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PROPOSED STEEL SCRAP MELTING AND CASTING FOR BILLET PRODUCTION PLANT

ENVIRONMENTAL IMPACT ASSESSMENT STUDY

GPS COORDINATES
Latitude -3.9121 and Longitude 39.51764

Compiled
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ENVIRONMENTAL IMPACT ASSESSMENT STUDY

MR. HASMUKH PATEL., OGW
DIRECTOR
CORRUGATED SHEETS LIMITED

EXECUTIVE SUMMARY

This report presents findings of an Environmental Impact Assessment Study for a proposed steel plant for melting of steel scrap and casting to produce billets.. The proponent of the project is Corrugated Sheets Limited; the location of the proposed project is within the Reinforced Steel Division (RSD) of the Corrugated Sheets Limited (CSL). RSD is located on a section of land parcel number 24606 at Kokotoni area of Kaliangombe Sub-location, Rabai location, Rabai Sub-County, Kilifi County. The Environmental Impact Assessment Study was carried out as provided for in Legal Notice No. 31 of 2019, section 58 (2) of the Environmental Management and Coordination Act, 1999 (Amended) 2015 and the Environmental (Impact Assessment and Audit Regulations), 2003. Other national policies and legislations relevant to the proposed project were reviewed.

Objective

The objective of the proposed project is to manufacture billets from steel scrap..

Process inputs and products

The main raw material that will be used in billet manufacturing process will be mild steel scrap which will be procured from local and international markets. Water will be the main coolant. Expected products will steel billets

Expected waste

Expected waste will slag.

Potential positive impacts

Potential positive environmental impacts will include: -

- ✓ On job training opportunities for local people
- ✓ Technology transfer
- ✓ Support for development of local community through company CSR programme
- ✓ Taxes to National government
- ✓ Taxes to Kilifi County Government
- ✓ Foreign exchange earnings through exports
- ✓ Potential for local economic improvement

Potential negative impacts

Construction phase potential negative environmental impacts will include:-

- ✓ Waste generation
- ✓ Local air pollution
- ✓ Occupational injuries and accidents to construction workers
- ✓ Labour influx

Operational phase potential negative environmental impacts will include:-

- ✓ Explosions from decarburization
- ✓ Dust pollution
- ✓ Exposure to heat
- ✓ Air pollution by noxious odours and dioxins in exhaust gas from bag house
- ✓ Soil and ground water contamination from toxic EAF dust
- ✓ Noise and vibration pollution
- ✓ Oils and lubricants spills
- ✓ Traffic congestion
- ✓ Pollution from waste disposal
- ✓ Water scarcity
- ✓ Injuries and accidents

Decommissioning phase potential negative environmental impacts will include:-

- ✓ Noise and vibration
- ✓ Injuries and accidents
- ✓ Dust pollution
- ✓ Waste generation

Proposed mitigation measures

Potential negative impacts	Proposed mitigation measures
Construction & installation Phase	
Impacts resulting from waste generation	The Project Proponent will: a) Ensure that all generated waste will be managed and disposed as provided for in the Sustainable Waste Management Act 2022 and the Environmental Management and Coordination (Waste Management) Regulations, 2006. b) Ensure that all generated steel scrap generated to be collected and safely kept at a designated location on site from where it will later be recovered for onsite recycling to produce billets c) Ensure that excavated overburden (soil and rock material) to be reused in landscaping within the CSL RSD and also in the rehabilitation of quarry pits of the adjacent sister company Kavee Quarries Limited d) Ensure that timber offcuts generated to be donated out to local food vendors as firewood. e) Segregate non-hazardous waste into organic and non-organic fractions. f) Provide facilities that are properly labeled and color-coded receptacles, bins, containers and bags for the placement of the segregated waste. g) Hire the services of a licensed waste collector to collect, handle and transport the waste. h) Ensure any hazardous waste generated is handled and managed as prescribed in the Environmental Management

Potential negative impacts	Proposed mitigation measures
	and Co-ordination Act, 1999 (No. 8 of 1999) and dispose of the hazardous waste in a facility provided by the County Government of Kilifi or the Authority.
Local air pollution	The Project Proponent will: a) Install a functional and efficient air pollution control system (fume extraction system) consisting of movable fume collection hood, pipeline, cyclone, bag house, sanction blower, bag house cleaning system, chimney, liquid metal and ladle a system that will be working together to ensure air quality standards prescribed in the Environmental Management and Coordination (Air Quality) Regulations 2014 are strictly adhered to. b) Carry out quarterly (every three months) monitoring of local air quality as provided for in the Environmental Management and Coordination (Air Quality) Regulations 2014. c) Monitor noise and vibrations as provided for in the The Environmental Management and Coordination ((Noise and Excessive Vibration Pollution) (Control) Regulations 2009.
Injuries and accidents	The Project Proponent will: a) Register the workplace as per the provisions of the Occupational Safety and Health Act, 2007. b) Hire well trained and experienced plant and equipment operators. c) Only use and operate serviceable plant and equipment d) Ensure all plant and equipment are timely serviced and maintained as per manufacturer's instructions.

Potential negative impacts	Proposed mitigation measures
	e) Carry out daily safety briefings and or tool box meetings to all workers on site. f) Carry out safety trainings to all new staff and refresher trainings to existing staff. g) Ensure appropriate safety information, signs and slogans are strategically placed throughout the workplace. h) Develop and document an emergency evacuation plan for the workplace i) Provide all workers appropriate personal protective equipment (PPEs). j) Enforce the appropriate use of all provided PPEs by all workers. k) Maintain a record of all injuries and accidents at the workplace. l) Promptly report accidents at the workplace to the Directorate of Occupational Safety and Health as provided for in the Occupational Safety and Health Act, 2007. m) Promptly and accurate investigate and document all accidents and injuries reported at the workplace. n) Provided appropriate resting facilities for workers to use during breaks. o) Maintain a well-stocked first aid box at the workplace p) Ensure there is at least one trained first aider at the workplace to handle first aid cases.
Labour influx	The Project Proponent will: a) Prioritize hiring all required skilled, semi-skilled and unskilled workers from the local community.

Potential negative impacts	Proposed mitigation measures
	b) Consider hiring outside the local community when such required skill is not available in the local community. c) Only hire internationally required expatriates who will not be available locally and nationally.
Production phase	
Prolonged exposure to heat results in heat illness such as heat stroke, heat exhaustion, heat cramps and heat rash	The Project Proponent will: a) Identify and designate someone trained in heat hazards, physiological responses to heat, and controls. This person will develop, implement and manage heat stress program. b) Identify heat hazards at the workplace through recognition of heat hazards and the risk of heat illness due to high temperature, humidity, sun and other thermal exposures, work demands, clothing or PPE and personal risk factors. c) Ensure that cool drinking water is available and easily accessible. d) Encourage workers to drink a litter of water over one hour, which is about one cup every fifteen minutes. e) Provide or ensure that fully shaded or air-conditioned areas are available for resting and cooling down. f) New workers and those returning from a prolonged absence support for gradual acclimatization to work environment should begin with 20% of the workload on the first day, increasing incrementally by no more than 20% each subsequent day. g) Schedule altering work schedules to reduce workers' exposure to heat. h) Provide training in a language and manner workers understand, including information on health effects of heat,

Potential negative impacts	Proposed mitigation measures
	the symptoms of heat illness, how and when to respond to symptoms, and how to prevent heat illness. i) Establish a system to monitor and report the signs and symptoms of heat stroke, heat exhaustion, heat cramps and heat rash to improve early detection and action. j) Have an emergency plan in place and communicate it to supervisors and workers. k) Utilise engineering controls specific to indoor workplaces to reduce indoor temperature such as providing reflective shields to redirect radiant heat, insulating hot surfaces, and decreasing water vapour pressure.
Explosions from decarburization	The Project Proponent will: a) Train workers on how to recognize and avoid unsafe EAF operations associated with excess carbon monoxide concentrations during decarburization. b) Verify that the off-gas analyser system accurately measures off-gas accumulation in the furnace. c) Use off-gas composition analyses to control the oxygen injection rate and ensure that gas mixtures above "the heat" stay well below the lower limit of the carbon monoxide explosive range, between 12.5% to 74%. d) Ensure that proper furnace ventilation along with off-gas composition analyses are used to help control chemical reactions in the EAF headspace. e) Not consider smaller explosions as acceptable and immediately investigate their cause to modify furnace process controls to prevent them.

Potential negative impacts	Proposed mitigation measures
	f) Control furnace tilting during EAF operations to help avoid creating potentially explosive gas mixtures.
Dust pollution	The Project Proponent will: a) Fully enclose the EAF b) Install a large capacity bag house to capture all dust as part of the pollution control system c) Continually monitor floating dust loading of the workspace atmosphere and were necessary systematically change design and operation criteria based on the relationships between off-gas emission pattern, in-house gas stream, operational sequence of the de-dusting system, and floating dust loading of the workspace atmosphere d) Install an isolation wall for the yard, properly arrange ventilation air inlet positions and increase flow rate of air through the canopy hood to decrease dust loading. e) Dust treatment by either solid reduction process or smelting reduction process to recover valuable metals from the dust and to make the residue chemically harmless for disposal. The solid reduction process partially reduces iron oxide to FeO, whereas, the smelting reduction process melts down and reduces almost all the metal oxides in the dust.
Noxious odours and dioxins in exhaust gas	The Project Proponent will: a) Increase EAF temperature to achieve complete combustion of organic matter during the low temperature phase to avoid generation of pollutants.

