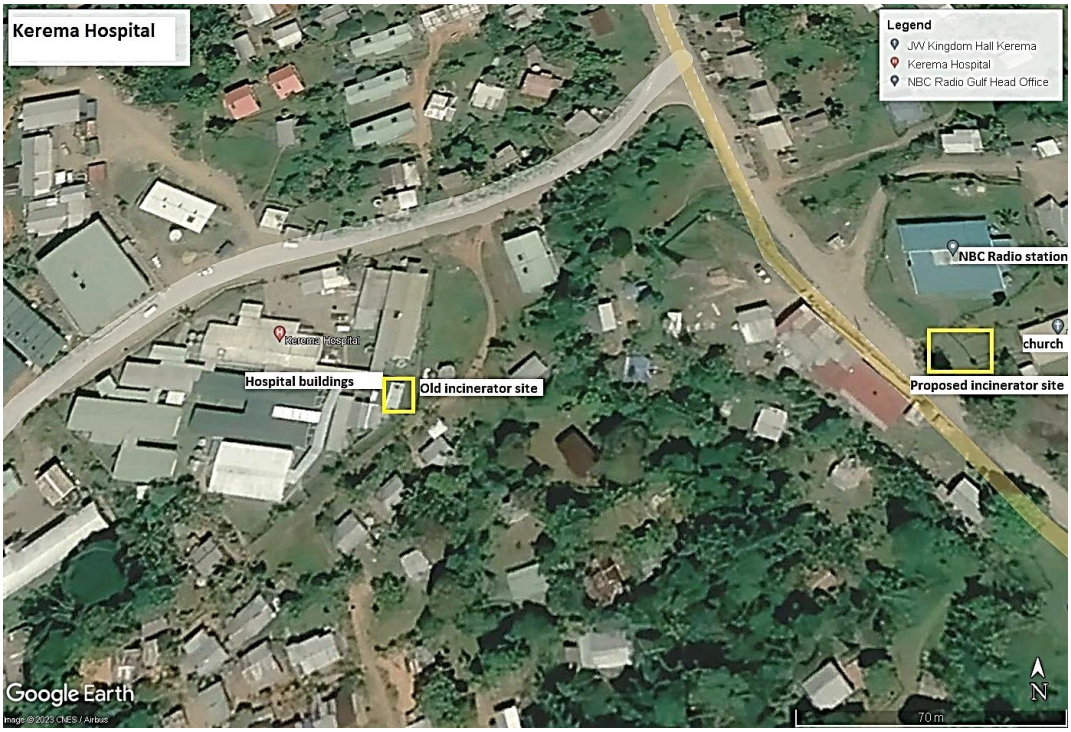


Figure 20: Kerema Provincial Hospital Incinerator Site

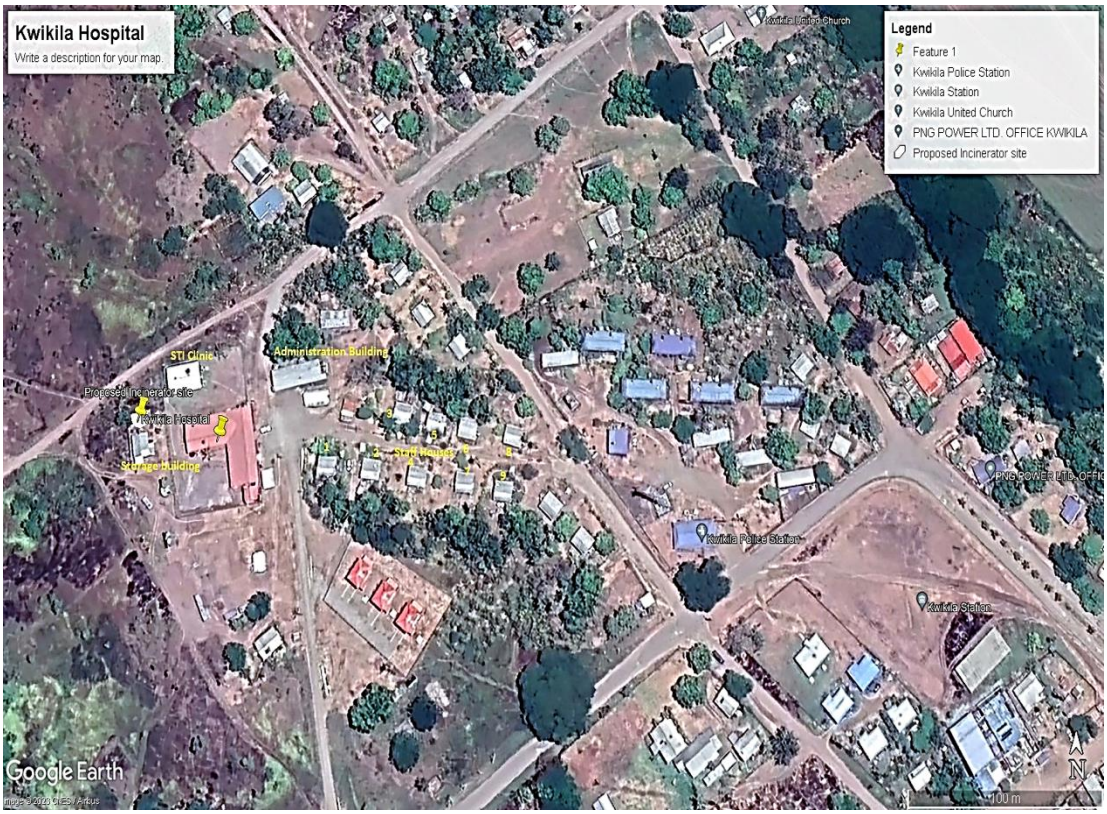


Figure 21: Kwikila Provincial Hospital Incinerator Site

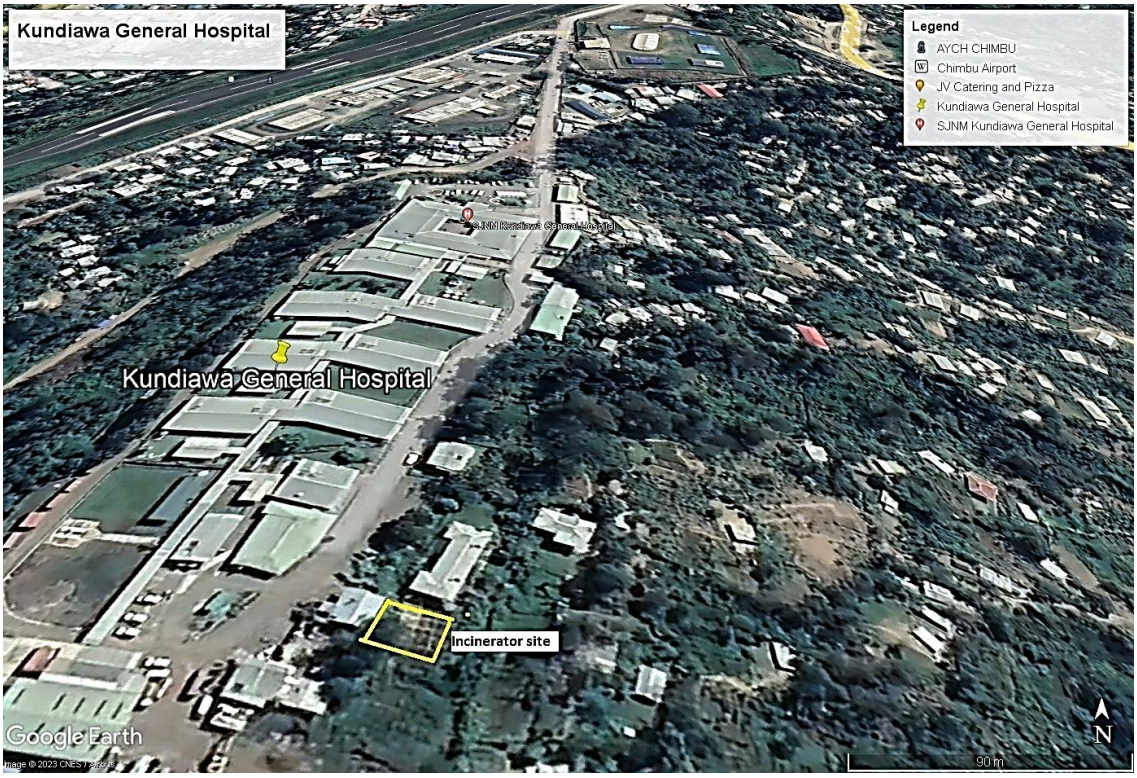


Figure 22: Kundiawa Provincial Hospital Incinerator Site

Figure 23: Goroka Provincial Hospital Incinerator Site

Figure 24: Lorengau Provincial Hospital Incinerator Site

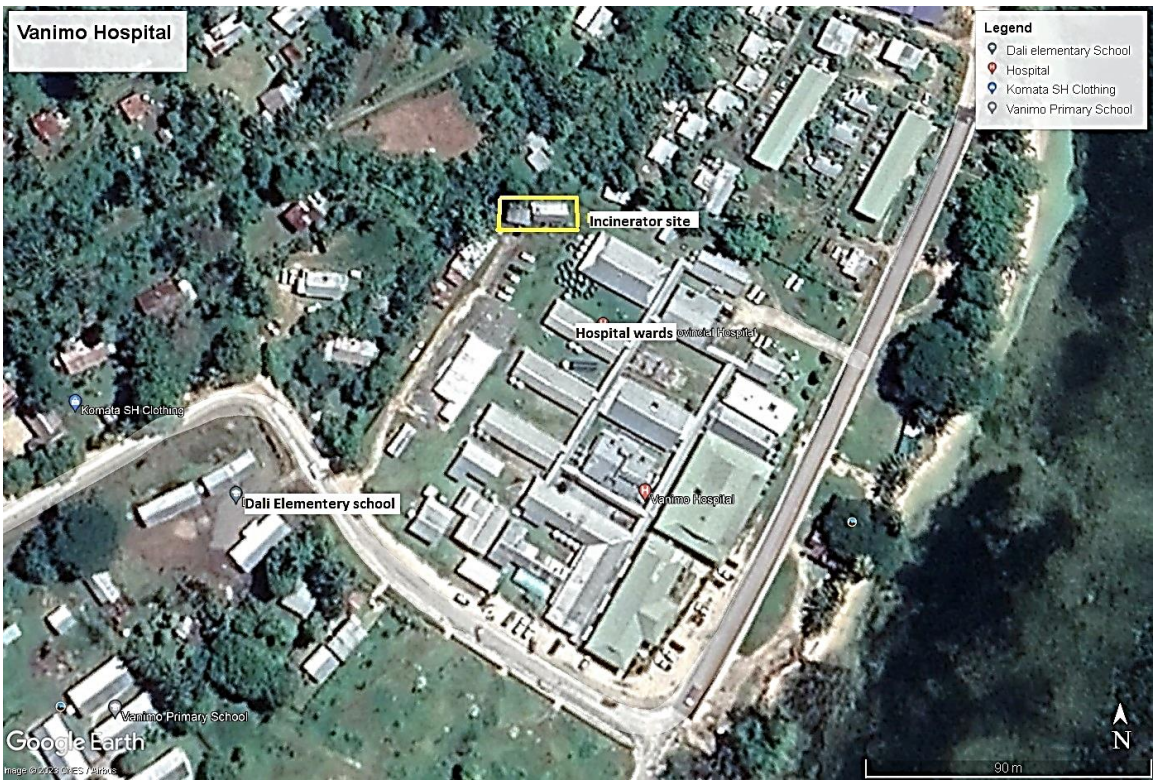


Figure 25: Vanimo Provincial Hospital Incinerator Site

Figure 26: Boram Provincial Hospital Incinerator Site

Figure 27: Buka Provincial Hospital Incinerator Site

4.2 Climate

The climate of PNG is tropical and characterized by[12]:

- High rainfall, particularly during the monsoon season (December to March). The average monthly rainfall ranges between 250 and 350 mm.
- High humidity of around 70% to 90%.
- Fairly consistent temperatures throughout the year, with the average temperature being between 26 and 28°C. Lowlands areas are hotter than the highland areas.

Wind characteristics will vary between the subproject locations. Wind roses for the incinerator locations are not available, although wind direction is an important factor to consider with the operation of the incinerators (to minimize dispersal of air emissions from the incinerators onto populated areas). Local knowledge of wind direction will be used to determine appropriate operational times, where feasible (e.g., due to security issues some incinerator may only be able to operate during the day; due to high volumes of waste some incinerators may need to operate almost continuously).

4.3 Flora and Fauna

All incinerator sites are within hospital grounds and have been previously disturbed and therefore do not contain significant populations of rare or endangered flora or fauna species. There are no wetlands or primary forests located at or adjacent to the sites.

There are no substantially vegetated areas at the sites. Most sites are predominately clear of vegetation and contain some grasses, various shrubs, palms and banana plants (Figure 28).

Domestic dogs are found at some sites, attracted to the waste.

Popondetta

Kerema

Figure 28: Example subproject sites showing typical vegetation

4.4 Air Quality

The existing air quality at the subproject locations varies, however, at most sites the air quality is poor due to smoke and odor from the burning of hospital waste in open pits and use of poorly maintained single-burner incinerators without gas scrubbing systems. This smoke and odor are the subject of community grievances at some locations (see Chapter 5). Information collected during the site visits

[12] https://climateknowledgeportal.worldbank.org/country/papua-new-guinea/climate-data-historical

indicated that air quality monitoring was not being undertaken. Air quality in populated areas in PNG is often also affected by residents burning wood in open fires for cooking and heat.

4.5 Land Use and Ownership

The subproject sites are all located on State Alienated Land by way of Certificates of Occupancy from the Department of Lands and Physical Planning, and under control of the PHAs.

The land use surrounding the hospitals vary between sites. The hospitals are mainly in built-up areas and near residential areas, schools and churches (see Figure 7 to Figure 27)

4.6 Population

The overall total population of PNG is estimated to be 9 million with a population growth rate of 1.9%[13]. According to UNFPA[14], 58% of 7.3 million of its people are below 25, one of the highest proportions in the South Pacific. The site also reported that high population growth rates are affecting effective delivery of services and impact on infrastructures.

The population of each of the towns in which the Provincial Hospitals are located is provided in Table 8. Note that this data is from the 2011 National Population and Housing Census (census) and likely outdated. The planned 2021 census has been delayed due to COVID.

Table 8: Population of towns where subprojects located

Hospital	Town	Population	Hospital	Town	Population
Popondetta Provincial Hospital	Popondetta	29,454	Kimbe Provincial Hospital	Kimbe	22,923
Kavieng Provincial Hospital	Kavieng	16,725	Nonga Provincial Hospital	Rabaul	4,785
Alotau Provincial Hospital	Alotau	11,857	Kerema Provincial Hospital	Kerema	5,885
Modilon Provincial Hospital	Madang	35,971	Kwikila Provincial Hospital	Kwikila	1,500
Mt Hagen Provincial Hospital	Mt Hagen	32,830	Kundiawa Provincial Hospital	Kundiawa	10,833
Kudjip Provincial Hospital	Kudjip	1,391	Goroka Provincial Hospital	Goroka	23,277
Daru Provincial Hospital	Daru	15,142	Lorengau Provincial Hospital	Lorengau	8,882
Mendi Provincial Hospital	Mendi	21,135	Vanimo Provincial Hospital	Vanimo	13,970
Wabag Provincial Hospital	Wabag	5,041	Boram Provincial Hospital	Wewak	24,471
Tari Provincial Hospital	Tari	39,279	Buka Provincial Hospital	Buka	53,986
Angau Memorial Provincial Hospital	Lae	88,608			

Source: https://www.nso.gov.pg/statistics/population/

Migration patterns differ from province to province. According to the 2011 census, urban areas remain an attractive destination for migrants. A similar trend was reported in the 2000 census. Migration occurs

[13] https://www.worldbank.org/en/country/png/overview

[14] https://png.unfpa.org/en/topics/population-dynamics-1

within provinces and between provinces. There were some differences in migration patterns between the urban and rural sectors. It was reported that in the urban sector migration patterns, there was 80% of movement between provinces and 20% between provinces in the rural sector.

Provinces that recorded high in migration were NCD, Morobe, Western Highlands and West New Britain. Provinces that recorded high out migration were Simbu, Southern Highlands, NCD and Eastern Highlands. Majority of those moving are young people between the ages of 25 and 29 years.

4.7 Economy

The economy of PNG is dominated by two sectors:

- the agricultural, forestry, and fishing sector that engages most of PNG's labour force (the majority informally), and
- the minerals and energy extraction sector that accounts for most export earnings and GDP.

An economic update provided by the WB in September 2022 concluded that[15]:

- The economy is back to growth following a sharp contraction in 2020, with a 1% growth rate recorded in 2021.
- Higher commodity prices have contributed to higher inflation.
- The modest headline economic growth in PNG has translated into meagre per capita income growth in the past four decades.
- The considerable natural resources wealth has not been channeled into broad-based and sustained productivity growth.
- PNG's future growth and quality of life hinge on improving human capital, given the growing young population.

Most of the towns at which the provincial hospitals are located are also the main economic hubs for each of the provinces.

4.8 Water, Electricity, Phone and Internet Services

Public Utilities in the provincial towns at which the hospitals are located are provided by the GoPNG through Water PNG and PNG Power for water and electricity services. Any period without water and electricity can be detrimental for hospitals. Because of this, most Provincial Hospitals have diesel generators and backup water reservoirs.

Communication through landlines is provided by Telikom PNG. Other big communication companies operating in PNG providing mobile phone services are Digicel and Bmobile. Internet services are provided by Telikom, Datec and other internet service providers. The provinces in PNG are most serviced by Telikom and Digicel.

4.9 Health Services

Over 80% of the PNG population live in rural PNG and therefore there is a heavy reliance on healthcare facilities outside major cities. There are 21 provincial hospitals, 14 district hospitals, 732 health centers

[15] https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099020009142275189/p1793220e4e59d0e08ebb05316324bc183

and 40 community health posts in PNG that are government-run[16]. Other hospitals present within some provinces include church-run and private hospitals.

Health services are provided through the different departments within the hospital and through district hospitals, rural health centres and community health posts. Referrals from the community health posts are made to the health centres and from the health centres referrals are made to the district hospitals and from the district hospitals referrals are made to the provincial hospitals.

The Provincial Hospitals where the incinerators are being installed offer varying levels of healthcare ranging from Level 3 to Level 6 (see Table 2). The services provided at each of the levels are described in Table 9.

Table 9: Levels of the public health care system in PNG

Level	Name of Level	Core Services
1	Aid Post/Public Health Services and Community	Basic medical services (as per competencies of the aid post worker)
2	Community Health Post/ Public Health Services	Basic medical services and primary emergency obstetric and neonatal care
3	Rural Health Centre/Public Health Services	Medical, child, neonatal and pediatric services
4	Urban Health Services	Medical, child, neonatal and pediatric services, basic surgical services
5	District Hospital/Public Health Services	All of the above plus basic specialist obstetric, medical and surgical services. Service support (Diagnostics and Allied Health)
6	Provincial Hospital/Public Health Services	All of the above plus some subspecialty medical and surgical services. Management and leadership, clinical, public health and professional support
7	Regional Hospital/Public Health Services	All of the above plus critical care. Management and leadership, clinical, public health and professional support

4.10 Provincial Hospital Features

4.10.1 Infrastructure

The Provincial Hospitals have a capacity of up to approximately 400 beds at the largest hospital (Angau Memorial Provincial Hospital). The hospitals have several departments (which vary between hospitals) including outpatient, ophthalmology, maternity, tuberculosis, radiology, pharmacy and casualty. From the site visit it was observed that the level of maintenance of infrastructure at the hospitals varied, with some being maintained well and others in urgent need of maintenance of some of the infrastructure. Asbestos Carrying Materials (ACM) was noted at Modilon Provincial Hospital.

4.10.2 Waste Management Services

Health-care waste from various departments within the hospitals are segregated into sharps (e.g., syringes), infectious waste (e.g., cannulas) and non-infectious wastes (e.g., papers). The waste is collected in colour coded receptacles. Colour coding for the receptacles is however not consistent through-out the Provincial Hospitals. There is also inconsistency with standard of the colours used for receptacles hence labels are also used. Use of one colour bin liners confuses efforts of waste segregation thus health care waste ends up with general waste at public landfills. Inconsistency was noted that no bin liners (hazardous waste bags) and covers (especially for infectious and non-infectious waste) are placed in the receptacles.

[16] https://www.health.gov.pg

Generally, amongst all the hospitals, when full, the receptacles are emptied into wheelie bins and are kept in a closed waste collection area. Placing of bin liners in large bins are inconsistent. From the collection area, wastes are carted to the waste disposal area where sharps and infectious waste are incinerated whereas non-infectious waste is disposed of in an open pit and burned. For hospitals that did not have incinerators functioning, infectious waste was burnt in open dumps or landfills within the incinerator site or taken out of hospitals to be disposed of (typically at local dumps). Improper disposal of radioactive and pharmaceutical waste was raised as a concern.

From the site visits to the incinerator sites, waste disposal areas and through on-site interviews, the following was established in relation to waste management at the hospitals. This information about current waste management practices is included as it provides context of the current situation and rationale (and urgency) for the installation of a new incinerator.

Solid Waste Management. Observations on solid waste management practices are as follows:

- Waste segregation is not effectively done – infectious waste such as gloves were also found at the pit for disposal of non-infectious waste
- Non-infectious waste is burnt in the pits and this produces smoke (especially when the waste is mixed with wet infectious waste)
- General waste is transported away by the Town Council for emptying. In some hospitals the Town Council does not remove the waste on the scheduled times and therefore receptacles are overfilled with waste and overflow.
- Solid waste accumulation by old dysfunctional incinerators around current incinerator sites is a common site for many hospitals and presence of ACM is possible.
- The waste disposal pits are not covered which attracts animals.
- Some open dumps are not securely fenced. This results in dogs entering the area with filled open dumps for infectious and non-infectious waste (Figure 29).

Figure 29: Without fencing, dogs entering an open burning area used for burning infectious waste

Figure 30: Incinerator in disrepair at Popondetta Provincial Hospital

Service and Maintenance. Observations on service and maintenance of existing incinerators are as follows:

- The incinerators of some hospitals needed major repairs. The mechanical parts (e.g. fans, and igniter) are no longer functioning and few of the incinerators have leaks, such that they are unable to attain very high temperatures. Smoke leaks out before reaching the chimney (i.e., at Nonga Provincial Hospital).
- Sub-standard material used to construct scrubbers at some hospitals (i.e., Popondetta Provincial Hospital). The material used could not withstand heat or the scrubber may have disintegrated due to weather conditions (Figure 30).

Occupational Health and Safety. Observations on OHS are as follows:

- Waste handlers are generally provided with appropriate personal protective equipment (i.e. gumboots, uniforms, mouth and nose masks and gloves). However, it was reported that they do not always use the PPE issued to them and/or there is insufficient supply of proper PPE.
- Low literacy and/or technical knowledge levels of the incinerator operators.
- Operators lack basic information about impacts of incineration waste on the environment and how to reduce emissions.
- Confined space and lack of ventilation inside incinerator sheds.
- Lack of weighing scales and proper record keeping of waste before and after incineration. Lack of checking waste weight before incineration contributes to overloading incinerators' primary chambers during burning and this is most likely one of the reasons the incinerators break down.
- Lack of hygiene and sanitation facilities for the incinerator operators and waste handlers.
- Absence of fire safety equipment, safety signage and instructions on Emergency Response Procedures within incinerator sheds.

It is worth noting that some of the observations may not apply to some hospitals, details on individual hospitals can be found in Annex 1 to Annex 21.

Solid Management. Observations on the management of solid waste are as follows:

- Ineffective segregation of waste as source point. It was noted that waste segregation efforts were affected due to breakdown of incinerators.
- There were varying differences in the waste pathways in the hospitals visited. In some hospitals, there was a clear pathway where waste was taken from the wards and clinic and stored in a waste collection area.
- In some hospitals there was a mixture of both healthcare waste and general waste, and therefore the general waste was contaminated by the presence of health care waste (Figure 31).

Figure 31: Example of lack of segregation leading to contamination of general waste

Figure 32: Example of poor drainage at incinerator site

Liquid Waste Management. Observations on the management of liquid waste are as follows:

- Management of liquid waste from hospitals is inconsistent across the hospitals.
- At some hospitals untreated ponds are used and final effluent is released to the environment.
- Lack of proper plumbing and drainage for run offs and effluent at incinerator sites was also noted (Figure 32).
- Liquid waste from the bins wash down are not properly disposed into drains, sewer lines nor septic tanks.

Incinerator Operations. Observation made on incinerator operations are as follows:

- Lack of procedure for managing bottom ash (i.e., ash generated from the incineration process).
- Lack of operating manuals for incinerators, thus regular service and maintenance of incinerators is not understood or effectively done.
- Sourcing incinerator parts and expertise for service and maintenance is sometimes problematic.
- No standards are applied in procurement of incinerator types based on level of hospitals and waste calculations.
- Insufficient numbers of incinerators on site to share load. As a result, when an incinerator breaks down, it takes a longer replacement period thus healthcare waste accumulates causing additional issues.

Community Health and Safety. Observation made on community health and safety are as follows:

- Lack of proper fencing around public waste disposal areas.
- Complaints from members of the community and other stakeholders about the nuisance of smell and noise from the operating incinerators and smell from healthcare waste disposal in unregulated public dumps.
- Transportation of healthcare waste to incineration sites on vehicles that do not meet health and safety standards. In some places, healthcare waste is transported past residential areas.

Resource Efficiency. Observation made on resource efficiency are as follows:

- Insufficient application of standards in electricity connections and water connections to incinerator sites.
- Continuous blackouts would likely affect incinerator operations in some hospitals.

5.0 STAKEHOLDER CONSULTATION

5.1 Initial Consultation

Stakeholder consultation took place as part of the site visits undertaken by the assessment team (i.e., the NDoH PCU Safeguards Officer, CEPA Environmental Officers and the Health Facility Technical Team). The stakeholders consulted as part of the consultation included:

- Community representatives
- Representatives from Provincial Administration
- Urban Local Level Government Authorities
- PNG Power
- Water PNG
- PHA and Hospital Management Teams

Due to the COVID-19 pandemic rules, large community gatherings were avoided. The stakeholder meeting dates and locations are provided in Table 10. Further details of the meetings held relating to each of the Provincial Hospitals are in Annex 1 to Annex 21.

Table 10: Summary of Sites Visits and Stakeholder Meeting Dates

Site (Provincial Hospital)	Stakeholder meeting date	Stakeholder meeting location
Popondetta Provincial Hospital	12 February 2021	Governor's Office Conference Room
Kavieng Provincial Hospital	4 March 2021	Hospital Training Room
Alotau Provincial Hospital	15 March 2021	PHA CEO Office
	8 February 2023	PHA Conference Room
Modilon Provincial Hospital	7 April 2021	PHA Conference Room
Mt Hagen Provincial Hospital	13 April 2021	Staff Training Room
Kunjip Provincial Hospital	14 April 2021	Hospital Conference Room
Daru Provincial Hospital	20 April 2021	PHA Conference Room
Mendi Provincial Hospital	26 April 2021	PHA Conference Room
Wabag Provincial Hospital	28 April 2021	PHA Conference Room
Tari Provincial Hospital	3 May 2021	Hospital Conference Room
Angau Memorial Provincial Hospital	7 May 2021	Angau Family Support Centre
Kimbe Provincial Hospital	11 May 2021	Genesis Hotel Conference Room
Nonga Provincial Hospital	14 May 2021	PHA Conference Room
Kerema Provincial Hospital	20 May 2021	PHA CEOs Office
Kwikila Provincial Hospital	24 May 2021	Kwikila Salvation Army Hall
Kundiawa Provincial Hospital	2 June 2021	Staff Training Room
Goroka Provincial Hospital	4 June 2021	Hotel Phoenix Conference Room
Lorengau Provincial Hospital	25 June 2021	PHA Public Health Conference Room
Vanimo Provincial Hospital	1 July 2021	PHA Conference Room
Boram Provincial Hospital	6 July 2021	Village Inn PHA Conference Room
Buka Provincial Hospital	2 March 2023	PHA Training Room

During consultations with stakeholders, there was indication that there is greater need and support for the Project given the fact that incinerators at many hospitals were dysfunctional causing a buildup in healthcare waste storage and unregulated waste disposal practices causing greater risk of health-related issues to the community and the wider environment. For hospitals that had functional incinerators, they were operating with a single burner and without a scrubber.

At each site, attendees expressed satisfaction in the transparent process of engagement and learning outcomes from sessions facilitated by CEPA on the Environmental Permitting processes and administrative functions of CEPA. The NDoH PCU Safeguards Officer facilitated a session on the PNG COIVD-19 ERP Component, the ESMF and GRM and the Word Bank E&S measures triggered by the Project including an HCWM SOP as a prerequisite by the WB for PHAs for operating the incinerators delivered under the Project. The Heath Facility Technical Team facilitated a session on the operational specifications of the incinerator and gas scrubber highlighting environmental compliance measures the project is applying to ensure less harm is caused to the environment and people from the operations of the incinerator. CEPA also presented a session on the Assessment Team's findings on each hospital's waste management practice and to obtain feedback on each of the presentations that were made. The PHAs were also given cost implications for ongoing Environmental Permit compliance and incinerator operational needs. The stakeholders expressed satisfaction that their livelihoods were considered in Project design and that they are fully sensitized on what the project involves.

A summary of key concerns and complaints raised and discussed across the 21 Provincial Hospitals visited is provided in Table 11, along with the responses provided by the assessment team. In some instances, some mitigation measures were explained as responses to questions asked by concerned stakeholders. The specific details of the consultation at each site are captured in Annex 1 to Annex 21. Issues raised through the consultations have been noted and where possible resolved during the meetings and/or mitigation measures incorporated into the ESMP.

Table 11: Summary of Stakeholder Meeting Discussions

Feedback / Concerns	Responses from the Assessment Team	Considerations and Mitigations
Dark Smoke and Bad Odor	In response to complaints raised about ongoing dark smoke and bad odor from incineration, the assessment team highlighted some control measures for the PHA and hospitals to consider;	
	i. a stronger HCWM SOP is needed for hospitals operations to improve waste segregation at point of generation, proper use of color coded receptacles, bin liners bags and bins and labelling,	HCWM SOP is being prepared by each hospital.
	ii. training and supervision of operators on proper loading procedures of waste and that is to weigh waste bags and to ensure correct weight is loaded into the primary chamber each burn cycle and	Training will be provided to incinerator operators by UNOPS during commissioning.
	iii. An Incinerator Operations Manual providing procedures for operation, including service and maintenance schedules. These will all form part of the ESMP.	Incinerator Operations Manul will be prepared by UNOPS prior to commissioning.
	It was highlighted to the PHAs that a HCWM SOP for their hospital is a prerequisite by the World Bank for having their incinerator operational.	