Potential negative impacts	Proposed mitigation measures
	b) Ensure performance of the de-dusting system is optimally sufficient to ensure no noxious odours and dioxins are emitted through the stack. c) Employ gas treatment technology for dioxin reduction by ensuring that gas temperature in furnace is over 850°C, hot gas retention time in furnace is over 2 seconds, quick gas cooling to avoid dioxin regeneration and use of a catalyst to decompose dioxins or activated carbon injection or bed to absorb dioxins. d) Use a semi-continuous charging type EAF as opposed to continuous charging type to ensure that the exhaust gas temperature from the furnace is relatively high and is stable to attain over 850°C gas temperature in furnace and over 2 seconds hot gas retention time in furnace.
Noise and vibration	The Project Proponent will: a) Develop and implement a comprehensive noise conservation programme that includes training, equipment maintenance, engineering controls, use of PPEs and noise level measurements. b) Ensure the site is secured by appropriate noise attenuators. c) Provide all employees with appropriate PPEs such as ear plugs and ear mufflers and ear plugs d) Enforce proper use of the provided PPEs by all workers. e) Ensure equipment used is well maintained and serviceable. f) Employee appropriate engineering controls to minimise noise production from plant and equipment
Oils and lubricants spills	The Project Proponent will:

Potential negative impacts	Proposed mitigation measures
	a) Provide appropriate containment structures /banding to collect any spills. b) Provide for oil spill absorbents for quick absorption of any accidental spills
Traffic congestion	The Project Proponent will: a) Develop and implement a traffic marshal plan. b) Provide sufficient parking/ holding area for traffic delivering raw materials and collecting finished from the steel mill
Waste related impacts	The Project Proponent will: i) Ensure that all generated waste will be managed and disposed as provided for in the Sustainable Waste Management Act 2022 and the Environmental Management and Coordination (Waste Management) Regulations, 2006. a) Provide appropriate receptacles for dropping waste b) Ensure only NEMA licenced vehicles collect waste from the hot rolling steel mill. c) Management to try to minimise waste generation during operational phase by reusing and or recycling most of generated waste.
Water scarcity	The Project Proponent will: a) Explore alternative sources of water that can be used such as roof catchment, rock catchment and collection from neighbouring quarry pits to minimise drawing water from local pipeline for industrial use. b) Provide adequate water storage tanks on site to store water from roof catchment from the extensive roofs of the

Potential negative impacts	Proposed mitigation measures
	godowns during rainy season that can be used in cooling of plant and equipment. c) Minimise water demand by ensuring used water from the cooling circuit is routed through an adequately sized and effective cooling tower and pressure filter to filter the water for recycling purpose
Injuries and accidents	The Project Proponent will: a) Ensure all workers are given appropriate PPEs. b) Ensure hired workers are first trained on the appropriate use of the provided PPEs. c) Ensure all workers and visitors to the project site also use the provided PPEs appropriately. d) Ensure that tools and equipment provided for use are well serviced and maintained. e) Ensure that at least four workers are trained first aiders. f) Ensure there is a fully equipped first aid station at various sections of the steel mill.
Decommissioning phase	
Noise and vibration	The Project Proponent will: a) Develop and implement a comprehensive noise conservation programme that includes training, equipment maintenance, engineering controls, use of PPEs, noise measurements. b) Ensure the decommissioning site is secured by appropriate noise attenuators. c) Provide all decommissioning staff with appropriate PPEs such as ear plugs and ear mufflers. d) Enforce proper use of the provided noise protective PPEs by all workers.

Potential negative impacts	Proposed mitigation measures
	e) Ensure equipment used is well maintained and serviceable.
Injuries and accidents	The Project Proponent will: a) Ensure all decommissioning workers are given appropriate PPEs. b) Ensure all decommissioning workers are trained on the appropriate use of the PPEs before use. c) Ensure each decommissioning worker and visitors to the decommissioning site also use the provided PPEs. d) Ensure that tools and equipment provided for use at the decommissioning site are well serviced and maintained. e) Ensure that the decommissioning site is free of hazards. f) Ensure that among the decommissioning workers at least one is a trained first aider. g) Ensure there is a fully equipped first aid station at the decommissioning site. h) Ensure appropriate measures are put in place to minimize fugitive dust by regularly sprinkling water on dusty ground.
Dust pollution	The Project Proponent will: a) Secure the entire decommissioning site with appropriate dust screens to trap fine dust particles. b) Sprinkle water to arrest fugitive dust. c) Provide all decommissioning staff with appropriate PPEs such as dust masks, overalls, helmet, dust coats, safety boots and goggles. d) Ensure all decommissioning workers make proper use of the PPEs provided.

Potential negative impacts	Proposed mitigation measures
	e) Periodically monitor air quality levels at the decommissioning site by measuring local particulate matter
Waste generation	The Project Proponent will: a) Ensure all waste generated at the site being decommissioned is managed and disposed as provided for in the Sustainable Waste Management Act 2022 and the Environmental Management and Coordination (Waste Management) Regulations, 2006. b) Provide appropriate receptacles for dropping waste. c) Ensure only NEMA licenced vehicles collect waste from the site being decommissioned.

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1. BACKGROUND

1.1 Introduction

This report presents findings of an Environmental Impact Assessment (EIA) Study for a proposed steel plant for melting of steel scrap and casting to produce billets. Steel mills are categorized as high risk projects as per Legal Notice No. 31 of 30th April 2019, that amended the second schedule of the Environmental Management and Coordination Act, 1999 section 3 (9) (p). The Environmental Impact Assessment Study and report was prepared as provided for in Legal Notice No. 31 of 2019, section 58 (2) of the Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit Regulations), 2003.

1.2 Project definition

The proposed project will be to construct and install a steel mill for the melting of steel scrap to generate molten metal that is continuously casted to produce billets.

1.3 Location

The proposed project will be located within the Reinforced Steel Division (RSD) of Corrugated Sheets Limited (CSL) on a section of land parcel number 24606 at Kokotoni area of Kaliangombe Sub-location, Rabai location, Rabai Sub-County, Kilifi County. The GPS Coordinates for the proposed project site is latitude -3.9121 and longitude 39.51764

Appendix 1 gives land documents.

1,4 Project Proponent

The project proponent is Corrugated Sheets Limited (CSL), a limited company carrying out business in the Republic of Kenya. A copy of the proponent's PIN certificate and certificates of incorporation is attached in appendix 2.

1.5 Project Objective and Scope

1.5.1 Objective

The objective of the proposed project is to manufacture billets from steel scrap.

1.5.2 Scope

The proposed study will cover construction of godown to house the steel mill, installation of various components of the steel mill and operation of the steel mill to produce billets.

1.6 Terms of Reference

Terms of reference (ToR) for the EIA study were prepared and submitted to the National Environment Management Authority (NEMA) for approval. The ToR was approved by NEMA appendix 3 is copy of the ToR approval letter from NEMA.

2. BACKGROUND TO ENVIRONMENTAL IMPACT ASSESSMENT

2.1 Definition of Environmental Impact Assessment

Broadly environmental impact assessment (EIA) refers to the need 'to identify and predict the impact on the environment and on man's health and wellbeing of legislative proposals, policies, programmes, projects and operational procedures, and to interpret and communicate information about the impacts'(Munn 1979). UNECE (1991) defines EIA as 'an assessment of the impacts of planned activity on the environment', IAIA (2009) on the other hand defines EIA as 'the process of identifying, predicting, evaluating and mitigating the biophysical, social and other relevant effects of proposed development proposals prior to major decision being taken and commitments made'. Glasson *et.al* (2012) defines EIA as 'a systematic process that examines the environmental consequences of development actions in advance'. EIA is thus a vital tool that aid formulation of development actions, decision making, an instrument for sustainable development and vehicle for stakeholder consultation and participation (Glasson *et.al* 2012).

2.2 The purposes of EIA

2.2.1 An aid to decision making

EIA is an aid to decision-making. For the decision maker, for example, a local authority, it provides a systematic examination of the environmental implications of a proposed action, and sometimes alternatives, before a decision is taken. The EIA can be considered by the decision-maker along with other documentation related to the planned activity. EIA is normally wider in scope and less quantitative than other techniques, such as cost-benefit analysis (CBA).It is not a substitute for decision making, but it does help to clarify some of the trade-offs associated with a proposed development action, which should lead to more informed and structured decision-making. The EIA process has a potential, not always taken up, to be a basis for negotiation between the developer, public interest groups and the planning regulator. This can lead to outcome that balances well the interests of the development action and the environment.

2.2.2 An aid to the formulation of development actions

Developers may see the EIA process as another set of hurdles to jump before they can proceed with their various activities; the process can be seen as yet another costly and time-consuming activity in the development consent process. However, EIA can be of great benefit to them, since it can provide a framework for considering location and design issues and environmental issues in parallel. It can be an aid to the formulation of development actions, indicating areas where a project can be modified to minimize or

eliminate all together its adverse impacts on the environment. The consideration of environmental impacts early in the planning life of a development can lead to more environmentally sensitive development; to improved relations between the developer, the planning authority and the local communities; to a smoother development consent process, and sometimes to a worthwhile financial return on the extra expenditure incurred. O'Riordan and Sewell (1981) links such concepts of negotiation and redesign to the important environmental themes of 'green consumerism' and 'green capitalism'. The growing demand by consumers to goods that do no environmental damage, plus a growing market for clean technologies, is generating a response from developers. EIA can be the signal to the developer of potential conflict; wise developers may use the process to negotiate 'environmental gain' solutions, which may eliminate or offset negative environmental impacts, reduce local opposition and avoid costly public inquiries. This can be seen in the wider and contemporary context of corporate social responsibility (CSR) being increasingly practiced by major businesses (Crane et al.2008)

2.2.3 A vehicle for stakeholder consultation and participation

Development actions may have wide-ranging impacts on the environment, affecting many different groups in society. There is increasing emphasis by government at many levels on the importance of consultation and participation by key stakeholders in the planning and development of projects. EIA can be a very useful vehicle for engaging with communities and stakeholders, helping those potentially affected by a proposed development to be much better informed and to be more fully involved in the planning and development process.

2.2.4 An instrument for sustainable

Existing environmentally harmful developments have to be managed as best as they can. In extreme cases, they may be closed down, but they can still leave residual environmental problems for decades to come. It would be much better to mitigate the harmful effects in advance, at the planning stage, or in some cases avoid the particular development together. This of course leads on to the fundamental role of EIA as an instrument for sustainable development-a role some writers have drawn attention to as one often more hidden than it should be when EIA effectiveness is being assessed (Jay et al.2007)

2.3 Origins and development of EIA

The first EIA legislation was formerly established in the United States of America in 1969 (NEPA 1970), in Europe the 1985 European Community directive on EIA (Directive 85/337) introduced broadly uniform

requirements for EIA for all member states (CEC, 1985). In Australia, the Commonwealth EIA system was established in 1974 under the Environmental Protection (Impact of Proposal) Act (Wood 2003, Ellott and Thomas, 2009). The United Kingdom enacted a formal legislation on EIA in 1988 (Glasson *et.al* 2012). China formerly enacted its first EIA legislation in 1979 (Moorman and Ge 2007). In Africa and the Middle East, Israel and Algeria pioneered in enactment and implementation of EIA legislations in 1982, 2003 and 1983, 1990 respectively (Economic Commission for Africa, (2005) Almagi *et.al* (2007). In East Africa Uganda pioneered in enacting EIA legislation in 1998, Kenya EIA legislation was enacted in 2000, and implemented in 2003 (Morara *et.al* 2011).

2.4 Key elements in the EIA process

The environmental impact assessment process comprises of various interactive steps such as screening, scoping, consideration of alternatives, action design, preparation of the EIA report, reviewing or evaluating the report, decision making, and post decision activities such as monitoring and auditing (Glasson *et al.*, 1994; Wood, 1995). According to UNEP (2002) key elements in the EIA process are screening, scoping, impact analysis, mitigation, reporting, review, decision-making, follow up and public involvement. Figure 2 is the schematic presentation of general EIA process adopted from UNEP' environmental impact assessment training manual.

2.4.1 Screening

Screening determines whether or not a proposal requires an EIA and, if so, what level of analysis is necessary. This process brings clarity and certainty to the implementation of EIA, ensuring that it neither entails excessive review nor overlooks proposals that warrant examination. Legal Notice No. 31 of 30th April 2019, that amended the second schedule of the Environmental Management and Coordination Act, 1999 categorizes Steel Mills under high risk projects in section 3 (9) (p) of the amended second schedule of the Act. Based on this, it is required that an environmental impact assessment study report be submitted for the proposed project. Regulation 11 (1) of the Environmental (Impact Assessment and Audit) Regulations, 2003 require that an environmental impact assessment study be conducted in accordance with the terms of reference developed during the scoping exercise by the proponent and approved by the Authority.

2.4.2 Scoping

Scoping identifies the important issues in readiness for preparation of terms of reference; it is a critical, early step in the preparation of an EIA (UNEP. 2002). The scoping process identified the issues that are likely to

be of most importance during the EIA and eliminated those that are of little concern. In this way, the EIA study was focused on the significant effects and time and money are not wasted on unnecessary investigations (Glasson *et al.*, 2012). The following were the key issues identified to be focused on during the EIA study.

- ✓ Impacts on local air quality
- ✓ Noise and vibration impacts
- ✓ Traffic related impacts
- ✓ Waste related impacts
- ✓ Occupational injuries and accidents
- ✓ Increase demand and use of water

2.4.3 Impact analysis

Impact analysis is carried out in the detailed phase of the EIA; it involved identifying the impacts more specifically, predicting the characteristics of the main impacts and evaluating the significance of the residual impacts (UNEP, 2002).

2.4.4 Impact Mitigation

Mitigation is the stage of the EIA process when measures are identified to avoid, minimize or remedy impacts. These measures are implemented as part of the process of impact management, together with any necessary adjustments to respond to unforeseen impacts. Both elements are integral to ensuring that the EIA process leads to practical action to offset the adverse environmental impacts of proposed developments (UNEP, 2002). Mitigation recommends feasible and cost–effective measures to prevent or reduce significant negative impacts to acceptable levels.

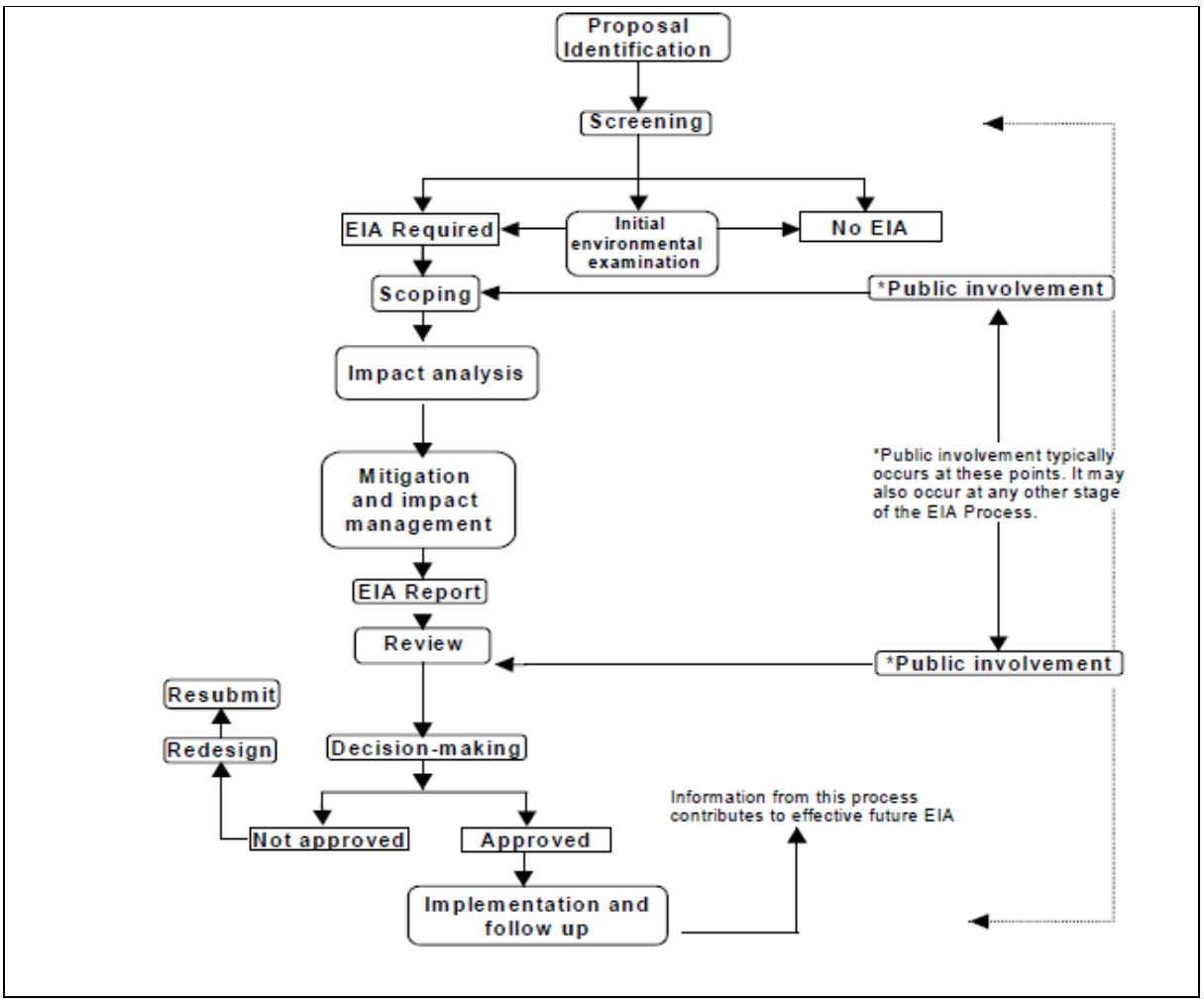

Figure 1: Generalized EIA process flowchart. Adapted from UNEP 2002

2.4.5 Reporting

Reporting involves compiling all the information obtained into an EIA report which is a keystone document. It assembles the information that assists the proponent in managing the impacts of the proposal, the responsible authority in decision-making and condition setting; and the public in understanding the likely impacts of the proposal (UNEP, 2002).

2.4.6 Report review

The review stage of the EIA report is one of the main 'checks and balances' built into the EIA process to establish the quality of an EIA. It helps to ensure the information submitted is credible and sufficient for decision-making purposes (UNEP, 2002) by verifying the accuracy and comprehensiveness of the report

(Glasson *et al.*, 2012). The decision-making element of the EIA process involves approving or rejecting the proposal and setting conditions. Decision making stage provides for incorporation of environmental considerations into proposed development (Glasson *et al.*, 2012). Once the proposed project is approved, implementation and follow up complete the EIA process (UNEP, 2002).

2.4.7 Monitoring and auditing

Monitoring, auditing and other tools are used to 'close the loop' of impact prediction and condition setting (Sadler, 1996). Monitoring and auditing is vital as it is used to identify the impacts that occur; to check that these are within the levels predicted and required by legislation; determine that mitigation measures are properly implemented and work effectively; ensure the environmental benefits expected are being achieved; and provide feedback to improve future applications of the EIA process (Arts, 1998).

3. APPROACH AND METHODOLOGY

3.1 Approach

At the beginning of the assignment inception meetings were held between the Proponent representative and the Consulting Team Leader in the proponent's office first and latter at the proposed project site. The meetings served as formal introduction for clarification of Terms of Reference (ToR) for the study team and physically show the team the proposed project site. A ToR for the EIA study was then developed and submitted to NEMA for approval.

3.2 Methodology

The following methodology was used in undertaking the Environmental Impact Assessment:

i) Scoping and development of Terms of Reference
ii) Desk review of relevant project documents including project design documents, relevant policy and legislative documents including relevant international conventions, agreements and protocols ratified by Kenya.
iii) Field visits for detailed documentation of site conditions and actual site assessment.
iv) Baseline studies
v) Public participation
vi) Impact prediction and mitigation measures determination
vii) Reporting.

3.2.1Scoping

Scoping identified the important issues in readiness for preparation of terms of reference; it was a critical, early step in the preparation of an EIA study report. The scoping process identified the issues that are likely to be of most importance during the EIA and eliminated those that were of no concern.

3.2.2 Desk review

Desk top review included review of National Policies are applicable to the proposed project including Kenya's Vision 2030, The Kenya Youth Development Policy 2019, National Energy Policy 2018, Sessional Paper no. 4 of 2013 on the Employment Policy and Strategy for Kenya, National Climate Change Framework Policy 2018, Climate Risk Management Framework (2017), National Climate Change Response Strategy 2010 among others**.** The review also include review of national laws including**,** Environmental Management and Co-ordination Act (EMCA) 1999**,** The Environmental Management and Coordination

(Water Quality) Regulations, 2006**,** The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009; Physical planning Act**,** The Local Authority Act**,** The Public Health act**,** the Environmental Management and Coordination (Water Quality) Regulations, 2006;**,** The Environmental Management and Coordination (Waste Management) Regulations, 2006**,** The Employment Act 2007**,** The labour Institutions Act 2007**,** The Work Injuries Benefits Act 2007**,** The Occupational Safety and Health Act 2007**,** The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009**,** The Lands Act 2012**,** The Energy Act 2006**,** Integrated Waste Management Act 2022**,** National Construction Authority Act No. 41 of 2011**,** The Environmental (Impact Assessment and Audit) Regulations 2003

3.2.3 Field assessment

Field assessment involved visiting the proposed project site and documenting the current condition on the site. This involved documenting exiting structures onsite and neighboring facilities. Also the location where the godown of the proposed project will be constructed was assessed in relation to the existing structures. The assessment also included the existing access road to the steel mill and available parking space within the compound of the facility. The site was assessed for any flora and fauna and observations recorded. GPS coordinates for the site were taken by a handheld GPS and photographs of site observation were taken. Site office meetings were held between the Lead Consultant, the Division Manager and the Company Environmental and Safety Officer respond to questions and emerging issues during site assessment.

3.2.4 Public participation

Public participation involved conducting three public meetings (barazas) in three different locations adjacent to the proposed project site as was suggested by the local leadership. The meetings were also publicized locally through the Sub-Chief- Mzee wa Mtaa- Nymba Kumi channel to ensure the information reached each housed within every Nyumba Kumi cluster. To supplement the local meetings a detailed questionnaire survey was carried out, the questionnaire survey targeted various groups/ institutions including local leaders, civil society groups operating in the area, local learning institutions, local faith based institutions and local health institutions.

3.2.5 Environmental baseline

Monitoring involved documentation of baseline air quality prior to implementation of the proposed project. The monitoring was to provide a benchmark and reference against which to compare the air quality conditions influenced by the construction, operation and closure phases of the billet melting plant.

3.2.6 Reporting

All the information and data collected from scoping exercise, the desk top document review, field assessments, monitoring and stakeholder consultation and participation was compiled into two reports namely:-

- ✓ Terms of Reference Report; and
- ✓ Environmental Impact assessment (EIA) Study Report.