	The Participants at the stakeholder meetings were given information on how the gas scrubbers function in reducing the dark smoke and bad odor.	
Timing of the Day for incinerating waste and Stack height	In response to complaints raised by nearby residents regarding timing of the burning activity, it was suggested that burning should not occur at nights when the climatic conditions are low because emissions filtration is low and it affects people in their homes while they are sleeping. One suggestion as a mitigation measure was to lift stack height from 10 to 100 metres. In response to such comments, the Engineer from the Heath Facility Technical team advised that adding more height to the stack would pose a threat of stack breakage during windy seasons or additional foundational structures that will have to be put in place at a cost to hold the stack in place. He also added that the scrubber blower can only function well with a stack height of 10 metres.	The incinerator will have a 10 m stack and operate with the scrubber in place to minimise emissions to air. Unfavourable weather conditions for operating the incinerator will be included in the Incinerator Operations Manual.
Removal of Old Nonfunctional Incinerators	In response to questions raised in some hospitals on whether the project costs will include dismantling and disposal of old nonfunctional incinerators, the response was that this task will be part of the construction contractors' scope. Contractors who will also have asbestos procedures for handling material containing asbestos and a disposal plan for disposing old incinerators that will be dismantled as part of this project. Removal of old incinerators will occur only at Popondetta, Angau, Modilon and Kundiawa hospitals.	The contractor will be responsible for removing and disposing of the old incinerators at sites where this is required (Popondetta, Angau, Modilon and Kundiawa)
Increased Water Demand	Concerns were raised relating to ongoing water demands by the incinerator's operations and suggestions were made that NDoH Contractor might have to seek alternative water sources for the construction phase of the incinerator project. Questions were also asked as to whether NDoH and the World Bank are able to support optional water supply sources for ongoing operational demands of the incinerator. The response was no, but PHAs should consider this as a project cost and budget for it. *Although not discussed at the consultation, it should be noted that the construction phase of the project will not have a significant water demand.*	N/A
Increase in demand for Power Usage	Concerns were raised that the NDoH should consider supplying standby generators as part of the project because current power supply to the hospitals is only	N/A

	sufficient for hospital operations therefore the incinerators need their own backup power source. The response was that PHAs should consider this as a project and have it planned in their annual budgets. *Although not discussed during the consultation, it should be noted that the incinerators use diesel as a fuel source and therefore electricity use will be minimal. The PHAs will need to budget for fuel usage for the incinerator operations.*	
Scavenging by humans and animals at public open dumps and landfills were health care waste is disposed	It is a common occurrence for dogs to scavenge on the open dump sites and landfills and around waste storage areas within the hospital grounds as a result of incinerators malfunction. The neighboring communities are concerned about contracting diseases from waste brought to their homesteads by their dogs or dogs get killed from consuming such waste. Such incidents do not directly relate to the operations and performance of the proposed incinerator, however it was worth noting that having a fully operational incinerator with proper fencing would prevent such cases from occurring. Regardless, this Project will improve waste management from the current potential impacts.	The incinerator sites will be fenced.
Alternatives to Incineration	Questions were raised regarding alternatives to incineration stating that if there are any other ways for treating healthcare waste that reduces toxins from entering the environment, would those alternatives be preferred over incineration. After much discussion, it was clarified that incineration was the best alternative for healthcare waste treatment for the country at present.	N/A
Effluent discarded through Sewer System	A concern was raised causing discussions around effluent waste from incinerators being directly disposed into sewer systems causing lives of microorganisms in sewer ponds to be at risk of toxins which might affect microorganism needed for breaking down human waste in the ponds. Related questions raised where; How will toxin levels in slurry waste be measured and how will monitoring be done to ensure toxins reaching sewer ponds are safe. Will there be testing of liquid waste to determine toxin levels. Mitigation measures proposed in response to the query was that the design of the incinerator site will consider absorption pits before liquid enters the sewer	The effluent will be treated and disposed of to absorption pits or drainage lines.

	lines. Where sewer lines are non-existent, septic tanks would be considered and occasional effluent tests for toxins should also be considered by NDoH and the PHAs. *It should be noted that the Project design changed following the consultation and the wastewater from the scrubbers will now be treated prior to disposal in absorption pits. The wastewater will be monitored regularly and the results communicated to the community.*	
Disposal of Pharmaceutical and Radio Active Waste	Concerns were raised regarding current pharmaceutical waste build up from expired drugs. There is in existence SOPs for Pharmaceutical Waste Management which Hospital Pharmacies adhere to. It was expressed in the one meeting that NDoH needs to review procurement processes of drugs sent to the Provincial Medical Stores from the NDoH Medical Store to avoid a buildup in expired drugs and that there is need for improvement in procedures for proper disposal of expired drugs. Concerns were also raised about disposal of radioactive waste by hospitals in public landfills, public waste dumps and seashores posing more environmental and health risks. Improvement in HCWM is needed in many hospitals to manage radioactive waste. *Although not discussed during the consultation, it should be noted that the incinerators are not proposed to be used to dispose of radioactive waste.*	HCWM SOP is being prepared by each hospital. *(It should be noted that the scope of the project is to install and operate incinerators. The issues raised are important and need addressing, although they are beyond the scope of this assessment).*
Color Coded Waste Bins, Receptacles, Bin Liners and Waste Signage Labels	Concerns were raised regarding lack of financial resources to support an effective Waste Segregation System in the hospitals where proper colored bin, receptacles, bin liners and appropriate labels can be used. PHAs to consider Annual Budgets for HCWM resources needed to support an effective health care waste management practice in their respective hospitals.	This is captured in the HCMW Plan
Waste Management and Training on IPC	Another common concern was the emphasis on support for provision of proper color coded bins and bags preferably see through bags, proper safety labelling and proper training on proper infection control in waste management for all workers involved with waste management at the hospitals. Operators at	Training to incinerator operators will be provided by UNOPS as part of commissioning.

	some facilities who also do waste removal from the wards to the incinerator site requested for training on IPC in waste management and training on operational procedures of the Incinerators including basic troubleshooting skills and basic information on environmental impacts caused by air emissions and bottom ash. PHAs should consider conducting scheduled training for operators of incinerators.	
Ongoing maintenance and spare parts of the incinerator	One common concern from the consultation meetings was the problem with availability of technicians and spare parts required to maintain incinerators in the event that the incinerators encounter technical problems. NDoH and the PHAs could consider establishing standards for procurement of incinerators for convenience obtaining spare parts with technicians and also for environmental compliance.	Mitigations have been proposed around adequate budgeting for maintenance and monitoring.
Operators to be literate and technically skilled	Concerns were raised in relation to Incinerator Operators knowledge of operating the incinerators which are highly mechanized equipment. Suggestions were made to involve operators in training on operational procedures of the incinerators and some opted for operators to have excellent literacy levels and sound technical knowledge of the incinerators operating system. It was suggested that as part of the hospital's Human Resources Plan, positions for Incinerator Operator should be created. Job requirements would include having background technical skills.	Training to incinerator operators will be provided by UNOPS as part of commissioning.
Business opportunities in Medical Waste Management	There were discussions around waste management and business opportunities where customary landowners could operate landfills or open dumps as a business and CEPA could provide assistance to assist people with the necessary requirements for acquiring the necessary permits for such an operation. Related to this discussion was discussion on the option for hospitals to give waste management to a private contractor so that they only manage medical services. This might be an option for consideration by the PHAs.	This is acknowledged, however, not covered by the scope of this project.

Town Council Landfills and Healthcare Waste	Concerns were raised and discussions were held around the current disposal of medical waste at town open dumpsite and landfills. Most unregulated. Requests were made for an immediate installation of the medical waste incinerators. Participants expressed concern about lack of controlled landfills or open dumps in relation to open disposal and burning of medical waste in both Town Council run and private open dump sites, lack of secure fencing around the sites and community members scavenging on waste sites exposing themselves to hazardous and infectious healthcare waste pathogens. Immediate installation of the incinerators is needed.	This is acknowledged, and the installation of the incinerators has been progressed as fast as practicable.
Use of Local Knowledge	During the consultations, concerns were raised about lack of involvement of the local hospital bio-medical team's involvement in site selection and design of the waste management site including design of the incinerator facility and involvement in development of the ESMPs. It was expressed that local knowledge is important in the design to avoid redesigning and causing delay in project delivery thus the idea of a local project committee to oversee the implementation of the incinerator project was suggested. NDoH and the Contractors will share the respective Site Designs and the ESMP for review by each Hospitals Project Committee. It will be up to each PHA to form a Project Steering Committee.	The hospitals have been kept informed of the project progress and planning, and contributed to the site selection process.
Environmental Permit Ownership	CEPA explained matters relating to the Environmental Permit and discussions were held around ownership of the permit and responsibilities for compliance to permit conditions and related penalty fees for non-compliance. The stakeholders were informed that NDoH will manage the Environmental Permit for Year 1 and PHAs in consecutive years. NDoH will work with CEPA and the PHAs to ensure this is arranged. CEPA advised to consider an Integrated Environmental Permit for all Health Care Facilities under a PHA.	The Environmental Permit has been issued under the NDOH for an initial period of three years.
Alternative Sites	Some Incinerator Sites are situated within or near hospital wards and residential buildings where nuisance from air-borne emissions reach on a daily	N/A

	basis. Alternative sites were discussed. Some of the key challenges for alternative sites included security from vandalism, ownership of land or ongoing land disputes between hospitals and land occupiers, distance from the hospital, connectivity costs for water and electricity and security services costs. Long term planning was required by the PHA and Provincial Government Administration to secure land outside hospital boundaries or to sub contract waste management. For long term planning by PHAs and their stakeholders are required to relocate incinerator sites. PHAs requested NDoH to do a full cost of a Waste Management Site and give it to PHAs. The design will include detailed designs with costs for Water, Power, Sewer, Fencing, etc. The meetings were informed that mitigation for the current locations will require an effective implementation of the HCWM SOP.	
50kg/cycle Incinerators not suitable for some level 5 and 6 hospitals	The PHAs requested for additional incinerators because of the waste load generated. Having additional incinerators would help with load sharing thus enhancing longevity of the incinerators.	This is acknowledged, however, not covered by the scope of this project. Some hospitals are also seeking additional incinerators from other donors.

5.2 Additional Consultation

Additional consultation was undertaken in early 2024 with the hospital staff and other potentially affected parties at the following hospitals: Popondetta, Mt Hagen, Kerema, Kwikla and Modilon. Details of the consultations are provided in the ESMPs. The issues and concerns raised were consistent with the 2021 consultation sessions, although a few additional items were raised. These were:

Popondetta:

- Issue: Use of net wire or gabion baskets holding in rocks should be removed and the area should be properly cemented. The net wire (gabion baskets) over time will break exposing the incinerator to vandalism. Mitigation: UNOPS will do a final site investigation before putting out bids for the Contractors so any risks identified now can be managed.

Mt Hagen:

- No additional issues and concerns

Kerema:

- After much discussions and assessment, the site for the incinerator was changed, as the previously proposed site was no longer available. The new site selected (near the morgue) was previously the site of an operating incinerator.

Kwikila:

- Issue: The community wants assurance that the emissions from the stack are clean and will not contaminate the air close to them. Mitigation: Stack height, and scrubber will mitigate this issue, and monitoring will be undertaken of the air quality.

Modilon:

- Various alternative site for the incinerator were discussed (and site visits undertaken) to reassure the stakeholders that the most suitable site had been selected. After discussion on the benefits and risks of each site, it was agreed to continue with the initially proposed site within the hospital grounds.

5.3 Future Planned Consultation

The PHA will undertake additional consultation with the community (targeting potentially affected parties, such as people residing near the proposed locations of the incinerators) before the site-specific ESMPs are finalised[17], and details of such consultation documented in the ESMPs. The consultation will focus on:

- Overall Project (and ESMP) disclosure
- Potential benefits and risks of the Project, and proposed mitigation
- Capturing any concerns or suggestions from the community

The construction contractor (UNOPS) will also prepare a SEP for each site, and implement these throughout the project. This will include keeping the community and other potentially affected parties informed on project construction timeframes and how to access the GRM.

[17] With the exception of Kwikila, as such consultation has already occurred at the site

6.0 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS AND PROPOSED MITIGATION MEASURES

The construction and operation phases of the project will have both positive and negative impacts on the bio physical and social environment. Construction phase impacts will be minor, localised and of a temporary nature. The operational phase will have minor impacts on the local community and environment and albeit will improve the current negative impacts resulting from management of healthcare wastes.

6.1 Impact Identification Method

The potential impacts of the Project were identified using the following approach and methodology:

- **Site Assessment Summary Sheet:** A Site Assessment Summary Sheet was developed by the PCU Safeguards Team and used during the site visits to ensure key information was collected at each site. The checklist included current waste management practices; utilities access; details of the proposed incinerator site; and existing grievance processes and records. The completed Site Assessment Summary Sheet for each site is provided in Annex 1 to Annex 21.
- **Literature review:** The PNG COVID-19 ERP ESMF, WBG ESF, WB EHS Guidelines and the WHO manual for health care waste management were reviewed together with other documents on waste management. The documents were reviewed to obtain a clear description of the environment in which the project will be implemented, the activities during operation and the anticipated impacts. The other documents reviewed included:
    - Sanitation and Health Protection of the Human Environment World Health Organization 20 Avenue Appia CH-1211, Geneva 27, Switzerland. By Stuart Batterman Environmental Health Sciences University of Michigan 109 Observatory Drive, Ann Arbor, MI 48109 USA, January 2004
    - Guidelines for Health Care Waste Management in PNG (Draft)
    - Maryam, K. G and Rosnah B. M. Y (2015) Advantages and Disadvantages of Healthcare Waste Treatment and Disposal Alternatives, Malaysia.
    - World Bank. 1999. World Bank Safeguards Policies – Environmental Assessment. Washington, DC: World Bank.
    - World Bank Group Good Practice Note. Asbestos: Occupational Health and Community Health Issues.
    - NDoH Health Facility Branch Proposal on Waste Management Site.
- **Site Investigations:** Site investigations were carried out to complement the literature review. The Assessment Team carried assessments at the hospital, the project site and access areas; the waste disposal area including the incinerator. No visits were made to sewer ponds. The investigations focussed on identification of critical environmental and socio-economic elements likely to be affected during the implementation and operation of the project. Information from the site investigations is documented in Annex 1 to Annex 21.
- **Stakeholder Consultations**: Stakeholder consultation was undertaken to information stakeholders about the Project and to get their feedback on potential general and site-specific issues (see Chapter 5).
- **Review of aerial images:** Aerial images were accessed from Google Maps for assessment of details of the site and surrounding areas. This was important as the project areas were too small to be fully assessed on conventional maps.

- **Understanding of Project activities.** The Project design documents and incinerator vendor-provided information was reviewed and, along with knowledge from the consultants preparing the ESIA, to understand the activities associated with each of the Project phases.

6.2 Summary of Project Activities

A summary of the project activities considered in the impact assessment is provided in Table 12. Further details of the Project, including types of project infrastructure, are provided in Chapter 3.

Table 12: Summary of Project activities

Project Phase	Breakdown of Activities
Planning	● Training on IPC and HCWM SOP ● Preparation and training on the GRM process ● Designing of the Incinerator Structures ● Assessment of existing incinerator sites and infrastructure ● Identification of the project site ● Preparation of the ESMPs ● Identification of the contractors
Construction	● Site clearing and excavations for foundation trenches ● Removal and disposal of old incinerators (at some sites) ● Construction of a concrete slab ● Installation of prefabricated walls ● Roofing of the building ● Excavation for drainage and absorption pits ● Installation of the slurry waste treatment system ● Installation of incinerators, scrubbers and stacks ● Connection of power and water ● Generation of waste
Operations	● Weighing and sorting waste ● Loading the incinerator ● Operating the incinerator, which will result in emissions to air ● Removing and disposing of bottom ash generated from the incineration process ● Maintenance of the incinerator ● Disposal of solids from the scrubber wastewater treatment system ● Environmental monitoring (stack emissions and wastewater quality) ● Refueling the fuel tank

6.3 Potential Positive Impacts and Enhancement Measures

This section describes the potential positive impacts associated with the Project and proposed enhancements measures to maximize such impacts.

6.3.1 Planning Phase

The potential positive impacts from the planning phase activities are:

- **Increased knowledge and skills on Health Care Waste Management (HCWM) and IPC.** The hospital staff associated with the incinerators will attend training on HCWM and IPC associated with the operations of the incinerator. Impact Enhancement Measures would include:
    - NDoH and the PHAs must ensure standard selection criteria is used to select people to participate in training. These people must be part of the waste management team, biomedical team and incinerator operators.
    - Ensure the HCWM SOPs are developed and followed.
    - Ensure that the IPC and WMP for the PNG COVID-19 ERP is implemented.
    - Ensure that continuous training is embedded in the Staff Development Training Plans.

- **Increased skills on grievances management.** The PHA will identify Focal Points for E&S monitoring to be trained by the PMU in grievances management and this will be completed prior to the start of construction. To enhance the impact, the PHA will develop its own grievances management system to be used for the operations phase.

6.3.2 Construction Phase

The potential positive impacts from the construction phase activities are:

- **Employment opportunities.** The construction works will provide employment opportunities for local people, although this will be short term and very few locals will be employed (about 10 people). Impact Enhancement Measures would include:
    - The main contractors (UNOPS) must observe the projects Labour Management Procedure (LMP).
    - Subcontractor workers must be paid fairly for the services rendered.