Terms of Reference Report was submitted to NEMA as specified in Regulation 11 (1) and 11(2) of the Environmental (Impact Assessment and Audit) Regulations, 2003. The Environmental Impact assessment (EIA) Study Report was prepared as specified in Regulation 18 of the Environmental (Impact Assessment and Audit) Regulations, 2003 and submitted to NEMA as specified in Regulation 19 of the Environmental (Impact Assessment and Audit) Regulations, 2003.

3.3 Study team

Sigtuna Consultancy Limited, a registered and licensed EIA/EA Firm of Experts registration number 9582, was contracted by Corrugated Sheets Limited to carry out the environmental impact assessment study for the project and prepare an environmental impact assessment study report. The team of Experts who undertook the environmental impact assessment study were Philip Manyi Omenge EIA/EA Lead Expert, Natural Resources Management/Ecology, Rural Development, Conflict Management and Gender Mainstreaming Specialist; James Morumbasi Mong'oni a registered EIA/EA Lead Expert, a Mechanical Engineer, a Safety Practitioner, Safety Trainer, and Inspector of pressure vessels and lifting equipment; Justus Aungo, Sociologist and Christopher Wanyama –Field Assistant. Environmental baseline was carried out by Lahvens Limited Laboratory Appendix 4 is copy of practicing licenses of the firm of experts and Lead Expert.

4. POLICY AND LEGAL FRAMEWORK

4.1 Relevant National Policies

4.1.1 National Environment Policy, 2013

The National Environment Policy document was prepared with the goal of bettering the quality of life for present and future generations through sustainable management and use of the environment and natural resources. The document underscores the importance and contribution of environment and natural resources to the local and national economy, people's livelihoods and the provision of environmental services such as watershed protection and carbon sequestration. It also reviews the status of environment in Kenya and highlights the key environmental issues and challenges. It identifies Kenya's critical ecosystems and natural resources and proposes measures to enhance conservation and management of ecosystems and sustainable use of natural resources. It addresses a wide range of issues relating to environmental quality and health. The areas covered include air quality, water and sanitation, waste management, radiation, toxic and hazardous substances, noise, HIV and AIDS and environmental diseases. It also outlines strategies and actions that will ensure effective implementation of the Policy and the Environmental Management and Coordination Act.

4.1.2 National Climate Change Framework Policy Sessional Paper No. 5 of 2016

This Policy was developed to facilitate a coordinated, coherent and effective response to the local, national and global challenges and opportunities presented by climate change. The policy adapts an overarching mainstreaming approach to ensure the integration of climate change considerations into development planning, budgeting and implementation in all sectors and at all levels of government. The Policy therefore aims to enhance adaptive capacity and build resilience to climate variability and change, while promoting a low carbon development pathway. The response to climate change in Kenya must adhere to the constitutional governance framework and commitment to sustainable development, while addressing the goal of attaining low carbon climate resilient development. To attain the latter, the policy focuses on appropriate mechanisms to enhance climate resilience and adaptive capacity, and the transition to low carbon growth.

4.1.3 Kenya's Vision 2030

The Country's development blueprint that aims to transform Kenya into a newly- industrializing, middle income country providing a high quality of life to all its citizens in a clean and secure environment by the year 2030.

4.1.4 The Kenya Youth Development Policy 2019

The Kenya youth development policy promotes holistic empowerment and participation of the youth in socio-economic and political development for themselves, the country and the future. Ensure adequate youth development and empowerment while harnessing their potential for productive engagement at local, County, National and International levels.

4.1.5 National Energy Policy 2018

The national energy policy's overall objective is to ensure sustainable, adequate, affordable, competitive, secure and reliable supply of energy at the least cost geared to meet national and county needs while protecting and conserving the environment.

4.1.6 Sessional Paper no. 4 of 2013 on the Employment Policy and Strategy for Kenya

This policy promotes full employment as a priority in national, economic and social policy and to enable the economically active population to attain and secure sustainable livelihood through productive and freely chosen employment by the year 2030.

4.1.7 Sessional Paper No. 01 of 2017 on National Land Use Policy

whose overall goal is to provide legal, administrative, institutional and technological framework for optimal utilization and productivity of land and land related resources in a sustainable and desirable manner at National, County and local level.

4.1.8 Sessional Paper 01 of 2021 on National Water Policy

The aim is to guide the achievement of sustainable management, development and use of water resources in Kenya. It provides a framework for sustainable management and financing of water resources; water harvesting and storage; and for equitable, efficient, and universal access to water supply and reasonable standards of sanitation, for domestic, economic use and ecosystem sustenance.

4.1.9 Sessional Paper No.13 of 2014 on Integrated Coastal Zone Management (ICZM) Policy The vision of the ICZM Policy is "A coastal zone with health ecosystem and resources that sustain the socio-economic development and well-being the current and future generations". It seeks to promote sustainable development in the coastal zone in line with the principles of the constitution and objectives of Vision 2030.

4.1.10 National Climate Change Framework Policy Sessional Paper No. 5 of 2016

The Policy aims to enhance adaptive capacity and build resilience to climate variability and change, while promoting a low carbon development pathway. The response to climate change in Kenya must adhere to the

constitutional governance framework and commitment to sustainable development, while addressing the goal of attaining low carbon climate resilient development. To attain the latter, the policy focuses on appropriate mechanisms to enhance climate resilience and adaptive capacity, and the transition to low carbon growth.

4.2 National legislations

4.2.1 The Constitution of Kenya 2010

The Constitution of Kenya 2010 is the overarching legal framework for matters on environment. It recognizes the environment as part of the country's heritage, and which must be safeguarded for future generations. It provides for the right to a clean and healthy environment for every person in Article 42, obligating the state to enact legislation to protect that right as well as to establish systems of environmental impact assessment, environmental audit and monitoring of the environment in Article 69.

Article 69 imposes on the State, other obligations including, to:

- Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
- Encourage public participation in the management, protection and conservation of the environment;
- Eliminate processes and activities that are likely to endanger the environment; and
- Utilize the environment and natural resources for the benefit of the people of Kenya.

Article 69 (2) similarly confers a conservation obligation on parties including the proponent of the proposed hot rolling steel mill. The proponent is thus obligated to cooperate with State organs and other persons to protect and conserve the environment.

4.2.2 The Environmental Management and Co-ordination Act, 1999

EMCA, 1999 (amended) 2015, provides a legal and institutional framework for the protection and conservation of the environment in line with Article 42 of the Constitution of Kenya, 2010. The ultimate objective is to provide a framework for integrating environmental considerations into the country's overall economic and social development. According to section 58 of the Act projects specified in the second schedule that are likely to have significant impact on the environment have to be subjected to an EIA study. Steel mills are categorized as high risk projects in the second schedule of the act and hence must be subjected to environmental impact assessment study prior to implementation.

4.2.3 The Occupational Safety and Health Act, 2007

This Act came into force in 2007 and replacing The Factories and Other Places of Work Act, Cap 514. It makes provisions for the health, safety and welfare to be observed by employers and persons employed in places of work. Part IV of the act covers health issues such as the state of cleanliness, refuse management, employee space requirement, ventilation and sanitary conveniences. Part V covers fire safety, operation and maintenance of machinery, fencing requirements, storage of dangerous substances, training and supervision of workers. Part VI deals with welfare issues; drinking water supply, washing facilities, sitting areas and first aid provision.

4.2.4 The Lands Act 2012

The Land Act 2012 is "an Act of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes". Part I of the act is preliminary provisions, part II of the act deals with management of public land, part III of the act deals with administration of public land (Leases, Licenses and Agreements), part IV of the act deals with community land, part V of the act deals with administration and management of private land, part VI of the act deals with general provisions of leases, part VII of the act deals with general provisions of charges, part VIII of the act deals with compulsory acquisition of interests in land, part IX of the act deals with settlement programmes, part X of the act deals with easements and analogous rights, part XI of the act deals with miscellaneous, the schedule lists repealed laws i.e. The Way leaves Act, Cap. 292 and The Land Acquisition Act, Cap. 295. The proposed project will fully comply with the provisions and requirements of the Lands Act 2012.

4.2.5 The Public Health Act Cap 242

Key relevant provisions of this Act are:

- Section 10, 11, 12, and 13 for regulating the maintenance, repair and inspection of drains, latrines, cesspool or septic tanks
- Section 28, 29, and 30 which give requirements for the construction of drains in connection with buildings and
- Section 115 prohibiting nuisances that may cause injury or health hazards.

The proposed project will comply with the provisions of the Public Health Act.

4.2.6 Work Injuries Benefits Act 2007

Section 7 of the Act stipulates that every employer shall obtain and maintain an insurance policy with an insurance company approved by the Minister in respect of any liability that the employer may incur under this Act to any of his employees. An employee who is involved in an accident resulting in the employees' disability or death is subject to the provisions of this Act, and entitled to benefits provided for under the Act. Section 3 of the Act however states that no employee shall be entitled to compensation if an accident, not resulting to serious disability or death, is caused by the deliberate and willful misconduct of the employee. The proposed project will comply with the provisions and requirements of this Act.

4.2.7 The Sustainable Waste Management Act 2022

The Sustainable Waste Management Act, 2022 provide for the sustainable management of waste. It provides for the creation of extended producer responsibility schemes as well as a circular economy for the reduction of waste. The Act provides for take back schemes and the labeling of products that may cause pollution. It provides for the creation of material recovery facilities in every County as well as the creation of incentives to encourage recycling. The purpose of the Act is thus to establish the legal and institutional framework for sustainable waste management and the realization of the constitutional provision on the right to a clean and healthy environment.

Section 19 of this Act outlines duties of private sector entities as follows:

(1) A private sector entity shall prepare a three-year waste management plan and submit an annual monitoring report to the Authority which shall specify—

(a) the actual quantities of waste generated by the entity;

(b) the waste management methods applied by the entity; and

(c) any other information that the Authority may require.

(2) Notwithstanding the generality of subsection (1), the Cabinet Secretary shall, within six months of the coming into force of this Act, *Gazette* the category of private sector entities that shall be required to prepare waste management plans which shall be based on the volume of production of waste.

(3) A private sector entity that fails to comply with the provisions of subsection (1) commits an offence and shall, on conviction, be liable to a fine of not more than two hundred thousand shillings and the person responsible for the private sector entity shall, in addition to the fine imposed on the entity, be liable to imprisonment for a term not exceeding three months.

(4) A private sector entity shall—

(a) adopt the following cleaner production principles including—

(i) improvement of production processes through conserving raw materials and energy;

(ii) Limit the use of toxic raw materials to safe laws within such times as may be prescribed by the authority;

(iii) reducing toxic emissions and wastes; and

(iv) monitoring the product cycle from beginning to end by;

(b) identify and eliminate potential negative impacts of the product;

(c) enable the recovery and reuse of the product where possible;

(d) reclaim and recycle;

(e) incorporate environmental concerns in the design, process and disposal of the product;

(f) collect, segregate and dispose of or cause to be disposed of the waste in accordance with this Act;

(g) shall segregate waste by separating hazardous waste from non-hazardous waste and

dispose of the waste in a facility provided by the county government or the Authority;

(h) transfer the waste to a person who is licensed to transport and dispose of the waste in accordance with this Act;

(i) clean up and restore the site it was using to its natural state;

(j) prepare a waste management plan and integrate it in its corporate strategies and plans; and

(k) provide waste segregation receptacles at its premises for organic, plastic and general dry waste.

(5) A private entity that generates waste shall segregate the waste by separating hazardous waste and dispose of the hazardous waste in a facility provided by the county government or the Authority.

(6) A private entity or any its officers that fails to manage waste in accordance with this Act commits and offence and on conviction, shall be liable to a fine—

(a) of at least five per cent of the entity's net income registered in the previous tax year or five million shillings whichever is the higher; and

(b) of at least two hundred thousand shillings for the entity's officers.

(7) Where a private entity or any of its officers has been convicted of an offence under subsection (3), and the entity continues to fail to comply with the provisions of this Act, the entity or the officer commits a further offence and for each day the failure continues on conviction, shall be liable to a fine -

(a) not exceeding zero-point-five per cent of the entity's net income registered in the previous tax year, for the private entity; and

(b) not exceeding twenty thousand shillings for the entity's officers.

4.3 Regulatory Framework

4.3.1 The Environment (Impact Assessment and Audit) Regulations, 2003

These regulations provide guidelines for conducting an EIA study as well as environmental auditing and monitoring. The Regulations state in Regulation 3 that "the Regulations should apply to all policies, plans, programmes, projects and activities specified in Part III and V of the Regulations" basically lists the guidelines of undertaking, submission and approval of the EIA/SEA Report.The Regulations requires proponents to conduct annual environmental audits

to identify the environmental impacts of their undertakings and propose mitigation measures to improve their environmental performance. Section 17 of the same regulation stipulates that during the process of conducting the audit the proponent shall seek the views of persons who may be affected by their operations. The proponent of the proposed project would be required to comply with the provisions of this legislation.

4.3.2 Building Operations and Works of Engineering Construction Rules, 1984

The provisions of the Factories Act relevant to building operations and engineering construction works are contained in the Abstract of the Act for Building Operations and Works of Engineering Construction Rules. These rules specify the minimum safety and health measures to be taken during construction works which include that the proponent should:

- Give notice of particular operations or works;
- Such notice should be sent in writing to the Occupational Health and Safety Officer, not later than seven days after commencement of construction;
- Post printed copies or prescribed abstracts of the Occupational Safety and Health Act at the site of operations or works (Section 61 of the Act);
- Provide sufficient and suitable sanitary conveniences for persons employed. These must be kept clean and well lit.

The contractor appointed by the proponent would be expected to adhere to these provisions.

4.3.3 Environmental Management and Coordination (Noise and Excessive Vibration) (Pollution Control) Regulations, 2009

The regulations apply to persons wishing to operate or repair any equipment or machinery, engage in any commercial or industrial activity that is likely to emit noise or excessive vibrations. The regulations specify the limits or levels within which these shall be undertaken. The Regulations also stipulate in the second schedule that construction activities undertaken during the night should not emit excessive noise beyond the permissible levels.

4.3.4 Environmental Management and Coordination (Water Quality) Regulations, 2006

These regulations provide protection to ground water or surface water from pollution by providing the limits and parameters of pollutants in treated waste water which can be discharged into the environment.

Relevant provisions of this regulation applicable to the proposed project include:-

- Every person shall refrain from any act which will directly or indirectly cause pollution and it shall be immaterial whether or not the water source was polluted before the enactment of these regulations;
- No person shall throw or cause to flow into or near a water source any liquid, solid or gaseous substance or deposit any such substance as to cause pollution;
- Discharge of effluent from sewer must be licensed according to the act;
- Water abstraction must only be done after approval of an Environmental Impact Assessment study.

4.3.5 Environmental Management and Coordination (Waste Management) Regulations, 2006

Part II of these regulations lists the responsibility of the waste generator and prescribes the proper mechanism of handling all waste through segregation and finally proposes environmental management programme through implementation of cleaner production mechanisms.

Relevant provisions of this regulation include:-

- Prohibition of any waste disposal on a public highway, street, road, recreational area or in any public place except in designated waste receptacle
- All waste generated to be collected, segregated and disposed in a manner provided for under these regulations
- All waste generators to minimize waste generated by adopting cleaner production methods
- All waste transporters to be licensed according to the Act
- Collection and transportation of the waste to be done in such a manner not to cause scattering of the waste
- The vehicle and equipment for waste transportation to be in such a manner not to cause scattering or escape of the waste

At the construction stage of construction debris would be generated. The proponent should ensure that the waste is managed in line with the provisions of these regulations.

4.3.6 Environmental Management and Coordination (Air Quality) Regulations, 2014

The objective of these Regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The general prohibitions state that no person shall cause the emission of air pollutants listed under First Schedule (priority air pollutants) to exceed the ambient air quality levels as stipulated under the provisions of the Seventh Schedule (Emission limits for controlled and non-controlled facilities) and Second Schedule (Ambient

air quality tolerance limits). The proponent will be guided by provisions of this act, during operation phase. Air quality monitoring will be guided by the standards stipulated thereof.

4.4 County legislations

4.4.1 Kilifi County Environment (Regulation and Control) Act, 2016

This Act provides for the protection of the environment in Kilifi County. It seeks to ensure a clean and healthy environment. The provisions of this Act are additional to other requirements imposed by or under the Environmental Management and Coordination Act, 1999 (amended) 2015 or any other written law. The Act established in every Sub-County, a Committee known as the Sub-County Environment Committee. Such Committees are responsible for the proper management of the environment within the sub-county for which it is appointed. Specific provision is made regarding air pollution, noise pollution and public nuisances. Every owner or operator of a controlled facility shall ensure that emissions from the facility do not cause air pollution in any territory outside the facility, in excess of the prescribed relevant ambient air quality levels. The Department shall, in collaboration with other departments and agencies of the county government provide methods of abating and regulating air pollution.

5. BASELINE INFORMATION

5.1 Environmental baseline for ambient green-house gases monitoring

Gases that trap heat in the atmosphere are called greenhouse gases. Baseline levels of six categories of pollutants were measured at the monitoring networks at the seventeen measurement locations within the proposed billets plant and the receiving neighborhoods. The monitored categories of pollutants were sulphur dioxide (SO_2); oxides of nitrogen (NO_x) (which includes nitric oxide (NO) and nitrogen dioxide (NO_2)); carbon monoxide (CO); carbon dioxide (CO_2); Total Volatile organic compounds, (TVOCs) and Ammonia (NH_3). Table 1 is a summary of singular air quality and environmental measurement, Table 2 gives the average results of the gaseous parameters, Table 3 gives results of environmental parameters. Figure 2 is a correlation analysis of CO concentrations against EMC (Air quality) regulations 2014 Target Values**.** Figure 3 is a correlation analysis of SO2 Concentrations against EMC (Air quality) regulations 2014 Target Values. Figure 4 is a correlation analysis between NO_2 concentrations against EMC (Air quality) regulations 2014 Target Values. Figure 5 is a correlation analysis between TVOC concentrations and target values EMC (Air quality) regulations 2014. Appendix 5 is a detailed environmental baseline for ambient green-house gases monitoring report.

Table 1: Summary of singular Air quality measurements

Monitoring Locations	CO mg/m^3	SO_2 ppm	NO_2 ppm	NO ppm	NH_3 ppm	TVOC µg/m^3	HUMIDITY %	TEMPS ^{0}C
Pastor Lwambi nursery school.	1.08	0.015	0.013	<0.001	<0.001	8	78	27
Office Area	0.89	0.032	0.060	<0.001	<0.001	4	73	28
Furnace Area	1.74	0.073	0.081	<0.001	<0.001	3	68	31
Westward Homestead 1:	0.48	<0.001	<0.001	<0.001	<0.001	2	67	30
Westward Homestead 2	0.51	<0.001	<0.001	<0.001	<0.001	5	63	29
Westward Homestead 3	0.42	<0.001	<0.001	<0.001	<0.001	3	61	29
Westward Homestead 4	0.38	<0.001	<0.001	<0.001	<0.001	2	59	29
Kokotoni mosque	0.65	0.022	0.011	<0.001	<0.001	9	80	26
Kokotoni dispensary	0.57	0.017	0.017	<0.001	<0.001	11	78	27
Market point 1 LHS	0.81	0.019	0.015	<0.001	<0.001	8	71	28
Market point 2 RHS	0.85	0.024	0.020	<0.001	<0.001	10	68	28
Kaliangombe pri. School.	0.60	<0.001	<0.001	<0.001	<0.001	6	63	29
Eastward Homestead 1	0.44	<0.001	0.014	<0.001	<0.001	7	62	30
Eastward Homestead 2	0.52	<0.001	0.012	<0.001	<0.001	9	58	31
Eastward Homestead 3	0.50	<0.001	<0.001	<0.001	<0.001	5	57	30

Table 2: Average results of gaseous parameters

Monitoring Locations	***NO_2***		***SO_2***		***CO***		***TVOC***		***REMARKS***
	Conc. (ppm)	EMC AQR guide 2014 (ppm)	Conc. (ppm)	EMC AQR guide 2014 (ppm)	Conc. (mg/m^3)	EMC AQR guide 2014 (mg/m^3)	Conc. ($\mu g/m^3$)	EMC AQR guide 2014 (ppm)	
Pastor Lwambi nursery school.	0.013	0.2	0.015	0.191	1.08	4.0	8	-	Complies
Office Area	0.060	0.2	0.032	0.191	0.89	4.0	4	-	Complies
Furnace Area	0.081	0.2	0.073	0.191	1.74	4.0	3	-	Complies
Westward Homestead 1:	<0.001	0.2	<0.001	0.191	0.48	4.0	2	-	Complies
Westward Homestead 2	<0.001	0.2	<0.001	0.191	0.51	4.0	5	-	Complies
Westward Homestead 3	<0.001	0.2	<0.001	0.191	0.42	4.0	3	-	Complies
Westward Homestead 4	<0.001	0.2	<0.001	0.191	0.38	4.0	2	-	Complies

Kokotoni mosque	0.011	0.2	0.022	0.191	0.65	4.0	9	-	Complies
Kokotoni dispensary	0.017	0.2	0.017	0.191	0.57	4.0	11	-	Complies
Market point 1 LHS	0.015	0.2	0.019	0.191	0.81	4.0	8	-	Complies
Market point 2 RHS	0.020	0.2	0.024	0.191	0.85	4.0	10	-	Complies
Kaliangombe pri. School.	<0.001	0.2	<0.001	0.191	0.60	4.0	6	-	Complies
Eastward Homestead 1	0.014	0.2	<0.001	0.191	0.44	4.0	7	-	Complies
Eastward Homestead 2	0.012	0.2	<0.001	0.191	0.52	4.0	9	-	Complies
Eastward Homestead 3	<0.001	0.2	<0.001	0.191	0.50	4.0	5	-	Complies