- **Acquisition of skills in construction of prefabricated buildings.** The local laborers will acquire skills in construction of prefabricated buildings. The main contractor will engage a sub-contractor will have to recruit local labourers. The local labourers are expected to acquire new skills from their counterparts through observation and training. To enhance the impacts, the contractor must be encouraged to provide on job training to the labourers.

- **Income to material and equipment suppliers.** Construction of the slab and drainage will require cement, sand, pipework, etc. Equipment, such as concrete mixers, will also be required. This will provide business opportunities for local materials suppliers hence increased income. The impact can be enhanced by paying suppliers within the agreed time. Local suppliers must also be encouraged to supply quality products.

6.3.3 Operations Phase

The potential positive impacts from the operations phase activities are:

- **Increased practice in HCWM and IPC.** The incinerator site will have additional space, improved ventilation and sanitation, hence improved IPC. The impact could be enhanced with retraining on the HCWM SOP and maintenance to ensure ongoing functionality of the incinerators and improved sufficiency in supply for PPE.

- **Improved operations of the incinerators.** The Project will prepare an Incinerator Operations Manual that covers the operation and maintenance requirements for the incinerators, along with the process for disposal of the ash generated from the incineration operations. Incinerator operators will be trained in the content of the manual. This training will improve capacity to monitor emissions, keep proper waste weight records, IPC, operations of the incinerators, troubleshooting and use of PPE.

- **Improved GRM processes.** The project will undertake accountability to surrounding communities and will improve capacity to manage grievances associated with the operations of the incinerators.

- **Reduction in odour and air emissions.** The Project will result in a reduction (or cessation) in the current practice of burning healthcare waste in open pits and therefore reduce odour and emission to air; and reduce corresponding community complaints.

6.4 Potential Negative Impacts and Proposed Mitigation Measures

This section describes the potential negative impacts associated with the Project and proposed mitigation measures to avoid or minimize such impacts.

6.4.1 Planning Phase

There is not expected to be impacts on the biophysical or socio-economic environment during the planning phases of the project because all activities are limited desktop work and site visits.

6.4.2 Construction Phase

The potential negative impacts from the construction phase activities are:

- **Inadequate compliance with the ESMP.** There is a risk of inadequate implementation of the ESMP due to capacity and awareness issues, causing inadequate mitigation and management of impacts during the construction phase of the project. Mitigation measures would include:
    - Collaboration by all project stakeholders in implementing the ESMP.
    - Contractors to develop and implement Construction ESMPs (CESMPs) in compliance with this ESMP to be included in bidding documents.
    - NDOH to review, approve and monitor implementation of the CESMPs.
    - NDOH to ensure contractors have suitable experienced personnel to implement ESMP requirements and/or to provide training and capacity building as required.
    - Contractors to ensure compliance to the ESMP are included in the bid conditions for subcontractors.

- **Impacts on air quality, noise and vibration from minor works.** Minor construction works may cause impacts on air quality (e.g., from dust generation), noise and vibration, which may cause nuisance for nearby receptors. These would be short-term (i.e., construction is likely to take less than a month at each site). Dust is likely to be generated during dry periods, which are infrequent in most locations in PNG due to the high rainfall and humidity. Noise would occur only during daytime hours when the construction teams are working. Such impacts are also readily minimized using standard environmental management measures.

  Mitigation measures relating to air quality include:

- Materials used shall be covered and secured properly during transportation to prevent scattering of soil, sand, materials, or generating dust;
- Keep stockpile of aggregate materials covered to avoid suspension or dispersal of fine soil particles during windy days or disturbance from stray animals;
- Minimize dust from exposed work sites by applying water on the ground regularly;
- No burning of site clearance debris (trees, undergrowth) or construction waste materials;
- Hydrocarbons shall not be used as a method of dust control; and
- Immediately re-vegetate and/or stabilize exposed areas.

Mitigation measures relating to noise and vibration include:

- Plan activities in consultation with communities so that noisiest activities are undertaken during periods that will result in least disturbance;
- Noise levels should be maintained within the national permissible limits/standards;
- If necessary, use temporary noise-control methods such as fences, barriers or deflectors (such as muffling devices for combustion engines) and select equipment with lower sound power levels where possible;
- Minimize transportation of construction materials through community areas during regular working time; and
- Maintain a buffer zone (such as open spaces, rows of trees or vegetated areas) between the project site and surrounding areas if possible, to lessen the impact of noise.
- Works to only be undertaken during day/light hours.

- **Erosion and sedimentation.** There is risk of erosion and subsequent sedimentation of watercourses from vegetation clearing associated with the incinerator shed construction and run-off from stockpiles of aggregate etc., used in concrete making. The impacts from these works are unlikely to be significant given the small construction footprint and small quality of materials required, nevertheless, the following mitigations are proposed:
  - Implement suitable project design (e.g., establish appropriate erosion and sediment control measures) to minimize soil erosion
  - Scheduling to avoid heavy rainfall periods, where practicable
  - Use mulch, grasses or compacted soil to stabilize exposed areas promptly.

- **Inappropriate construction material supply.** There is risk of materials being sourced from sources that are not licensed or permitted and therefore contributing to the unstainable extraction of resources. The risk of this occurring is high, although given the small qualities of materials required for each site the potential result impact is low. Mitigation measures include:
  - Source raw materials locally (where practicable) from licensed/permitted facilities only.
  - Using recycled or renewable building materials (e.g., timber) where practicable.

- **Damage to underground utilities from construction works.** The use of machinery to dig for footings, locate existing utilities to tie into, etc., could result in damage to the utilities (and associated repair

costs) and risk to worker safety and the environment. To mitigate this all excavation works must be done by hand.

- **Traffic obstruction, congestion, and traffic and road safety.** Impacts on local communities during general construction activities from traffic obstruction, congestion, and traffic and road safety is likely to be minimal and short term. The main sources of traffic related to the project will be from the small number of workers travelling to/from the site each day and deliveries of materials and equipment. Mitigation measures would include:
    - Minimize the extent of traffic and construction impacts on adjacent inpatient wards and other residential areas where possible; and
    - All traffic signs used for the warning or direction of traffic at road works sites shall comply with appropriate traffic regulations.

- **Damage to Cultural Heritage.** There are minimal risks involving excavation of cultural sites given the incinerators will be installed in previously disturbed areas. Nevertheless, a chance find procedure (that outlines the actions to be taken if previously unknown cultural heritage is encountered) was prepared for the PNG COVID-19 ERP Environmental and Social Management Framework, and has been included as an attachment to each of the Subproject-specific ESMPs. As a mitigation measure, the contractor(s) shall have a Chance Finds Procedure in place prior to works beginning.

- **Inadequate Waste Management.** Inadequate management of solid and hazardous waste and wastewater from general construction work could pollute land and surface water. Access to waste management facilities in many parts of PNG is challenging due to lack of appropriate facilities, lack of waste transport services and remoteness of many towns, making appropriate waste management challenging. Mitigation measures to be by the contractor(s) undertaking works area as follows:

    - Implement strategies to avoid/reduce waste generation in the first instance
    - Develop and follow a site-specific Waste Management Plan (separation of waste streams, storage, provision of bins, site clean-up, bin clean-out schedule, etc.) before commencement of any financed works
    - Use litter bins, containers and waste collection facilities at all places during works
    - Store solid waste temporarily on site in a designated place prior to off-site transportation and disposal through a licensed waste collector
    - On-site and off-site transportation of waste should be conducted to prevent or minimize spills, releases, and exposures to workers and the public
    - Dispose of waste only at designated place identified and approved by local authority. Open burning or burial of solid waste generated by the Project at the hospital premises shall not be allowed. It is prohibited for the contractor(s) to dispose of any debris or construction material/paint in environmentally sensitive areas (including watercourses)
    - Recyclable materials such as packaging material etc., shall be segregated and collected on-site from other waste sources for reuse or recycle, where practicable
    - Ensure onsite any temporary worker latrine/s (if required for the Project) are properly operated and maintained to collect and dispose of wastewater

- Minimize hazardous waste generation by ensuring hazardous waste is not co-mingled with non-hazardous waste.
- Collect, transport and disposal of hazardous waste to licensed/permitted hazardous waste sites only following good international industry practice for the waste being handled. Alternatively, the hazardous waste (except for ACM) could be stored and incinerated using the Project incinerator once commissioned given the practicalities of transporting hazardous waste to a licensed facilities given how few there are in PNG and the transport costs/risks involved.
- Provide training for staff in the segregation of wastes.

- **Land and Water Pollution by hazardous substances.** Land and/or water pollution as a result of use and inappropriate storage of hazardous substances e.g. fuel, oils, lubricants. There is unlikely to be a large amount of hazardous substances used as only small quantities will be required for the construction and commissioning of the incinerators. Mitigation measures would include that the contractor(s) undertaking works shall implement the following at a minimum:
  - Using impervious surfaces for refueling areas and other fluid transfer areas
  - Ensure that refueling and maintenance facilities are not located, or that activities do not take place, within 30m of a watercourse, or in ecologically sensitive areas. If a 30 m limit is impracticable, then a lesser limit may be adopted provided approval is obtained. On no account shall the limit be less than 10 m
  - Ensure that vehicles and plant are not stored within 30 m of a watercourse, or in ecologically sensitive areas, overnight or when not in use
  - Regular checks for leaking oil or fuel from machinery undertaken. Any leaks are promptly repaired and/or parts replaced within two days as part of maintenance of vehicles and equipment.
  - Training workers on the correct transfer and handling of fuels and chemicals and the response to spills.
  - Spill kit, appropriate to the hazardous materials being used, to be kept on-site and workers to be trained in its deployment.

- **Land and Water Pollution by hazardous waste.** During the construction phase at sites where old incinerator sites will be demolished (Popondetta, Angau, Modilon and Kundiawa), there is potential risks of land and water pollution from hazardous substance like asbestos, lead paints, Synthetic Mineral Fibres (SMF) and other substances including slurry waste from old scrubbers and from demolished facilities or their debris. Mitigation measures would include:
  - Conducting a building and incinerator inspection survey to identify asbestos containing materials or other hazardous materials present prior to demolition.
  - Dispose all asbestos containing materials according to WBG/IFC EHS Good Practice Note on Asbestos: Occupational and Community Health issues, WBG General EHS Guidelines April 2007 P34 & P37 and CEPA Guideline.
  - The above requirement (ii) should be included in bidding documents.
  - The contractor(s) undertaking works shall be required to do the following at a minimum:

    - Develop a Waste Management Plan with material assessment & management procedure prior to project commencement by the contractor in accordance with good international industry practice (GIIP).
    - Manage and dispose of asbestos containing materials in accordance the WBG guidelines on asbestos management or CEPA Guidelines of other GIIP guidelines (for example, be encased in concrete and buried within the hospital grounds).
    - Safely remove any asbestos-containing materials or other toxic substances by specially trained workers.
  - Dispose of the old incinerators and scrubbers, where required, in an environmentally sensitive manner in agreement with PHA and local authority. Disposal could involve, for example:
    - Encasing and burying the hazardous components within hospital grounds (e.g., beneath the new incinerator), and disposal of other components within local tip.
    - Transporting the old incinerators (or just hazardous components) to Port Moresby for disposal at licenced facility.
  - All asbestos waste and products containing asbestos shall not to tampered or broken down to ensure no fibers are airborne.
  - No asbestos containing materials should be used for construction works.

- **Community Health and Safety.** Health and Safety risks for community, health staff, patients and their visitors from construction activities. As mitigation measures the contractor(s) undertaking works shall implement the following at a minimum:

  - Develop and follow a brief site-specific construction occupational health and safety (OHS) Management Plan which includes health and safety measures for community, health staff, patients and their visitors.
  - Conduct daily discussions with healthcare facility staff to identify any issues that need to be managed so as to avoid adverse impacts to patients, staff and the wider community.
  - Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths.
  - Locating electrical cords and ropes in common areas and marked corridors.
  - Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic, where required, through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic.
  - Ensuring moving equipment is out fitted with audible back-up alarms.
  - Provide safe access routes and other safety measures as appropriate during works such as first aid kits, restricted access zones, warning signs, covering openings to small confined spaces, overhead protection against falling debris, lighting system to protect community, hospital staff and patients against construction risks.
  - A Grievance Redress Mechanism (GRM) developed and made operational in accordance with the Project SEP.

- **Workers Occupational Health and Safety**. OHS risks for workers from general construction activities. Injures resulting from on-site construction activities could range from injuries requiring on-site first-aid (eg. minor cuts and bruising), to and fatal injuries as a result of activities such as falls from height and impacts with motor vehicles. The level of OHS awareness varies across PNG and can be poor within some contractor organizations, particularly those who have limited experience working with international companies. Contractor(s) undertaking works shall as mitigation measures, comply with GIIP regarding workers' safety and develop an OHS Management Plan prior to construction and implement the following at a minimum:
    - Develop and follow a brief site-specific construction/renovation OHS Management Plan.
    - Appoint a health and safety officer at site, who will have the authority to issue directives for the purpose of maintaining the health and safety of all personnel authorized to enter and or work on the site.
    - Prepare and implement a simple action plan to cope with risk and emergency (e.g., fire, earthquake).
    - Have or receive minimum required training on occupational safety regulations and use of PPE.
    - Undertake training of staff to meet standards for the proper operation and use of equipment.
    - Training of workers in lifting and materials handling techniques in construction and decommissioning projects, including the placement of weight limits above which mechanical assists or two-person lifts are necessary.
    - Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths.
    - Locating electrical cords and ropes in common areas and marked corridors.
    - Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic.
    - Ensuring moving equipment is outfitted with audible back-up alarms
    - Provide PPE and other safety measures as appropriate during works such as safety glasses with side shields, face shields, hard hats, hi-vis vests and safety shoes, first aid kits, restricted access zones, warning signs, overhead protection against falling debris.
    - Provide project workers with accessible means to raise workplace concerns.

- **Workers accommodation and working conditions.** Issues related to inappropriate worker accommodations such as close working and poor living conditions which may create conditions for the easy transmission of COVID-19 and/or not facilitate the workers decent rest. The contractor(s) undertaking works shall comply with all national and good practice regulations regarding workers' safety by implementing the following at a minimum:
    - Wash stations should be provided at the site, with a supply of clean water, liquid soap and paper towels (for hand drying), with a waste bin (for used paper towels) that is regularly emptied. Wash stations should be located wherever there is a toilet, canteen/food and drinking areas and at waste stations. Where wash stations cannot be provided (for example at remote locations), alcohol-based hand rub should be provided.

- Accommodation for non-local workers that meets needs of workers and facilitates rest (e.g., no 'hot bedding', drinking water, washing, bathroom facilities etc.) and is in a clean and hygienic state.
- Undertaking health awareness and education initiatives with construction workers e.g. providing information on COVID-19 symptoms, transition paths etc.

- **Workers Infected with COVID-19***.* There is some risk related to workers exposure to COVID-19 at work. Site specific OHS Management Plans will include Training and Awareness on COVID-19 with emphasis to workers following the WHO PNG Nupela Pasin or the New Normal Guidelines[18] for reducing risk of COVID 19 infection.

- **Sexual exploitation and abuse/ harassment (SEA/H) and HIV**. There is a potential for sexual exploitation and abuse/ harassment (SEA/H) to be perpetrated by the Project workforce, and/or members of the Project workforce to be a victim of SEA/H. The spread of HIV related to Project workforce behaviour is also a risk. The Contractor(s) should at a minimum:
  - Comply with all relevant national laws and legislations.
  - Include SEA/H and HIV prevention requirements in the site-specific construction Health and Safety management plan including aspects relating to preventing Gender-based Violence (GBV) and SEA/H and zero tolerance for these behaviors.
  - Ensure that workers are well briefed on the GBV and SEA/H requirements in the Health and Safety Plan.
  - Provide separate bathroom facilities for female and male workers.
  - Implement measures in the PNG COVID-19 ERP LMP.
  - Ensure a Code of Conduct is part of Workers contracts.

- **Underage Workers***.* Child Labour or forced labour is prohibited on the project. All contractors will need to maintain evidence that their staff are at least 18 years old.