Table 3: Results of environmental parameters

Monitoring Locations	**Environmental parameters**	**Remarks**

	Air temps °C	Pressure hPa	Humidity %	Wind Speed km/hr	
Pastor Lwambi nursery school	27	1010.9	78	22 km/hr South West wind	Ambient conditions present
Office Area	28	1010.9	73	24 km/hr South West wind	Ambient conditions present
Furnace Area	31	1010.9	68	26 km/hr South West wind	Ambient conditions present
Westward Homestead 1:	30	1010.9	67	25 km/hr South West wind	Ambient conditions present
Westward Homestead 2	29	1010.9	63	26 km/hr South West wind	Ambient conditions present
Westward Homestead 3	29	1010.9	61	27 km/hr South West wind	Ambient conditions present
Westward Homestead 4	29	1010.9	59	27 km/hr South West wind	Ambient conditions present
Kokotoni mosque	26	1010.9	80	28 km/hr South West wind	Ambient conditions present
Kokotoni dispensary	27	1010.9	78	27 km/hr South West wind	Ambient conditions present
Market point 1 LHS	28	1010.9	71	22 km/hr South wind	Ambient conditions present
Market point 2 RHS	28	1010.9	68	23 km/hr South wind	Ambient conditions present
Kaliango'mbe pri. School.	29	1010.9	63	23 km/hr South wind	Ambient conditions present

Eastward Homestead 1	30	1010.7	62	26 km/hr South wind	Ambient conditions present
Eastward Homestead 2	31	1010.7	58	26 km/hr South wind	Ambient conditions present
Eastward Homestead 3	30	1010.7	57	28 km/hr South wind	Ambient conditions present

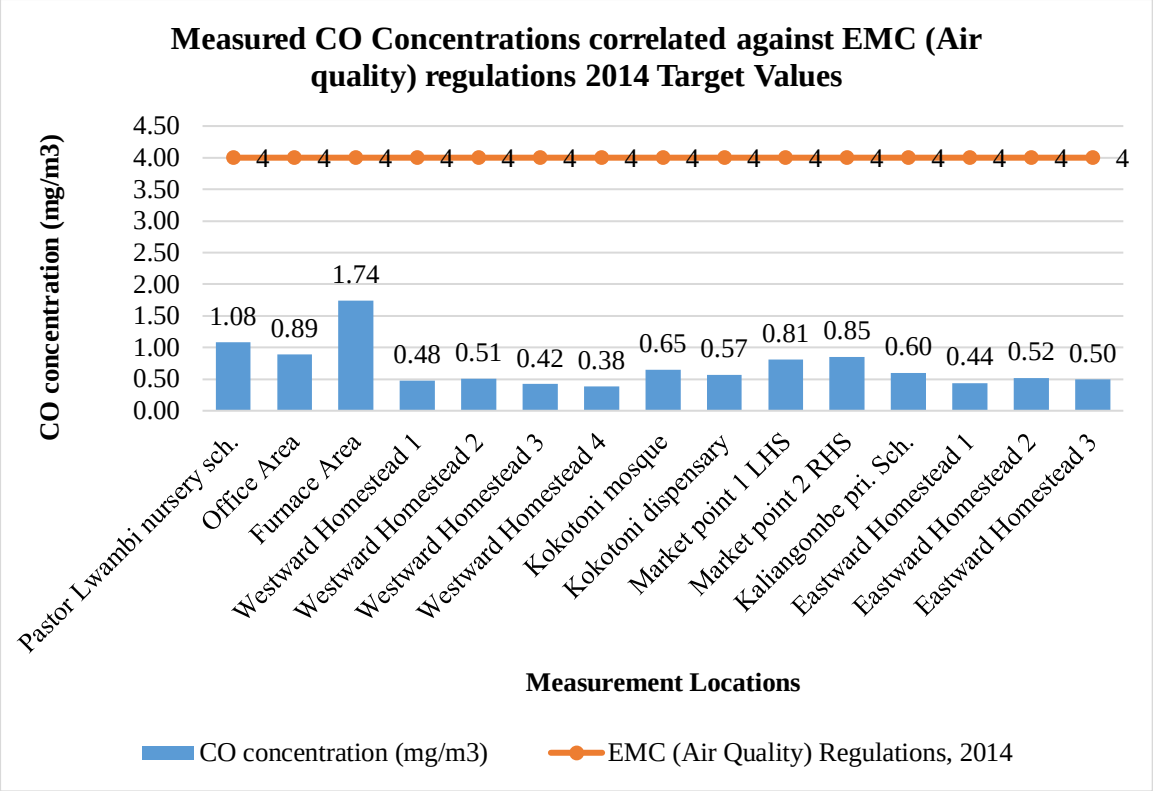

Figure 2: Correlation analysis between CO Concentrations and target values of EMC (Air quality) regulations 2014

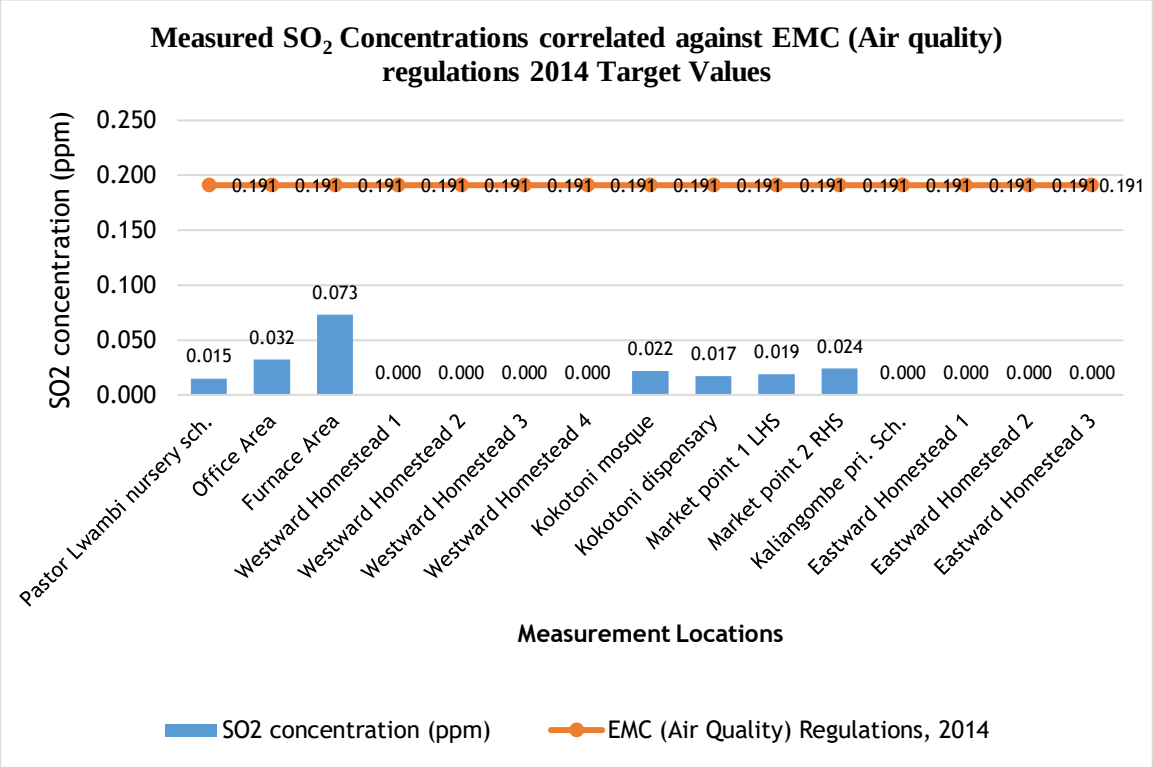

Figure 3: Correlation analysis between SO_2 concentrations and target values of EMC (Air quality) regulations 2014 Target Values

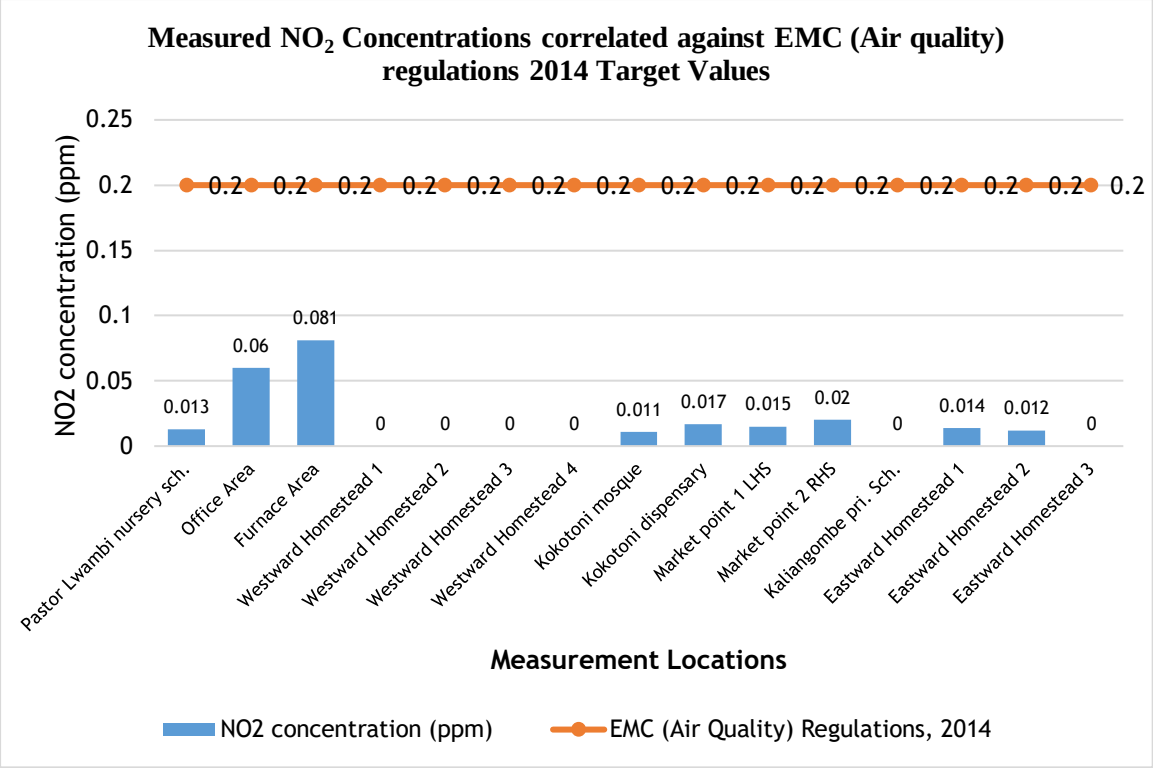

Figure 4: Correlation analysis between NO_2 concentrations and target values of EMC (Air quality) regulations 2014 Target Values

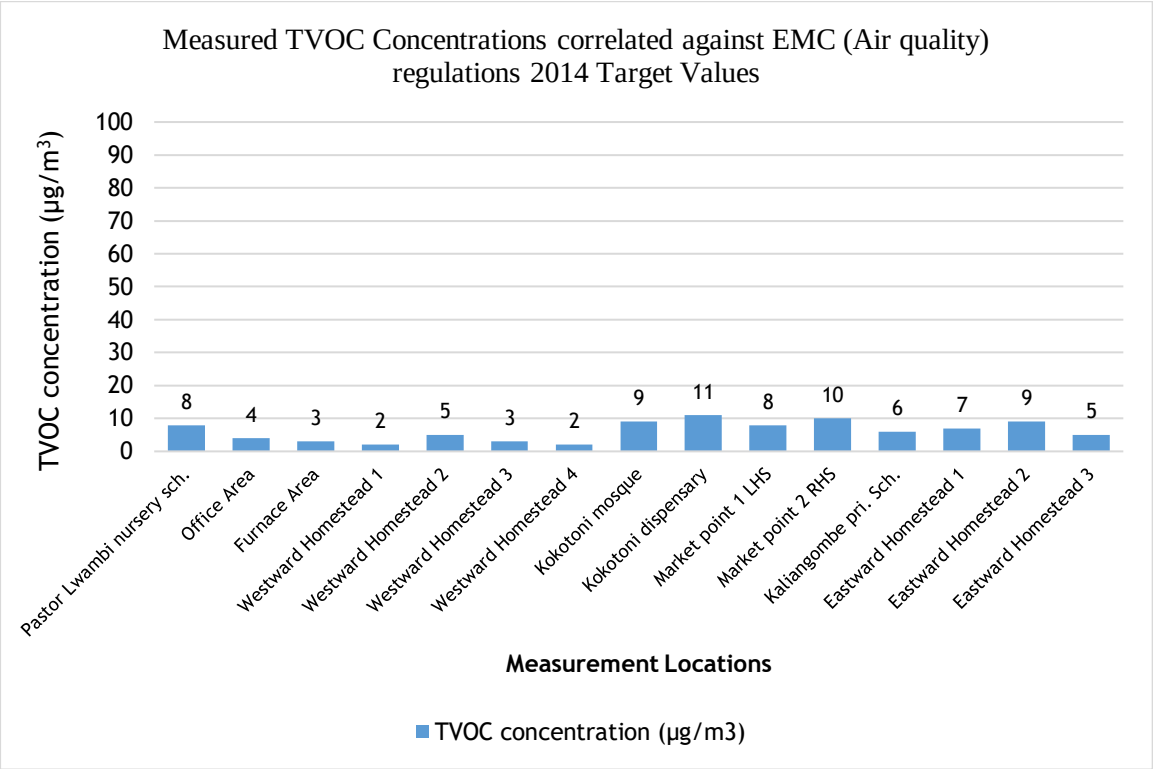

Figure 5: Correlation analysis between *TVOC concentrations and target values EMC (Air quality) regulations 2014*

5.2 Environmental baseline study report for ambient particulate matter monitoring

Particulate matter is the term for particles and aerosols found in the air, including dust, dirt, soot, smoke, and liquid droplets, and can be large and dark enough to be seen with the naked eye or so small that they can only be detected with an electron microscope. Many manmade and natural sources emit particulate matter directly while others emit gaseous pollutants that react in the atmosphere to form particulate matter. During billet melting process, dust is likely to be generated from different process, starting from storage of raw materials, handling, loading, charging, and melting process. The level and contents of the fugitive dust will strongly depend on the scrap composition and types, furnace additives, efficiency of the control devices, and the measurements taken during storage and handling. It is important to accurately determine prevailing air quality conditions against which predicted impacts can be determined and assessed for any environmental change. Ambient air quality survey for this study consists of fifteen representative monitoring locations. Results presented were based on air monitoring completed for two hour weighted average for particulate pollutants. Table 4 presents results of baseline air quality measurements, Table 5 presents results of baseline particulate matter (<10 microns). Table 6 presents results of baseline particulate matter ($PM_{2..5}$). Table 7 presents results of baseline environmental parameters. Figure 6 is correlation analysis of particulate parameter (PM_{10}) against target values of Air quality Regulations of 2014. Figure 7 is correlation analysis of particulate parameter ($PM_{2.5}$) against target values of Air quality Regulations of 2014. Appendix 6 is a detailed environmental baseline study report for ambient particulate matter monitoring.

Table 4 Air quality measurements

Monitoring Locations	**$PM_{2.5}$ $\mu g/m^3$**	**PM_{10} $\mu g/m^3$**	**HUMIDITY %**	**TEMPS ^0C**
Pastor Lwambi nursery school.	29.84	37.30	78	27
Office Area	33.17	49.00	73	28
Furnace Area	45.26	59.90	68	31
Westward Homestead 1:	20.80	32.38	67	30
Westward Homestead 2	20.15	34.25	63	29
Westward Homestead 3	22.29	33.74	61	29
Westward Homestead 4	19.00	30.20	59	29

Kokotoni mosque	27.77	35.90	80	26
Kokotoni dispensary	30.46	38.58	78	27
Market point 1 LHS	35.38	43.60	71	28
Market point 2 RHS	38.55	45.88	68	28
Kaliangombe pri. School.	29.71	40.17	63	29
Eastward Homestead 1	28.29	37.39	62	30
Eastward Homestead 2	30.48	41.66	58	31
Eastward Homestead 3	32.52	43.44	57	30

Table 5: Particulate matter (<10 microns)

Monitoring Locations	**Particulate Matter ≤10 (PM_{10})**			
	Sampling time	**Concentration (µg/m^3)**	**Guideline (µg/m^3)**	**Remarks**
Pastor Lwambi nursery school.	2 hours	37.30	-	No guideline for short term emissions
Office Area	2 hours	49.00	-	No guideline for short term emissions
Furnace Area	2 hours	59.90	-	No guideline for short term emissions
Westward Homestead 1:	2 hours	32.38	-	No guideline for short term emissions
Westward Homestead 2	2 hours	34.25	-	No guideline for short term emissions
Westward Homestead 3	2 hours	33.74	-	No guideline for short term emissions
Westward Homestead 4	2 hours	30.20	-	No guideline for short term emissions
Kokotoni mosque	2 hours	35.90	-	No guideline for short term emissions
Kokotoni dispensary	2 hours	38.58	-	No guideline for short term emissions

Market point 1 LHS	2 hours	43.60	-	No guideline for short term emissions
Market point 2 RHS	2 hours	45.88	-	No guideline for short term emissions
Kaliangombe pri. School.	2 hours	40.17	-	No guideline for short term emissions
Eastward Homestead 1	2 hours	37.39	-	No guideline for short term emissions
Eastward Homestead 2	2 hours	41.66	-	No guideline for short term emissions
Eastward Homestead 3	2 hours	43.44	-	No guideline for short term emissions

Table 6: Particulate matter ($PM_{2.5}$)

Monitoring Locations	**PARTICULATE MATTER ≤2.5 ($PM_{2.5}$)**			
	Sampling time	**Concentration (µg/m^3)**	**Guideline (µg/m^3)**	**Remarks**
Pastor Lwambi nursery school.	2 hours	29.84	-	No guideline for short term emissions
Office Area	2 hours	33.17	-	No guideline for short term emissions
Furnace Area	2 hours	45.26	-	No guideline for short term emissions
Westward Homestead 1:	2 hours	20.80	-	No guideline for short term emissions
Westward Homestead 2	2 hours	20.15	-	No guideline for short term emissions
Westward Homestead 3	2 hours	22.29	-	No guideline for short term emissions
Westward Homestead 4	2 hours	19.00	-	No guideline for short term emissions
Kokotoni mosque	2 hours	27.77	-	No guideline for short term emissions

Kokotoni dispensary	2 hours	30.46	-	No guideline for short term emissions
Market point 1 LHS	2 hours	35.38	-	No guideline for short term emissions
Market point 2 RHS	2 hours	38.55	-	No guideline for short term emissions
Kaliangombe pri. School.	2 hours	29.71	-	No guideline for short term emissions
Eastward Homestead 1	2 hours	28.29	-	No guideline for short term emissions
Eastward Homestead 2	2 hours	30.48	-	No guideline for short term emissions
Eastward Homestead 3	2 hours	32.52	-	No guideline for short term emissions

Table 7: Baseline Environmental parameters

Monitoring Locations	**Environmental parameters**				***Remarks***
	Air temps °C	Pressure hPa	Humidity %	Wind Speed km/hr	
Pastor Lwambi nursery school.	27	1010.9	78	22 km/hr South West wind	Ambient conditions present
Office Area	28	1010.9	73	24 km/hr South West wind	Ambient conditions present
Furnace Area	31	1010.9	68	26 km/hr South West wind	Ambient conditions present
Westward Homestead 1:	30	1010.9	67	25 km/hr South West wind	Ambient conditions present
Westward Homestead 2	29	1010.9	63	26 km/hr South West wind	Ambient conditions present
Westward Homestead 3	29	1010.9	61	27 km/hr South West wind	Ambient conditions present
Westward Homestead 4	29	1010.9	59	27 km/hr South West wind	Ambient conditions present

Kokotoni mosque	26	1010.9	80	28 km/hr South West wind	Ambient conditions present
Kokotoni dispensary	27	1010.9	78	27 km/hr South West wind	Ambient conditions present
Market point 1 LHS	28	1010.9	71	22 km/hr South wind	Ambient conditions present
Market point 2 RHS	28	1010.9	68	23 km/hr South wind	Ambient conditions present
Kaliango'mbe pri. School.	29	1010.9	63	23 km/hr South wind	Ambient conditions present
Eastward Homestead 1	30	1010.7	62	26 km/hr South wind	Ambient conditions present
Eastward Homestead 2	31	1010.7	58	26 km/hr South wind	Ambient conditions present
Eastward Homestead 3	30	1010.7	57	28 km/hr South wind	Ambient conditions present