6.4.3 Operational Phase

The potential negative impacts from the operations phase activities are:

- **Inadequate ESMP Implementation.** Implementation of the Incinerator ESMP will remain the responsibility of each PHA who will own and manage the incinerators. There are potential risks for inadequate implementation of the ESMP due to lack of capacity, training and budget for implementation of mitigation measures. Mitigation measures include:
  - Collaboration between different stakeholders in implementing the ESMP before construction work begins
  - Build capacity of PHA E&S Focal Point to monitor compliance on ESMP based on Project E&S Check List before construction begins
  - Adequate budget annually to meet responsibilities outlined in the Operations and Maintenance ESMP

[18] https://www.who.int/papuanewguinea/emergencies/covid-19-in-papuanewguinea/information/niupela-pasin

- **Audits on the ESMP.** Apart from implementing mitigation measures outlined in the ESMP, there is also potential risk for inadequate capacity to implement audits on ESMP. Mitigation measures include:
    - PHAs to work closely with the Provincial Environmental Office and CEPA to facilitate Environmental Audits against the Operational Phase ESMP and EP Conditions and budget for environmentally audit annually
    - Audits are to include (but not limited to), incinerator monitoring data, observations of waste segregation within facilities, and management of all incinerator residues. These will be undertaken by NDoH with regular reporting to WB.
    - NDoH PCU to collaborate with PHAs and Hospital E&S Focal Persons on ongoing ESMP responsibility including reporting to CEPA
    - E&S Focal Person to be trained on the ESMP and EP compliance requirements.

- **Air Pollution from the Incinerator.** Given the current practice of open burning and/or use of incinerators without scrubbers, the project is likely to result in an overall improvement of ambient air quality. Nevertheless, uncontrolled emissions from the incinerator could contribute to air pollution. The emissions testing carried out by the vendor on the incinerators without the scrubbing system show alignment with EU standards (which are referred to in the Draft Guidelines for Health-Care Waste Management in PNG) for the parameters tested (see Table 5). The WB EHS Guidelines for Health Care Facilities incinerator emissions levels are slightly different for most parameters and hence cannot be directly compared to the stack monitoring data provided by the vendor for most parameters. The measured carbon monoxide levels are above the levels provided in the EHS guidelines, albeit the EHS guidelines do not specify the averaging time the levels apply to. The EU guidelines provide values for various averaging times and the vendor monitoring data for carbon monoxide meets these targets. The use of the scrubbing system will further reduce emissions levels and therefore the data provided by the vendor is highly conservative and the actual emissions will be lower with the scrubbing system in place. Overall, the incinerators meet good industry practice and therefore will improve the ambient air quality at receptors providing the incinerators are operated and maintained correctly. Routine monitoring of emissions will be undertaken to check that the incinerator and scrubber are operating as expected. The key mitigation for managing this potential impact is the preparation and implementation of the Incinerator Operations Manual. This document will include:
    - Scheduled training and refresher training to sensitize workers on health care waste segregation at point of generation to ensure only combustible waste goes into the incinerator
    - Only qualified personnel are allowed to operate the incinerator
    - Operation of the incinerator to be conducted according to manufacturer's specifications
    - Loading of the incinerator to be in accord with manufacturer's specifications and only with permissible waste materials
    - Maintenance of the incinerator and air pollution control equipment to be undertaken in accord with manufacturers specifications
    - Adequately budgeting for fuel for the incinerators
    - Daily logs maintained for each "burn" – this to include type and volume of wastes processed, temperature operated at fuel consumption and monitoring data
    - Conducting monthly air quality monitoring. The community will also be informed of the results to alleviate concerns.

- Establishing optimal times for operating the incinerator based on local wind patterns to minimize dispersal of emissions onto populated areas

- **Inappropriate Management of Hazardous Materials**. Inadequate management of hazardous materials can result in pollution of land and water and pose OHS risks. In the context of incinerator operations, the most risk is posed from the transfer and storage of fuel that will be used to run the incinerators. Mitigation measures include:
  - Refueling procedures to be developed for filling the fuel tank.
  - Fuel tank to be above-ground on a hard stand area that drains to an oily water separator.
  - Fuel tank and pipes to be inspected regularly for leaks and/or corrosion.
  - Maintenance procedures for the incinerator to include use of drips trays, bunds, etc to capture minor spill and leaks.
  - Spill kit to be placed at the incinerator area and checked regularly.

- **Inappropriate Management of Hazardous Solid Waste**. Inadequate management of hazardous waste (e.g., ash from the incinerator) can result in pollution of land and water and pose OHS risks. Mismanagement of hazardous waste can also result in inappropriate wastes being placed in the incinerator (i.e., due to mis-labeling or contamination). Mitigation measures for mitigating this include:
  - All hospitals shall implement a HCWM SOP that:
    - Requires that receptacles for waste should be sized appropriately for the waste volumes generated, and colour coded and labelled according to the types of waste to be deposited.
    - Includes protocols for the collection of waste and transportation to storage/disposal areas in accordance with WHO guidance and the National Health care Waste Guidelines (Draft).
    - Includes training for staff in correct waste management including the segregation of wastes at the point of generation.
  - Systems for segregating all wastes generated at the facility to be implemented to ensure only approved wastes are incinerated.
  - Fly and bottom ash and other incineration residuals shall be disposed of in conjunction with the Town Council and/or in pits within the hospital grounds.
  - Procedures for handling and disposing of ash will be included in the Incinerator Operations Manual.

Inappropriate Management of Wastewater (Sludge). The wastewater from the scrubber is hazardous and it is acidic and contains contaminants (e.g., heavy metals). This wastewater will be treated to neutralize the pH and remove solids (as described in Section 3.2.3 and consistent with the 'Draft PNG National Health Care Waste Management Guidelines' and 'WBG EHS Guidelines for Healthcare Facilities') and then disposed of in absorption pits. Inadequate management of this wastewater and disposal of the solids could result in pollution of land, surface water and/or groundwater and pose OHS risks.

- Mitigation measures include:

- Monitor treatment chambers and to ensure early detection of problems and prevent leaks/spills.
- Ensure clean out of the chambers is adequately budgeted and planned for to facilitate regular cleaning of chambers.
- Handle and dispose of the solids collected in the treatment process in the same manner as the ash generated from the incineration process.
- Sensitize staff to avoid spillage of wastewater or solids on ground surface.
- Regular monitoring of the treated wastewater (including during commissioning) to check levels of heavy metals and pH against the effluent criteria in the 'WBG EHS Guidelines for Healthcare Facilities'. The community will also be informed of the results to alleviate concerns.

- **Fire Resulting in Injury and Pollution.** The potential for the incinerator to cause a fire, resulting in risk to workers and potential for pollution to air, land and/or water. Fire protection and preparedness measures include:
  - Provide training in fire avoidance and management to relevant staff.
  - Install firefighting equipment.
  - Ensure firefighting equipment are inspected semi-annually.
  - Conduct fire drills.
  - Appoint fire volunteer aiders.

- **Occupational Health and Safety Risks to Workers.** There are OHS and security risks for workers from operating the incinerator. These include handling of hazardous (and infectious waste, risk of burns from the incinerator. PHAs/Hospitals as mitigation measures, comply with GIIP regarding workers' safety and ensure OHS measures at a minimum:
  - Develop OHS guidelines, sensitize workers on regulations and use of PPE in relation to operations of the incinerator.
  - Issue helmet, goggles, mouth respirators, overcoat/overalls, heavy duty gloves, heat resistant apron and boots on needs basis
  - Sensitize workers on environmental and social impacts associated with incorrect incinerator operational practices
  - Appoint an IPC or OHS officer at site, who will have the authority to issue directives for the purpose of maintaining the health and safety of all personnel authorized to enter and or work on the incinerator site.
  - Prepare and implement a simple action plan to cope with risk and emergency (e.g., fire, earthquake)
  - Provide project workers with accessible means to raise workplace concerns.
  - Sensitize operators on importance of hand hygiene and ensure hand hygiene accessories are installed at Incinerator Site
  - Sensitize operators and arrange medical examinations prior to implementation or regularly. Operators should be provided the opportunity to be vaccinated against Hepatitis B and Tetanus
  - Train and Supervise Operators on correct operational procedures

- Ensure good housekeeping practice in incinerator shed and safe handling of electrical appliances
- Ensuring moving equipment transporting waste is outfitted with audible back-up alarms

- **Community Health and Safety.** Residential areas and other social spaces occupied by people at locations near the incinerators might be exposed to nuisance caused by the operations of the incinerator through air emissions and odor. This will likely be more prevalent for sites like Popondetta, Lorengau, Nonga, Tari, Boram, Buka, Mt Hagen, Goroka and Wabag Provincial Hospitals, as they are closer to residential areas. A lack of community support for the Project (e.g., due to grievances related to smoke and odour) could result in the incinerators not being used. The incinerator can pose a safety risk to the public should the public access the site. As a mitigation strategy, PHAs and Hospital Management should:
  - Maintain fencing around the HCWM area to prevent unauthorized access
  - Place signage on the fencing to alert the public to the dangers of the site
  - Implement measures relating to minimizing air pollution (see measures under "Air Pollution from the Incinerator")
  - Maintain a GRM to address any complaints from the community and sensitize the community about the GRM through community meetings
  - Take corrective operational actions to mitigate complaints

- **Compliance with Legal and Regulatory Requirements.** There is a risk of Non-compliance with the Legal and Regulatory Requirements, including Environment Permit Conditions. This could result in reputational damage and/or fines. The NDoH and PHAs should:
  - Appoint an Environmental Health Officer to oversee Permit Conditions and ensure Operations of the Incinerator comply with the conditions.
  - Ensure monitoring data on daily burn and monthly air monitoring data are adequately maintained for Environmental Auditing and Reporting Purposes
  - Ensure monitoring and data management on any other EP requirements
  - Allow for maintenance, training, monitoring, and auditing in annual budgets

- **Emergency Response Procedures**. Inadequate or lack of emergency response could exacerbate the impact of emergencies.
  - Include Emergency Response Procedure in HCWM SOP and Incinerator Operations Manual
  - Keep a record of the emergency service phone numbers and other means of contacting relevant organizations
  - Train staff on emergency response

6.5 Significance Assessment

The significance of the identified potential negative environmental and social impacts has been determined by assessing and rating the impacts using the available information, professional judgment and experience from similar development projects. The ratings are based on:

- Likelihood of occurrence (L) – a measure of the likelihood of the impact to occur
- Spatial Distribution (SD) - size of the area to be impacted

- Time (duration) of impact (TD) - the period of time over which the impact may occur.

The impact assessment does not take into consideration the implementation of the proposed mitigation (i.e., it is a pre-mitigation assessment) and therefore the actual impacts are likely to be less. The significance of the impact has been determined by the product of L, SD and TD. Table 13 provides the significance rating of the impacts of the construction and operation of the incinerators. The severity of impact was rated as Low or Moderate for all potential impacts/risks.

Table 13: Significance Rating of Negative Impacts Pre Mitigation

Potential Risks or Impacts	**Likelihood of Occurrence (L)** Very likely to occur=3 May occur=2 Unlikely to occur=1	**Spatial Distribution (SD)** Regional=3 National=2 Local=-1	**Time (Duration of Impact)** Long Term=3 Medium Term=2 Short Term=1	**Severity of Impact (LxSDxTD)** High: 8 to 27 Moderate: 4 to 7 Low: 1 to 3
Construction				
Inadequate compliance with the ESMP	3	1	1	3
Impacts on air quality, noise and vibration from minor works	1	1	1	1
Erosion and sedimentation	1	1	1	1
Inappropriate construction material supply	2	1	1	2
Damage to underground utilities from construction works	2	1	1	2
Traffic obstruction, congestion, and traffic and road safety	1	1	1	1
Damage to Cultural Heritage	1	1	1	1
Inadequate Waste Management	3	1	1	3
Land and Water Pollution by hazardous substances	2	1	1	2
Community Health and Safety	2	1	1	2
Workers Occupational Health and Safety	2	1	1	2
Workers accommodation and working conditions	1	1	1	1
Workers Infected with COVID-19	2	1	1	2
Sexual exploitation and abuse/ harassment (SEA/H) and HIV	2	1	2	4
Underage Workers	2	1	1	2
Operations				
Inadequate ESMP Implementation	3	1	1	3
Audits on the ESMP	2	1	1	2
Air Pollution from the Incinerator	3	1	1	3

Inappropriate Management of Hazardous Materials	2	1	1	2
Inappropriate Management of Hazardous Solid Waste	2	1	1	2
Inappropriate Management of Wastewater (Sludge)	3	1	1	3
Fire Resulting in Injury and Pollution	1	1	2	2
Occupational Health and Safety Risks to Workers	2	1	1	2
Community Health and Safety	2	1	1	2
Compliance with Legal and Regulatory Requirements	2	1	1	2
Emergency Response Procedures	3	1	2	4

7.0 ANALYSIS OF PROJECT ALTERNATIVES

7.1 No Project Alternative

A no project option is the least preferred from a public health and environmental perspective. A no project option would also continue the current negative risks and impacts to the community where infectious waste is disposed of in landfills and public dumps and burnt in open pits.

7.2 Incineration

Incineration is a dry oxidation process which reduces organic and combustible waste into inorganic incombustible matter at high temperature. The process is usually selected to treat wastes which cannot be recycled, reused or dumped in a landfill site.

Distinctive disadvantages of incineration including:

- Cost of construction, operation and maintenance, particularly of a purpose-built high temperature incinerator.
- Requirement of skilled operators.
- Emission of hazardous air pollutants if the incinerator is not properly designed or operated

On the other hand, incineration of health-care wastes provides the following advantages:

- Reduction in the mass and volume of wastes.
- Destruction of infectious organisms (pathogens) in infectious wastes.
- Destruction of pathological wastes (eg. human organs, body parts, animal carcasses) which are considered aesthetically objectionable. In addition, a purpose-built high temperature incinerator with flue gas cleaning can destroy hazardous chemical waste (e.g. cytotoxic, pharmaceutical and chemical wastes) to acceptable emission requirements.

Proper operation and management of high temperature incinerator is considered to be an effective method for the safe disposal of infectious and other hazardous health-care wastes.

7.2.1 Analysis of Alternatives to Incineration

An analysis of alternatives to incineration is provided below.

Open uncontrolled, non-engineered dumpsites. Untreated waste dumped into uncontrolled, non-engineered open dumps is common. This practice does not protect the local environment therefore should not be used. Discharging waste in open dumps either within the hospital grounds or in the town council facilities is seen to be an insufficient solution to waste treatment and contributes to more environmental pollution.

Sanitary landfill. Properly constructed and operated land fill sites offer an improved disposal route for municipal solid waste including healthcare wastes than uncontrolled landfills. Each day waste should be compacted and covered with soil to maintain sanitary conditions. The priority is protection in sanitary land fill sites is that of the water aquifers. However, these landfills do not exist in the regions where the incinerators are to be installed. This method requires a larger space for compaction of each day's waste.

Crude burning. Burning healthcare waste at low temperatures in the open should not be undertaken because this may release toxic pollutants into the air.

Microwaving. A microwave treatment system uses heat to decontaminate medical waste. These systems work best for waste that is not 100% dry or solid, as the moisture allows the heat to penetrate deeper, and the steam sterilizes. Microwave has significant electricity requirements. Microwaving Technology is easy, it reduces volume by 80%, is environmentally sound, has no liquid effluents and emissions are minimal. Cost associated with this technology is very high, it is not suitable for all types of waste, its shredder is noisy, and it produces offensive odors. The method is not suitable for all types of waste.

Autoclaves. An autoclave consists of a metal chamber sealed by a charging door and surrounded by a steam jacket. Steam is introduced into both the outside jacket and the inside chamber which is designed to withstand elevated pressures. Heating the outside jacket reduces condensation in the inside chamber wall and allows the use of steam at lower temperatures. Because air is an effective insulator, the removal of air from the chamber is essential to ensure penetration of heat into the waste. This is done in two general ways: gravity displacement or pre-vacuuming. A gravity-displacement (or downward-displacement) autoclave takes advantage of the fact that steam is lighter than air; steam is introduced under pressure into the chamber, forcing the air downward into an outlet port or drain line in the lower part of the chamber.

Advantages of Autoclaves:

- Steam treatment is a proven technology with a long and successful track record,
- The technology is easily understood and readily accepted by hospital staff and communities,
- It is approved or accepted as an alternative technology in various health settings,
- The time-temperature parameters needed to achieve high levels of disinfection are well established,
- Autoclaves are available in a wide range of sizes, capable of treating from a few pounds to several tons per hour,
- If proper precautions are taken to exclude hazardous materials, the emissions from autoclaves and retorts are minimal.
- Many autoclave manufacturers offer many features and options such as programmable computer control, tracks and lifts for carts,
- Permanent recording of treatment parameters, autoclave able carts and cart washers, and shredders.

The disadvantages include the following:

- They are expensive to install and maintain.
- The technology does not render waste unrecognizable and does not reduce the volume of treated waste unless a shredder or grinder is added,
- Any large, hard metal object in the waste can damage any shredder or grinder,
- Offensive odors can be generated but are minimized by proper air handling equipment,
- If hazardous chemicals such as formaldehyde, phenol, cytotoxic agents, or mercury are in the waste, these toxic contaminants are released into the air, wastewater, or remain in the waste to contaminate the landfill,
- If the technology does not include a way of drying the waste, the resulting treated waste will be heavier that when it was first put in because of condensed steam,
- Barriers to direct steam exposure or heat transfer (such as inefficient air evacuation; excessive waste mass; bulky waste materials with low thermal conductivities; or waste loads with multiple bags, air pockets, sealed heat-resistant containers, etc.) may compromise the effectiveness of the system to decontaminate waste.
- They require trained personnel to implement.

Autoclaving is a modern method of treating healthcare waste however this method could be too expensive to install and maintain, they are not common, and trained personnel to operate cannot be easily found. This, in addition to the above disadvantages rendered the technology not considerable.

Plasma Pyrolysis

Plasma pyrolysis is a modern technology for safe disposal of healthcare waste. An environmentally friendly technology that transforms organic waste into useful products. It is another type of thermal parsing of carbonaceous materials in oxygen. Plasma pyrolysis technology needs two chambers installed so that the primary chamber operates at a high temperature of 1,100ºC and secondary chamber ignition operates at 950 to 1,000ºC. Heat generated by the plasma can dispose of all types of waste, including municipal solid waste, biomedical waste, and hazardous waste in a safe and reliable manner.

Advantages include:

- Suitable for all types of wastes,
- Consumes less space,
- Environmentally sound,
- Not require chimney,
- Toxic residuals is much below,
- Not require segregation,
- Energy recovery,
- Reduce volume more than 99%

Disadvantages include:

- Requires technical persons,
- Cost is very expensive.
- They are not common.
- Large initial investment costs relative to that of alternatives, including landfill and incineration.
- Operational costs are high relative to that of incineration.
- Little or even negative net energy production.

- Wet feed stock results in less syngas production and higher energy consumption.
- Frequent maintenance and limited plant availability.

This technology could not be considered because of the high cost involved including other disadvantages highlighted above.

7.3 Project Site Selection Alternatives

All sites have been selected by the Health Facility Branch. At 19 of the 21 hospitals, the current waste management areas have been selected for installation of the new incinerators and in some instances, they will replace an existing (dysfunctional) incinerator .The main reasons for locating incinerators at the existing sites are the cost implications for any new site associated with fencing, transportation distance, security, water connections, and power connectivity. It is also more practicable to have all the hospital waste management facilities in one location. The placement of incinerators outside of the land already leased by the hospitals can be problematic due to the customary land ownership laws in PNG, limited availability of alienated land and time constraints of the Project. Sites away from the main hospital complex were selected for Kerema Provincial Hospital and Alotau Provincial Hospital due to limited space within the main hospital complex. Both sites are on land under management of the PHAs.

Nevertheless, future long-term planning for healthcare waste management facilities beyond this Project should consider using sites away from populated areas.

Advantages

- Advantages for relocating incinerator sites to alternative sites includes reducing environmental impacts (odor and air emissions) on the hospital workers, patients, and residents near the existing sites

Disadvantages

- Distance at which hazardous waste will be transported poses risks to the community
- Risks to the community exposure to hazardous waste
- Security risks of the incinerator facility (e.g., risk of vandalism) and operators considered high at remote sites
- Additional project costs for electricity connections, and water connections and road connections (e.g., access roads may be required)
- Additional operational costs associated with transportation of the waste
- Time required for planning purposes, and potential need for land acquisition (which would make the subproject ineligible for funding under the PNG COVID-19 ERP).

7.4 Management of scrubber slurry (wastewater)

The incinerator scrubber produces a hazardous liquid waste, as described in Section 3.2.3. Various alternatives for treatment of this waste were investigated as part of project planning, and include:

No treatment. The no treatment option was considered, despite the environmental and social risks it would pose. This option was considered to reduce burden on the PHAs from aspects such as:

- operational costs and logistical issues of procuring the limestone for the treatment systems

- operational costs and logistics issues with sending the treated wastewater samples to the laboratory for testing/monitoring
- complexity of maintaining the treatment system and capacity of the incinerator operators.

Due to the potential environmental and social impacts of disposing of the untreated wastewater, this option was discounted, and the Project decided to proceed with a treatment system, acknowledging that the PHAs would need to plan and budget for the operational costs associated with the treatment system, and ensure the incinerator operators were provided with adequate training.

Three-chamber filtration system. The NDOH team designed a wastewater treatment process that involves passing the water through three chambers that would allow solids to settle in the base of each chamber, with the chambers fitted with drain values and sediment collection beds for ease of cleaning and maintenance. The chambers also included neutralizing media (e.g., limestone) to neutralize the pH of the wastewater and aid in the precipitation of dissolved contaminants. This system is a viable option for the Project, and it was only discounted because a similar design suggested by UNOPS (and adopted by the Project) was tried and tested with UNOPS having used it successfully on similar projects.

Neuratank. The neuratank treatment system was the selected design for treatment of the scrubber slurry. It is described in Section 3.2.3 and shown on Figure 6. This system was selected as it has been used successfully by UNOPS on previous projects, and therefore seen as a safer option compared to the three-chamber filtration system.

8.0 ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

8.1 Overview

This chapter describes the way the environmental and social impacts identified in Chapter 6 will be managed, including mitigation measures, responsibilities for implementation, budget requirements, verification, auditing, reporting and proposed environment monitoring.

Other documents that provide additional information for managing environmental and social risks and impacts associated with the Project include:

- **Subproject-specific ESIA/ESMPs** (Annex 1 to Annex 21) - these documents provide additional site-specific requirements.
- **HCWM SOP** – this key document will be prepared and implemented by each of the Provincial Hospitals. It will outline a system improvement to mandate color coded receptacles and bin liners, labelling of receptacles, bin liners and wheeler bins, proper segregation of waste at source, etc. This document must be implemented prior to the incinerators being commissioned. Training is proposed to be provided to the representatives from each PHA in August 2023 in Port Morseby. This training will include preparation of a HCWM SOP for each hospital.
- **Incinerator Operations Manual** – this key document will be the manual the incinerator operators follow to ensure the incinerators are operated and maintained safety and according to the vendor's specifications. It will include training requirements, correct operation (including not exceeding loading standards and what waste types can/cannot be incinerated), documentation requirements (e.g., for each load), troubleshooting, maintenance requirements (e.g., daily, weekly, fortnightly, etc.), training, ash disposal, sludge disposal, record keeping (e.g., waste records, burn temperature, smoke color, fuel usage, etc.), air emissions monitoring and treated wastewater monitoring. This document will be prepared by UNOPS prior to commissioning of the incinerators and implemented by each of the Provincial Hospitals.
- **Construction ESMPs** – the CESMPs will be prepared by each contractor and identify environmental and social risks related to the task the contractor has been employed for and specify the mitigation measures, monitoring and reporting etc. Importantly, as a condition of engagement for this project, all contractors will ensure that there are clear statements as to compliance with all aspects of WB requirements (e.g., LMP, grievance mechanisms etc).
- **Emergency Response manual** - the NDoH will be responsible for the preparation of an emergency response manual that will contain the requirements as specified in the WB's ESF. This manual will be prepared prior to the commencement of any constructions works (including site preparation). and detail all aspects of emergency prevention and preparedness and response arrangements to emergency situations. The manual will also detail reporting to WB and other relevant stakeholders as to compliance and/or any issues that have occurred (regardless of perceived level of the incident). NDoH will also ensure that all appointed contractors prepare and submit for approval a similar document to address the scope of works that the contractor has been engaged for prior to the commencement of any works.
- **PNG COVID-19 ERP ESMF** – this document provides the framework for how E&S issues will be managed for the overall PNG COVID-19 ERP and includes an ESIA template.
  PNG COVID-19 ERP LMP – this document provides the labour management requirements for the overall PNG COVID-19 ERP.

- **PNG COVID-19 ERP SEP** – this document provides stakeholder engagement requirements for the overall PNG COVID-19 ERP.

8.2 Mitigation Measures

The mitigation measures for managing the impacts identified in Chapter 5 are provided in Table 14 (Construction Phase) and Table 15 (Operations). These are provided with the responsibilities for implementation, timeframe for implementation, budget required and verification method/s.

Table 14: Mitigation Measures - Construction Phase

Key Activities	Potential Environment and Social Risks and Impacts	Proposed Mitigation Measures	Responsibility	Timeframe	Budget (PGK)	Verification
ESMP Implementation to manage E&S risks and impacts for construction activities	Inadequate ESMP implementation results in E&S impacts	● Collaboration by all project stakeholders in implementing the ESMP ● Contractors to develop and implement CESMPs in compliance with this ESMP to be included in bidding documents ● NDOH to review, approve and monitor implementation of the CESMPs ● NDOH to ensure contractors have suitable experienced personnel to implement ESMP requirements and/or to provide training and capacity building as required	NDoH E&S Specialist Contractors NDoH PCU/Contractor	Contractor CEMPs to be in place prior to works commencing and implemented during the entire construction phase	Included in Contractors budget	Compliance against this ESMP E&S Risk Management conditions to be included in bidding documents Contractor CESMPs approved Inspections completed by NDoH/PHA E&S Focal Officer during construction activities
General Construction activities	Workers Occupational Health and Safety – risk of injury/fatality	● Contractor OHS management plan(s) to be developed and submitted for approval prior to the commencement of construction works by the contractor, and construction works completed accordingly. ● The Contractor OHS plan will include training requirements, including on topics such as safe work practices, emergency procedures for fire, evacuation and natural disaster. ● Induction briefing will be conducted to explain all potential risks and impacts for this project as well as the correct management processes as well as responsibilities of all personnel working on this project. ● Clear communication of risks and prevention measures will be included in training activities. ● Obligations under the WB EHS Guidelines, relevant Good International Industry Practice (GIIP), and legislation will be included in the ESMPs and fully enforced by including obligations in the contract. ● Establishment of worker grievance management procedures. These will be included in training as well as signage posted around construction areas advising as to the procedures. ● Provision of appropriate PPE for workers ● Provision of first aid and trained first aid officers. ● Signage advising as to what PPE is required and other safety related instructions (eg., hazardous areas, electric cord placement, trenches, fall from height risks) placed in relevant areas around the site (eg., lunch rooms). ● Frequent site inspections to ascertain compliance with EHS requirements. ● Measures for fall prevention relating to working at heights (e.g., use of scaffolding, harnessing, etc.). ● Measures for excavations (e.g., shoring up pits, preventing workers from falling into pits, etc.).	NDoH PCU/Contractor	Contractor OHS management plan to be in place prior to works commencing and implemented during the entire construction phase	Included in Contractors budget	Compliance against this ESMP OHS Risk Management conditions to be included in bidding documents Contractors OHS management plan Inspections completed by NDoH/PHA E&S Focal Officer during demolition activities

		● Bidding and Contractual documents will be incorporate above and will be legally binding. ● Training of workers in lifting and materials handling techniques in construction and decommissioning projects, including the placement of weight limits above which mechanical assists or two-person lifts are necessary. ● Planning work site layout to minimize the need for manual transfer of heavy loads. ● Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths. ● Cleaning up excessive waste debris and liquid spills regularly. ● Locating electrical cords and ropes in common areas and marked corridors. ● Provision of and training in fall prevention and arrest systems. ● Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle. ● Ensuring moving equipment is outfitted with audible back-up alarms. ● Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations. ● Traffic management plans will be required to be prepared and submitted for approval by all contractors (or a joint plan). ● Traffic management personnel to be employed. ● First Aid area will be properly demarcated. ● OHS Officers will be trained and their activities will be monitored to ensure compliance with all OHS requirements.				
General Construction activities	Air quality, noise, and vibration generated from minor civil works	<u>Air Quality:</u> The contractor undertaking works shall implement dust suppression measures (e.g. covering of material stockpiles, etc.) as required. At a minimum the following is required: ● Materials used shall be covered and secured properly during transportation to prevent scattering of soil, sand, materials, or generating dust; ● Keep stockpile of aggregate materials covered to avoid suspension or dispersal of fine soil particles during windy days or disturbance from stray animals; ● Minimize dust from exposed work sites by applying water on the ground regularly; ● No burning of site clearance debris (trees, undergrowth) or construction waste materials; ● Hydrocarbons shall not be used as a method of dust control; and	Contractor	Throughout Construction Phase	Included in Contractor budget	CESMP Compliance Reporting Dust Suppression Measures in place GRM in place Records of related grievances addressed

		● Immediately re-vegetate and/or stabilize exposed areas. <u>Noise and vibration:</u> The contractor(s) undertaking works shall implement the following at a minimum: ● Plan activities in consultation with communities so that noisiest activities are undertaken during periods that will result in least disturbance; ● Noise levels should be maintained within the national permissible limits/standards; ● If necessary, use temporary noise-control methods such as fences, barriers or deflectors (such as muffling devices for combustion engines) and select equipment with lower sound power levels where possible; ● Minimize transportation of construction materials through community areas during regular working time; and ● Maintain a buffer zone (such as open spaces, row of trees or vegetated areas) between the project site and surrounding areas if possible, to lessen the impact of noise. ● Works to only be undertaken during day/light hours. A communication strategy will be developed and implemented to advise affected people or organisations of stages of construction and timeframes as well as dates/times of activities that have the potential to impacts on them. The communication strategy (including aspects of the grievance process as below), will be provided in all appropriate languages and delivered via such means as flyers. Details of grievance process will also form part of the communication strategies. A grievance process will be established to enable members of the community (including all neighbouring facilities), impacted by noise to communicate their complaints. The grievance process will also allow for sectors of the community to request periods when noise will be limited due to various activities such as exams.				
General Construction – Foundation excavation, slab construction	Soil erosion causing impacts to surface or groundwater.	The contractor(s) undertaking works shall implement the following at a minimum: ● Implement suitable project design (e.g., establish appropriate erosion and sediment control measures) to minimize soil erosion; ● Scheduling to avoid heavy rainfall periods, where practicable; and ● Use mulch, grasses or compacted soil to stabilize exposed areas promptly.	Contractor	During Construction	Included in budget	Sedimentation Controls
Construction - Material Supply, Transport and Storage	Contribute to unsustainable extraction of	The contractor(s) undertaking works shall at a minimum: ● Source raw materials locally (where practicable) from licensed/permitted facilities only.	Contractor	Construction Phase	Included in budget	Records (invoices) of materials purchased

	resources, sedimentation	● Using recycled or renewable building materials (e.g., timber) where practicable. ● Store sand, gavel, etc in shallow stockpiles in manner than prevents run-off. ● Transport sand, gravel, etc in a manner that prevents generation of dust and hazardous to other road users.				
General Construction Activities – Traffic and Road Safety	Impacts on local communities from traffic obstruction, congestion, and traffic and road safety.	The contractor(s) undertaking works shall implement the following at a minimum: ● Develop a traffic management procedure ● Minimize the extent of traffic and construction impacts on adjacent inpatient wards and other residential areas where possible; and ● All traffic signs used for the warning or direction of traffic at road works sites shall comply with appropriate traffic regulations.	Contractor	Construction Phase	Included in budget	Traffic Management procedure
General Construction Works involving Excavation	Damage to cultural heritage.	The contractor(s) shall have a Chance-Finds Procedure in place prior to works beginning.	Contractor Site Engineer NDoH E&S Specialist	Construction Phase	Included in budget	Chance Find Procedure (example from PNG COVID-19 ERP ESMF is included in each subproject-specific ESMP)
General Construction Works involving Excavation	Damage to underground utilities from construction works	Excavation works must be done by hand.	Contractor	Construction Phase	Included in budget	Included in Work Method Statement
General Construction Works – Waste Management	Land and/or water pollution generated (solid, hazardous, and wastewater)	The contractor(s) undertaking works shall implement the following at a minimum: ● Implement strategies to avoid/reduce waste generation in the first instance ● Develop and follow a brief site-specific Waste Management Plan (separation of waste streams, storage, provision of bins, site clean-up, bin clean-out schedule, etc.) before commencement of any financed works ● Use litter bins, containers and waste collection facilities at all places during works; ● Store solid waste temporarily on site in a designated place prior to off-site transportation and disposal through a licensed waste collector; ● On-site and off-site transportation of waste should be conducted to prevent or minimize spills, releases, and exposures to employees and the public; ● Dispose of waste only at designated place identified and approved by local authority. Open burning or burial of solid waste at the hospital premises shall not be allowed. It is prohibited for the contractor(s) to dispose of any debris or construction material/paint in environmentally sensitive areas (including watercourses); ● Recyclable materials such as packaging material etc., shall be segregated and collected on-site from other waste sources for reuse or recycle (where practicable);	Contractor	Construction Phase	Included in budget	Contractor Waste Management Plan Records of waste disposal

		● Ensure onsite any temporary worker latrine/s (if required for the Project) are properly operated and maintained to collect and dispose of wastewater ● Minimize hazardous waste generation by ensuring hazardous waste is not co-mingled with non-hazardous waste. Collect, transport and disposal of hazardous waste to licensed/permitted hazardous waste sites only following good international industry practice for the waste being handled ● Design training for staff in the segregation of wastes.				
General Construction Activities – Hazardous Materials Management	Land and/or water pollution from use and storage of hazardous substances e.g. fuel, oils, lubricants.	The contractor(s) undertaking works shall implement Spill Control Measures and undertake the following at a minimum: ● Use impervious surfaces for refueling areas and other fluid transfer areas ● Ensure that refueling and maintenance facilities are not located, or that activities do not take place, within 30 m of a watercourse, or in ecologically sensitive areas. If a 30 m limit is impracticable then a lesser limit may be adopted provided approval is obtained. On no account shall the limit be less than 10 m; ● Ensure that vehicles and plant are not stored within 30 m of a watercourse, or in ecologically sensitive areas, overnight or when not in use; ● Regular checks for leaking oil or fuel from machinery undertaken. Any leaks are promptly repaired and/or parts replaced within two days as part of maintenance of vehicles and equipment; ● Training workers on the correct transfer and handling of fuels and chemicals and the response to spills; and ● Spill kits, appropriate to the hazardous materials being used, to be kept on-site and workers to be trained in its deployment.	Contractor(s)	Construction Phase	Include in Contractors budget	Training records Spill kits on site Spill prevention measures in CESMPs
Handling Hazardous Waste during demolition of old incinerator facilities (for Popondetta, Angau, Modilon and Kundiawa only)	Land and/or water pollution from hazardous wastes such as asbestos, lead paints, SMF, ozone depleting substances that may be present in old health-care facilities or construction debris.	The Contractor(s) undertaking the works inspect demolition waste to identify presence of ACM or other hazardous materials prior to demolition. Then the Contractor(s)consider presence of asbestos and ensure the following measures are undertaken; ○ Conducting a building and incinerator inspection survey to identify asbestos containing materials or other hazardous materials present prior to demolition. ○ Dispose all asbestos containing materials according to WBG/IFC EHS Good Practice Note on Asbestos: Occupational and Community Health issues, WBG General EHS Guidelines April 2007 P34 & P37 and CEPA Requirements. ○ The above requirement should be included in bidding documents. ○ The contractor(s) undertaking works shall be required to do the following at a minimum: ○ Hazardous material assessment & management procedure detailed in the Construction Waste Management Plan(s) to be developed prior to project commencement by the contractor in accordance with good GIIP.	Contractor(s)	Construction Phase	Included in Contractor budget	Inclusion of requirements regarding ACM disposal in CESMPs and in Bid Documents Construction Waste Management Plan CESMPs

		○ Asbestos containing materials managed in accordance with GIIP such as WBG guidelines on asbestos management. ○ Safe removal of any asbestos-containing materials or other toxic substances shall be performed and disposed of by specially trained workers in line with the WBG guidelines on asbestos management. ○ All asbestos waste and products containing asbestos is to be sealed by double wrapping/bagging in plastic and then buried in a concrete lined pit within the hospital grounds. It shall not to be tampered or broken down to ensure no fibres are airborne. ○ No asbestos containing materials should be used for construction or renovation works. Dispose of the old incinerators and scrubbers, where required, in an environmentally sensitive manner in agreement with PHA and local authority. Disposal could involve, for example: ○ Encasing and burying the hazardous components within hospital grounds (e.g., beneath the new incinerator), and disposal of other components within local tip. ○ Transporting the old incinerators (or just hazardous components) to Port Moresby for disposal at licenced facility.				
General Construction Works – Management of Community Health and Safety during Construction Work	Health and Safety risks for community, health staff, patients and their relatives from construction activities.	The contractor(s) undertaking works shall implement the following at a minimum: ● Develop and follow a brief site-specific construction health and safety (OHS) Management plan which includes health and safety measures for community, health staff, patients and their relatives. ● Comply with all national and good practice regulations regarding health workers' safety and the Project's LMP; Take protective measures to prevent accidents such as: ○ Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths. ○ Locating electrical cords and ropes in common areas and marked corridors. ○ Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic ○ Ensuring moving equipment is outfitted with audible back-up alarms. ○ Provide safe access routes and other safety measures as appropriate during works such first aid kits, restricted access zones, warning signs, covering openings to small confined spaces, overhead protection against falling debris, lighting system to	Contractor(s)	During Construction Phase	Included in Contractor budget	Construction OHS Management Plan SEP and GRM Traffic Management Plan Appropriate High Visibility PPE for Traffic Control Worker

		protect community, hospital staff and patients against construction risks; and ○ Grievance Redress Mechanism (GRM) developed and made operational in accordance with the Project SEP.				
Construction Work- Management of Workers working and living conditions	Issues related to inappropriate worker accommodation resulting in easy transmission of COVID-19 and/or not facilitate the workers decent rest	The contractor(s) undertaking works shall comply with all national and good practice regulations regarding workers' safety by implementing the following at a minimum: ● Wash stations should be provided at the site, with a supply of clean water, liquid soap and paper towels (for hand drying), with a waste bin (for used paper towels) that is regularly emptied. Wash stations should be located wherever there is a toilet, canteen/food and drinking areas and at waste stations. Where wash stations cannot be provided (for example at remote locations), alcohol-based hand rub should be provided. ● Accommodation for non-local workers that meets needs of workers and facilities rest (e.g., no 'hot bedding', drinking water, washing, bathroom facilities etc.) and is in a clean and hygienic state. ● Undertaking health awareness and education initiatives with construction workers e.g. providing information on COVID-19 symptoms, transition paths etc.	Contractor	Construction Phase	Include in Contractor budget	Accommodation Safety Checklist
Construction Work – Labour Issues	There is some risk related to workers exposure to COVID-19 at work	Site specific OHS Management Plans will include Training and Awareness on COVID-19 with emphasis to workers following the WHO PNG Nupela Pasin or the New Normal Guidelines[19] for reducing risk of COVID 19 infection	Contractor NDoH E&S Specialist	Construction Phase	Include in Contractors budget	Construction OHS Management Plan to include COVID-19 prevention measures
Construction Work - Managing any case of Sexual exploitation, abuse and harassment and HIV relating to Project Workforce	Increase in sexual exploitation and abuse/ harassment (SEA/H) and HIV related to project workforce	The Contractor(s) should at a minimum: Comply with all relevant national laws and legislations. ● Comply with all relevant national laws and legislations. ● Include SEA/H and HIV prevention requirements in the site-specific construction Health and Safety management plan including aspects relating to preventing GBV and SEA/H and zero tolerance for these behaviors. ● Ensure that workers are well briefed on the GBV and SEA/H requirements in the Health and Safety Plan. ● Provide separate bathroom facilities for female and male workers. ● Implement measures in the PNG COVID-19 ERP LMP. ● Ensure a Code of Conduct is part of Workers contracts.	Contractors NDoH E&S Specialist	Construction Phase	Include in Contractors budget	GBV and SEA/H Management in Construction OHS Management Plan
Construction Work - Managing incidences of Underage Workers on Construction Work Team	Presence of Underage Workers	Child labour or forced labour is absolutely prohibited on the project. All contractors will need to maintain evidence that their staff are at least 18 years old.	Contractor NDoH E&S Specialist	Construction Phase	Include in Contractors budget	LMP No Child at Work Records of staff age

[19] https://www.who.int/papuanewguinea/emergencies/covid-19-in-papuanewguinea/information/niupela-pasin

Table 15: Mitigation Measures – Operations

Key Activities	Potential Environment and Social Impact	Proposed Mitigation Measures	Responsibility	Time Frame	Budget (PGK)	Verification
ESMP implementation	Inadequate implementation of the ESMP	● Collaboration between different stakeholders in implementing the ESMP ● Engagement with the PHAs on EP Conditions ● Memorandum of Agreement between NDoH and PHA on ongoing maintenance of the PHA ● Memorandum of Agreement between NDoH and PHA on Annual Permit Fee	NDoH	All Project Stages	NDoH PCU Costs	SEP MOAs in place
Environmental audits	Inadequate capacity to implement audits on ESMP	● Environmental Audits to be carried out against the Operational Phase of the ESMP and EP Conditions ● PHAs to work closely with the Provincial Environmental Office and CEPA to facilitate Environmental Audits against the Operational Phase ESMP and EP Conditions and budget for environmentally audit annually ● Audits are to include (but not limited to), incinerator monitoring data, observations of waste segregation within facilities, and management of all incinerator residues. These will be undertaken by NDoH with regular reporting to WB. ● NDoH PCU to collaborate with PHAs and Hospital E&S Focal Persons on ongoing ESMP responsibility including reporting to CEPA ● E&S Focal Person to be trained on the ESMP and EP compliance requirements.	PHA/CEPA	Annually	20,000	Compliance with license conditions and ESMP requirements
Operation of incinerators	Air Pollution from the incinerator and Operational Risks	The PHAs to ensure that an Incinerator Operations Manual is in place and includes: ● Scheduled training and refresher training to sensitize workers on health care waste segregation at point of generation to ensure only combustible waste goes into the incinerator ● Only qualified personnel are allowed to operate the incinerator ● Operation of the incinerator to be conducted according to manufacturer's specifications ● Loading of the incinerator to be in accord with manufacturer's specifications and only with permissible waste materials ● Maintenance of the incinerator and air pollution control equipment to be undertaken in accord with manufacturers specifications ● Adequately budget for fuel for the incinerators ● Daily logs maintained for each "burn" – this to include type and volume of wastes processed, temperature operated at fuel consumption and monitoring data ● Conduct monthly air quality monitoring and communicate results to community ● Establish optimal times for operating the incinerator based on local	PHA	Annually Proponent	Costs to be captured in Annual PHA Budget	Daily logs and emission data – this latter aspect compared with license conditions Grievances related to air quality

		wind patterns to minimize dispersal of emissions onto populated areas				
Operations phase – refueling and maintenance works	Inadequate management of hazardous materials can result in pollution of land and water and pose OHS risks	● Refueling procedures to be developed for filling the fuel tank. ● Fuel tank to be above ground on a hardstand area that drains to an oily water separator. ● Fuel tank and pipes to be inspected regularly for leaks and/or corrosion. ● Maintenance procedures for the incinerator to include use of drips trays, bunds, etc to capture minor spill and leaks. ● Spill kit to be placed at the incinerator area and checked regularly.	PHA			Procedure for refueling Records of fuel tank and pipe inspections
Operation phase – Management of Hazardous Solid Waste	Inadequate Management of hazardous waste	● All hospitals shall implement a HCWM SOP that: ○ Requires that receptacles for waste should be sized appropriately for the waste volumes generated, and colour coded and labelled according to the types of waste to be deposited ○ Includes protocols for the collection of waste and transportation to storage/disposal areas in accordance with WHO guidance and the National Health care Waste Guidelines (Draft) ○ Includes training for staff in correct waste management including the segregation of wastes at the point of generation ● Systems for segregating all wastes generated at the facility to be implemented to ensure only approved wastes are incinerated. ● Fly and bottom ash and other incineration residuals shall be treated as hazardous waste and be disposed of in concrete-lined pits within the hospital grounds. ● Procedures for the safe handling and disposal of incinerator ash will be included in the Incinerator Operations Manual.	NDoH and the PHAs	Continuous	Costs to be captured in Annual PHA Budget	HCWM SOP Procedure for ash disposal to included in Incinerator Operations Manual Records of waste treatment and disposal Record of ash disposal
Operation phase – Management of Wastewater (Sludge)	Inadequate handling/management of liquid waste from the scrubbers	● Conduct monitoring of the treated wastewater and communicate results to community ● Monitor treatment chambers to ensure early detection of problems and prevent leaks/spills. ● Ensure clean out of the chambers is adequately budgeted and planned for to facilitate regular cleaning of chambers. ● Handle and dispose of the solids collected in the treatment process in the same manner as the ash generated from the incineration process. ● Sensitize staff to avoid spillage of wastewater or solids on ground surface.	PHAs	Continuous	Costs to be captured in Annual PHA Budget	Records of checking treatment system
Operation phase	Lack of Fire protection preparedness	Fire Preparedness should form part of the Emergency Response Procedures in the HCWM SOP; PHAs should ensure; ● Firefighting equipment in inserted into the Incinerator Shed	PHAs	During operation phase	Costs to be captured in	Fire safety preparedness and Emergency Response Procedures

		● Firefighting equipment are inspected semi-annually and replaced as necessary ● Conduct fire drills ● Appoint fire volunteer aiders			Annual PHA Budget	
Operation phase – Handling of Health Care Waste	Occupational Health and Safety of Workers involved in healthcare waste handling	Occupational Health and Safety of Operators should form part of the HCWM SOP and Incinerator Operations Manual. ● Develop occupational health and safety (OHS) guidelines, sensitize workers on regulations and use of PPE in relation to operations of the incinerator. ● Issue helmet, goggles, mouth respirators, overcoat/overalls, heavy duty gloves, heat resistant apron and boots on needs basis ● Sensitize workers on environmental and social impacts associated with incorrect incinerator operational practices ● Appoint an IPC or OHS officer at site, who will have the authority to issue directives for the purpose of maintaining the health and safety of all personnel authorized to enter and or work on the incinerator site. ● Prepare and implement a simple action plan to cope with risk and emergency (e.g., fire, earthquake) ● Provide project workers with accessible means to raise workplace concerns. ● Sensitize operators on importance of hand hygiene and ensure hand hygiene accessories are installed at Incinerator Site ● Sensitize operators and arrange medical examination prior to implement or regularly. Operators should be provided the opportunity to be vaccinated against Hepatitis B and Tetanus ● Train and Supervise Operators on correct operational procedures ● Ensure good housekeeping practice in incinerator shed and safe handling of electrical appliances ● Ensuring moving equipment transporting waste is outfitted with audible back-up alarms	PHA	During operation	Costs to be captured in Annual PHA Budget	OHS Training
Operation phase - Community Health and Safety	nuisance caused by the operations of the incinerator through air emissions and odor; incinerator area a safety risk to the public	● Maintain fencing around the HCWMA to prevent unauthorized access ● Place signage on the fencing to alert the public to the dangers of the site ● Implement measures relating to minimizing air pollution (see measures under “Air Pollution from the Incinerator”) ● Maintain a Grievances Redress Mechanism to address any complaints from the community and sensitize the community about the GRM through community meetings ● Take corrective operational actions to mitigate complaints ● Provide awareness to nearby community on the results of the environmental monitoring undertaken	PHAs	During operations	Included as part of maintenance budget	Fencing and signage in place and in good repair Grievance records

Operation phase – EP Permit Compliance	Lack of Compliance to the Legal and Regulatory Requirements as mentioned in the ESMP and described in the EP Conditions	Lack of compliance will result in Penalties applied by CEPA. As a minimum the PHA should; ● Appoint an Environmental Health Officer to oversee Permit Conditions and ensure Operations of the Incinerator comply with the conditions. ● Ensure monitoring data on daily burn and monthly air monitoring data are adequately maintained for Environmental Auditing and Reporting Purposes ● Ensure monitoring and data management on any other EP requirements	NDoH and the PHAs	During construction and operation of the Incinerators	Include allowance in Annual Budgets for breach of Permit Conditions	Data maintained Environmental Health Officer appointed
Operation phase – Emergency Response	Inadequate or lack of Emergency Response Procedures	PHA to ensure Emergency Response Procedure captured in the HCWM SOP and Incinerator Operations Manual is applied; ● Keep emergency contact details such as names and numbers ● Train staff on emergency response	NDoH	During construction and operation of the incinerator	Any ERP Incident costs to be included in PHA Costs	Emergency Response Procedures in the HCWM SOP and Incinerator Operations Manual

8.3 Responsibilities for Implementation of the ESMP

The main organizations involved in the implementation of this ESMP are NDoH; the PHAs; UNOPS and their subcontractors. Each of these organizations and key roles within the organization are described in the following sections. The roles of external organizations are also provided.

8.3.1 The National Department of Health

The NDoH will undertake the following responsibilities during the construction phase:

- The NDoH Health Facility Branch Manager and the NDoH PCU Coordinator in consultation with the Contractor are charged with the responsibility of coordinating all matters pertaining to the implementation of the project.
- The NDoH Project Coordination Team will work with the Contractors Engineer/Environment and Social Experts to ensure compliance with the CESMP.
- The NDoH PCU will work with the PHA Public Health Directors will ensure Provincial Hospital Environmental Officers or similar are assigned to oversee compliance monitoring by the Contractors and report to the NDoH E&S Specialist on a weekly basis.
- The NDoH PCU E&S Specialist together with the NDoH Facility Branch will ensure that the following are delivered:
    - An inspection tool/ checklist based on the ESMP and inspection program.
    - Monthly site meetings involving the NDOH, PHAs, the contractor and any applicable key stakeholders.
    - Provide monthly reports to WB on the progress of the project as well as any incidents and/or grievance reports.

The NDOH will be responsible for the start of operation of the Project (one year from the grant of the Environment Permit) and then hand over responsibility for implementation of the operational aspects of the ESMP to the PHAs.

8.3.2 Construction Contractor (UNOPS) and their Subcontractors

The construction contractor (UNOPS) and their subcontractors are expected to integrate environmental and social focus in their Project Management Plan to ensure effective implementation of the projects impacts mitigation measures, therefore, the contractor will mobilize an in-house Environment and Social Expert with the following responsibilities:

- Evaluate and review the ESMP developed from the main ESIA process and internalize the provisions for implementation based on the realities of each project.
- Customize the Project-wide ESMPs and subproject-specific ESMPs to generate CESMPs for each site. The CESMP is to identify environmental and social risks related to the task the contractor has been employed for and specify the mitigation measures, monitoring and reporting etc. Importantly, as a condition of engagement for this project, all contractors will ensure that there are clear statements as to compliance with all aspects of WB requirements (e.g., labour management procedures, grievance mechanisms etc). Key requirements will include:
    - Identification of potential impacts and development and implementation of strategies to avoid them being realised or mitigated
    - Incident monitoring, review and reporting
    - Development of an emergency response plan to manage incidents
    - Regular reporting through NDoH to WB on any incidents.
- Procure necessary equipment for implementing mitigation measures.

- Monthly reporting throughout the project period to the NDoH and PCU E&S Specialist who will submit these reports to WB.
- Set up a Site Specific GRM and a GRM Committee to resolve any construction related grievances.
- Ensure all subcontractors meet project requirements.

8.3.3 Provincial Health Authorities

The PHAs will appoint an Environmental Health Officer (EHO) or similar to act as the E&S Officer responsible for providing weekly briefings on E&S matters for the benefit of the PHA and NDoH. The EHO will report to the PHA Public Health Director. The EHO will:

- Work in close collaboration with the NDoH E&S Specialist Officer on all matters relating to the ESMP during construction work on the Incinerators.
- Provide oversight on the Operational ESMP and Environmental Permit conditions and report to the PHA through the Public Health Director, to CEPA and to NDoH.
- Organize stakeholder meetings for briefing on Project Updates in consultation with the PCU Safeguards Specialist
- Be the focal point for all project related grievances and work closely with other stakeholders to receive and process any grievances associated with the incinerators site construction and decommissioning work and eventual operations.
- Be an active member of the Site Grievances Redress Committee
- Provide monthly reporting throughout the project period to the PCU E&S Specialist who will submit these reports to WB.

The PHAs will be responsible for the operation of the Project.

8.3.4 External Organizations

External organizations that will play a role in the project include:

- **CEPA** - Their role is to ensure compliance with the Environmental Permit conditions, environmental audit monitoring and investigate any grievances raised to their level by any stakeholder who might have grievances against the project. The CEPA will also be invited to attend monthly project meetings.
- **Provincial Environment and Climate Change Office** - Provincial Environmental Office will also be involved in overseeing EP conditions compliance as a subordinate to CEPA.
- **Provincial Labor Office** - The Labor Authorities might be involved in the surveillance of public and occupational health aspects of the project.
- **The Town Authorities** - Will be involved on monthly stakeholder meetings and be involved in public concerns about public landfill issues
- **Utility Service Organizations** – Organizations such as PNG Power and Water PNG will be involved in monthly meetings.
- **Independent Auditors** - External experts may be called upon to undertake limited monitoring activities for the Contractor and/or the NDoH on pre-agreed terms. The areas requiring this initiative will include environment quality sampling and measurements, health impact assessment etc. The External Experts will be engaged on a need basis through the Contractor or NDoH or the PHAs but within the project implementation structures.

8.4 Capacity building

One risk that has been identified is what is termed a “capacity risk”. What happens if any of the tenderers/contractors don’t have the capacity to fulfill their obligations. This has been calculated as low risk. To mitigate, the PCU and NDoH will be applying guidance, training and oversight. Contract/tender

documents will specify either details of how the tenderer will comply with Project plans/procedures or for others the development of the required Plans/Procedures along with details of implementation. It will also be a requirement that such implementation processes and/or Plans/Procedures be submitted to the PMU and NDoH for approval (or advice on requirements for amending if required).

In addition, the PCU in conjunction with the NDoH will review each submitted Plans/Procedure to ensure that the required detail has been included as well as monitoring each for correct implementation.

PCU will also undertake monitoring of compliance. To assist with this monitoring, all contractors as part of the enforceable contract will be required to provide the PMU monthly reports on compliance and/or any incidents with adverse impacts, grievance log etc and actions undertaken throughout the project period. NDoH will also review any interim and progress reports to ensure that environmental and social mitigation measures are in place and functioning correctly.

8.5 Training

The training requirements for the Project are described throughout this document. A summary of the training requirements is provided in Table 16.

Table 16: Training requirements

Topic	Scope	Training provided to	Responsibility	Timing
HCWM SOP and IPC	Implementation of the HCWM SOP and IPC; emergency response	All personnel involved in health care waste management at each of the hospitals	NDoH (initial training – train the trainer) PHAs (ongoing training)	Completed in November 2023, refresher in 2024 Ongoing in 2024, Refresher in April 2024
Incinerator Operations Manual	Operation of the incinerator, including PPE requirements, emergency response, trouble shooting, record keeping, ash disposal, sludge disposal, maintenance requirements, monitoring requirements	Incinerators operators	UNOPS (initial training) PHAs (ongoing training)	Prior to commissioning
Construction OHS and environment management	OHS and environmental management requirements relevant to contractor scope and as per Contractor OHS Plan and CESMP, including: ● Waste management ● Handling of hazardous substances / waste ● Use of PPE ● Safe operation of equipment ● Lifting and materials handling techniques ● Awareness on COVID-19 ● Fall prevention and arrest systems	Contractors and subcontractors	Contractors	At the start of, and regularly throughout construction
ESMP Implementation	Requirements of the ESMP EHO (E&S Officer)	Contractors	NDoH	Prior to mobilization
Worker GRM	How the worker mechanism works and how to lodge a grievance	Contractors and subcontractors	Contractors	At the start of, and regularly throughout construction
GRM	How the Project GRM works (in anticipation of potential community grievances regarding the new incinerators)	PHAs	NDoH	Completed in March and November 2023, refresher

				scheduled for April 2024 and during next round of consultation in the provinces

8.6 Verification and Monitoring

8.6.1 Verification

The Project will undertake verification of the implementation of the mitigation measures outlined in Table 14 and Table 15. This will be undertaken through inspections and audits carried out by the contractors (during construction), NDoH and the PHAs. These will include:

- Regular site inspections carried out by the contractor as per their CESMP (typically this would be daily or weekly).
- Regular site inspections carried out by the PHAs throughout constructions and operations.
- Annual auditing carried out by the PHAs (and CEPA at their discretion) during operations. Funding for this has been allowed for in the annual budgets.

8.6.2 Monitoring

Air quality monitoring is proposed at commissioning and during the operations phase to confirm the incinerators (and scrubbers) are operating as expected. The procedure for air quality monitoring will be included in the Incinerator Operating Manual. This will include how to use the monitoring equipment and how to safely collect the samples. An emissions stack sampling port will be located on the stack to allow for sampling of the emissions after they have passed through the scrubbing system. The parameters to be monitored are provided in Table 17. The monitoring program has been developed based on the ability of portable testing equipment and the project targets based on the WB EHS guidelines. Although not all parameters are included (e.g., dixon monitoring is not proposed due to a lack of testing facilities in PNG), exceedances of the project targets will indicate potential issues with the incinerator operations and/or maintenance and be a trigger for investigating and resolving such issues.

Table 17: Air emissions monitoring criteria

Parameter	Project target	Frequency	Method
Hydrogen chlorine	10 mg/m^3	Monthly	Portable meter
Sulphur dioxide	50 mg/m^3	Monthly	Portable meter
NOx	400 mg/m^3	Monthly	Portable meter
Carbon monoxide	50 mg/m^3	Monthly	Portable meter
Oxygen content	At least 7%	Monthly	Portable meter

*based on WBG EHS Guidelines for Health Care Facilities

Monitoring of the treated wastewater is also proposed at commissioning and during the operations phase to confirm the wastewater treatment is effective. The procedure for wastewater quality monitoring will be included in the Incinerator Operating Manual. This will include how to safely collect the samples, transport them to the laboratory and complete the required chain of custody forms, etc., required by the laboratory. The parameters to be monitored are provided in Table 18. The monitoring program has been developed based on the potential contaminants of concern and the project targets based on the WB EHS guidelines. Exceedances of the project targets are a trigger for investigating and resolving potential issues with the wastewater treatment system.

Table 18: Treated wastewater monitoring criteria

Parameter	Project target*	Frequency	Method
pH	Between 6 and 9	Monthly	Onsite using testing strips or similar
Total suspended solids	50 mg/L	Quarterly	External laboratory
Cadmium (total)	0.05 mg/L	Quarterly	External laboratory
Chromium (total)	0.5 mg/L	Quarterly	External laboratory
Lead (total)	0.1 mg/L	Quarterly	External laboratory
Mercury (total)	0.01 mg/L	Quarterly	External laboratory

*based on WBG EHS Guidelines for Health Care Facilities

The Project will also undertake any additional monitoring if specified in the Environment Permit. Ad hoc monitoring may also be undertaken in response to a grievance; outcome of an inspection or audit; or in response to an incident.

8.7 Reporting Requirements

8.7.1 General

Reporting will include progress with the implementation of mitigation measures, planned activities, results of inspections/audits, results of monitoring, stakeholder engagement undertaken, non-conformances (and how they have/will be addressed), status of grievances, etc. The following reporting is proposed:

- NDoH (and then PHAs) to provide reports to CEPA as per the Environment Permit conditions.
- NDoH to provide monthly reports to the WB.
- PHAs to provide monthly reports to NDoH who will provide these to the WB.
- PHA to provide monthly reports to NDoH who will provide these to the WB.

8.7.2 Incident

Despite efforts to manage environmental and social risks, there is potential for incidents to occur. An incident is defined as an accident or negative event resulting from failure to comply with the WB E&S requirements, or conditions that occur because of unexpected or unforeseen events during project implementation.

All incidents are to be reported to the WB as soon as practicable, with all Serious and Severe incidents being reported within 24 hours of their occurrence. The PCU and/or contractor involved in the incident are responsible for also reporting the incident to the relevant regulatory authority if required.

Upon request of the WB, the PCU (with support of the contractor involved, if applicable) shall prepare a report detailing the incident. The report should include the following information:

- Classification of the incident
- What was the incident? What happened? To what or to whom?
- Where and when did the incident occur?
- When and how did the PMU find out about it?
- Are the basic facts of the incident clear and uncontested, or are there conflicting versions? What are those versions?
- What were the conditions or circumstances under which the incident occurred (if known at this stage)?
- Is the incident still ongoing or is it contained?
- Is loss of life or severe harm involved?
- What has been the response to date?
- What remedial action, if any, is required?

- What measures have been or are being implemented to prevent reoccurrence?

The carrying out of any remedial action or implementation of preventive measures to prevent recurrence should be tracked to closure and progress included in the regular progress reports to the WB.

9.0 Grievance Redress Mechanism

This section provides information about the GRM for the construction phase and operational phase of the Project.

9.1 Construction Phase GRM

A GRM will be set up during the construction phase of the proposed project. This GRM will be jointly established by the proponent (NDoH), the contractor, project workers' representatives and senior hospital management staff. A committee made of representatives from the mentioned stakeholders to address any disputes, conflicts or concerns arising from stakeholders that may be affected by the project and communicate resolutions made to concerned stakeholders. Affected stakeholders will be involved in monitoring and evaluating the effectiveness of the GRM.

The Provincial Hospitals will have a grievance redress mechanism, which aggrieved staff, patients, neighbors, or community or other stakeholders can utilize. The NDoH PCU can also be contacted for any grievances, which will be investigated and resolved using the Project GRM process. Details of the GRM process can be obtained from the NDoH PCU. All grievances should be reported following this process:

- Complaints about any project activity can be made in person to the relevant PHA at the PHA Office (details of which are included in each subproject-specific ESMP) or concerned Project Manager or Subcontractor or through suggestion boxes at each sub-project office or by phone and text or email to NDoH PCU or UNOPS on the following addresses:

NDoH PCU	Name Phone: Email:	Ms. Jennifer Krimbu 71765064 Jenniferkrimbu99@gmail.com
UNOPS	Name: Phone: Email:	Mr. Benard Keitany 72653704 benardk@unops.org

- Suggestion Boxes will be installed in the Subcontractors Office and assessed weekly.
- Alternatively, complaint letters can be sent to the National Department of Health, Aopi Building Centre, Waigani Drive, PO Box 807, Waigani, NCD 121, Port Moresby with copies to the respective PHA Public Health Directors.
- Complaints can also be made in person at the NDoH Office, Level 2, Tower 1, Aopi Building Centre, Waigani Drive, NCD, Port Moresby.
- Information on how to make a complaint using the Complaint Forms can be obtained from the NDoH PCU Safeguards Officer through the Contractors Office.

9.2 Operations Phase GRM

During the operation phase, a GRM will be established under the PHA management providing an accountability mechanism for handling issues, disputes, and complaints raised by Stakeholders. The GRM could also be used as a monitoring system for engaging with the different stakeholders and it can also be used as a monitoring mechanism for project implementation.

10.0 CONCLUSION AND RECOMMENDATION

The ESIA report (and supporting ESMPs) gives indication that throughout the whole project cycle, both positive and potential risks and impacts on the physical and social environment will be present. The NDoH and its partners will follow the guidelines presented in the ESMP in order to reduce incidences of accidents, health problems and measures put in place to avoid compromising impacts on the environment. Continuous monitoring of the various indicators shall be followed throughout the project cycle.

The included environmental and social management plan shall be adopted and applied as the basis for addressing environmental and social aspects throughout the project cycle with necessary amendments as may be found appropriate. In this connection, it will be the guiding tool for future audits and monitoring exercises.