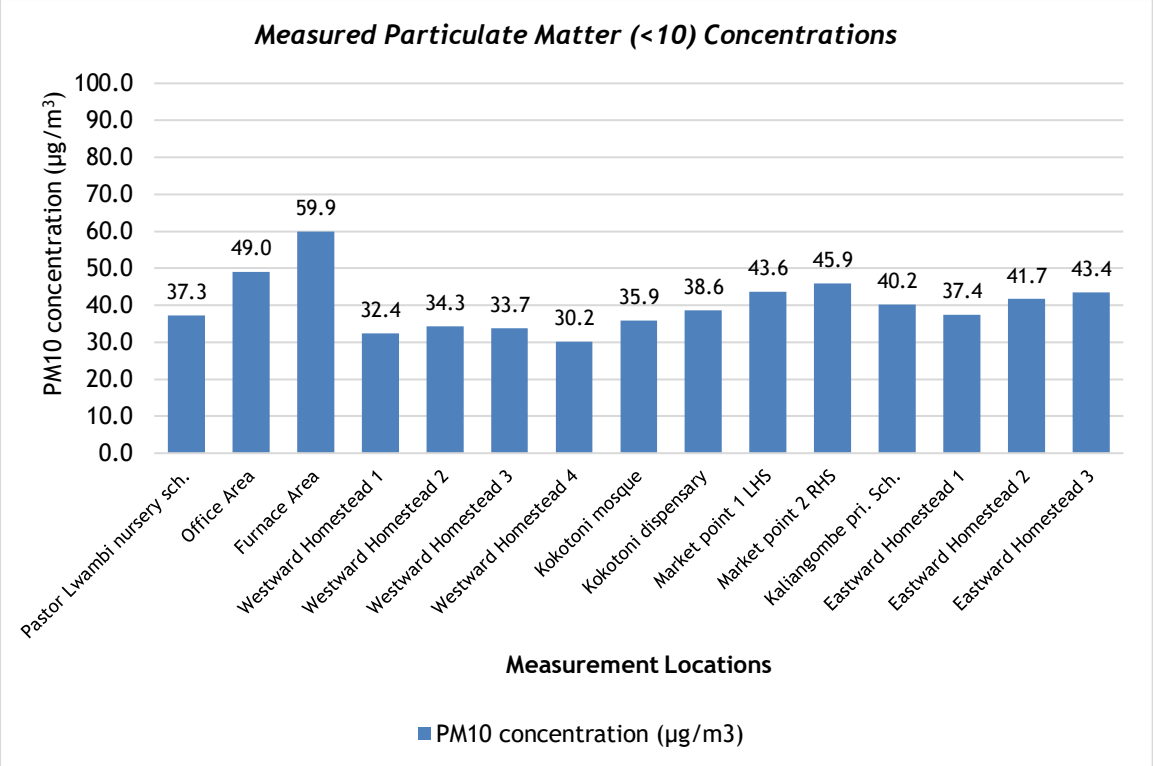

Figure 6: Correlation analysis of particulate matter (PM_{10}) against target values of Air Quality Regulations 2014

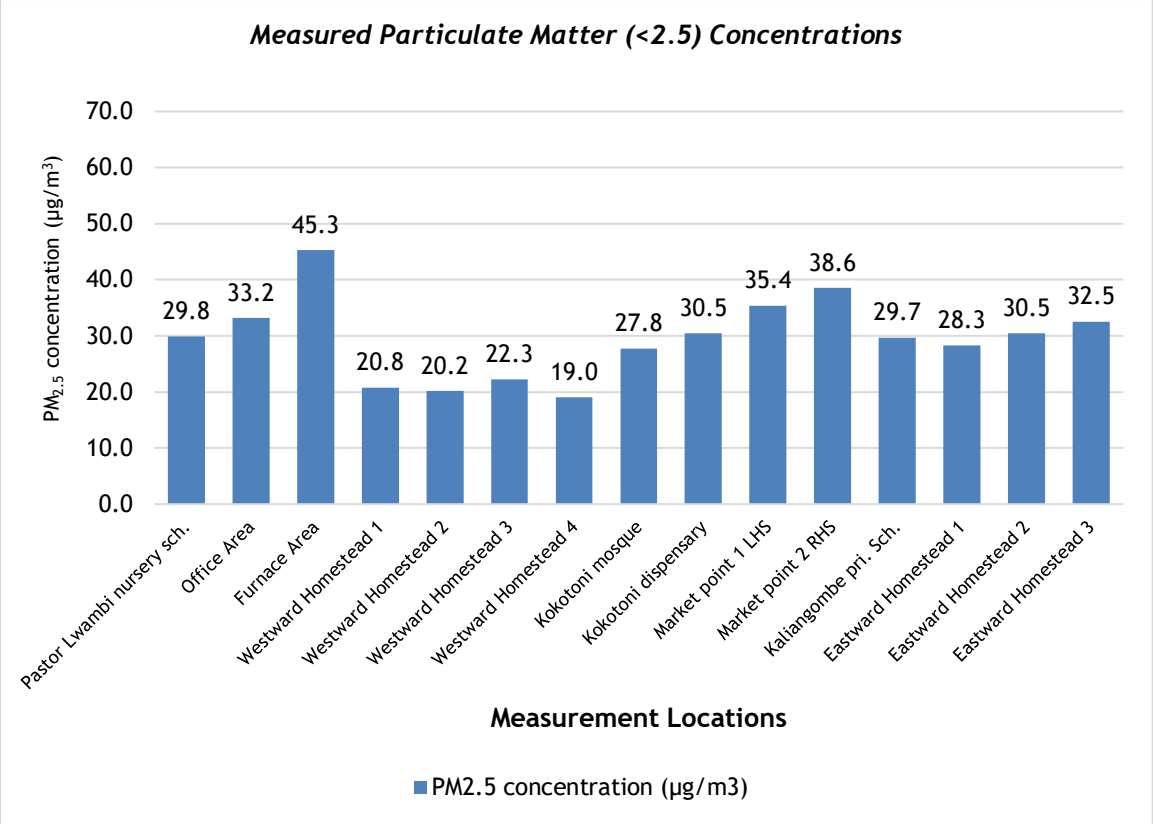

Figure 7 Correlation analysis of particulate matter ($PM_{2.5}$) against target values of Air Quality Regulations 2014

5.3 Climate change and vulnerability risk assessment

In its simplest form climate change refers to the long-term change in the earth's climate, especially a change due to an increase in the average atmospheric temperature. The global climate is the connected system of sun, earth and oceans, wind, rain and snow, forests, deserts and savannahs, and associated human activities. Climate change according to the UNFCCC is "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods''. Climate change is one of the environmental and developmental challenges that the natural ecosystems and socio-economic systems faces. Climate change negatively impact natural ecosystems and human societies. Climate change adversely impact food production, water resources, biodiversity and health. The impact or risk of climate change is the result of interaction of climatic hazards, exposure and vulnerability of the communities and systems.

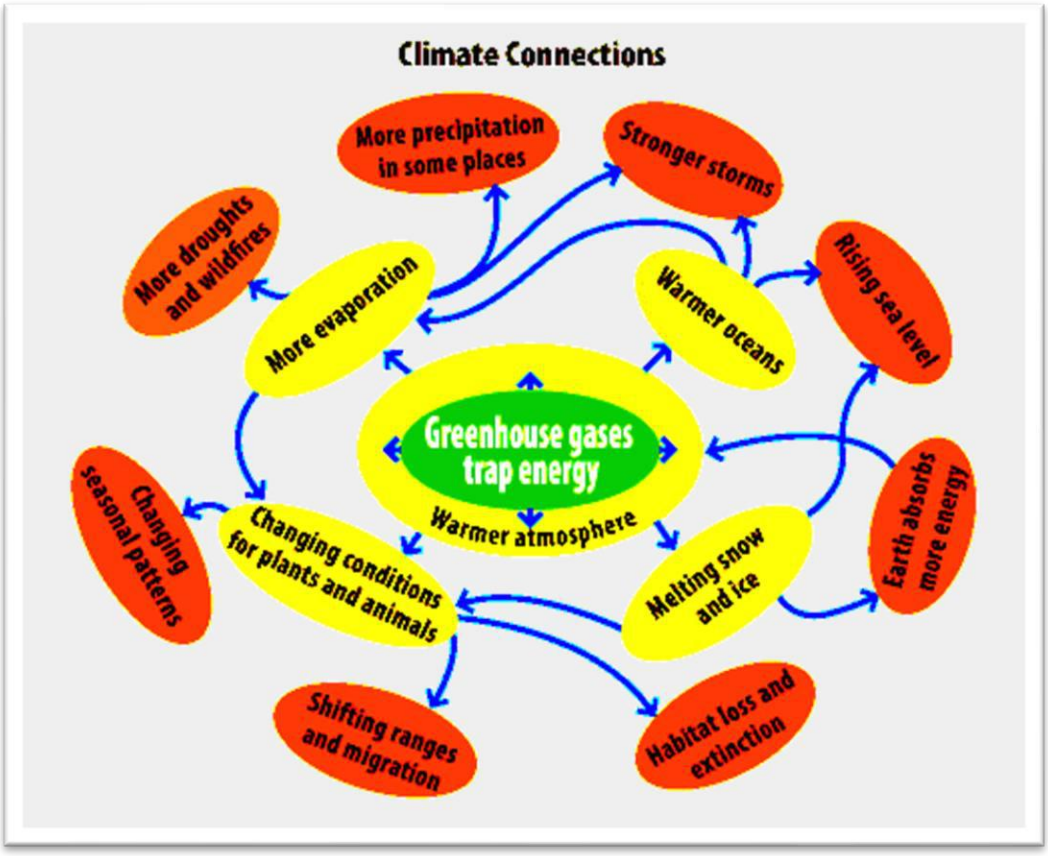

Figure 8: Climate connections

(Source: US Environmental Protection Agency)

Global warming and climate change result from human activities that have increased the amount of carbon containing gases in the upper atmosphere and to increased amounts of tiny particles in the lower atmosphere (figure 8). Industrial development contributes to release of "greenhouse gases" (GHGs) that trap heat in the atmosphere resulting in a 'greenhouse' effect. The most important GHGs are:

- ✓ Carbon dioxide CO_2 which is produced any time something is burned. It is the most common GHG, constituting by some measures almost 55% of total long-term GHGs. It is used as a marker by the United States Environmental Protection Agency, for example, because of its ubiquity. Carbon dioxide is assigned a Global Warming Potential (GWP) of 1.
- ✓ Methane (CH_4) is produced in many combustion processes and also by anaerobic decomposition. Methane breaks down in approximately 10 years, but is a precursor of ozone, itself an important GHG. CH_4 has a GWP of 28-36.

- ✓ Nitrous oxide (NO/N_2O or simply NOx is not only a by-product of fertilizer production and use, but also generated from industrial processes and the combustion of certain materials. Nitrous oxide lasts a very long time in the atmosphere, but at the 100 year point of comparison to CO_2; its GWP is 265-298.

5.3.1 Greenhouse gases emission from the proposed project

The following greenhouse gases are likely to be released during the implementation of the proposed project. Sulphur dioxide (SO_2); oxides of nitrogen (NO_x) (which includes nitric oxide (NO) and nitrogen dioxide (NO_2)); carbon monoxide (CO); carbon dioxide (CO_2); Total Volatile organic compounds, (TVOCs) and Ammonia (NH_3).

5.3.2 Potential effect of the generated and emitted GHGs

The GHGs that are likely to be generated from the proposed project will likely contribute to:

- ✓ Global warming which is the slow increase in the average temperature of the earth's atmosphere because an increased amount of the energy (heat) striking the earth from the sun is being trapped in the atmosphere and not radiated out into space as a result of the greenhouse gas effect created by emitted greenhouse gases.
- ✓ Local changes in temperature that will contribute to change in the patterns of wind and rain, making drought and unpredictable weather more common.

5.3.3 Mitigation

Generated GHGs can be mitigated by:

- ✓ Electricity to be used to power the EAF to be from green sources such as wind, solar, geothermal and not from fossil fuels.
- ✓ Carbon capture and utilization a process of capturing carbon dioxide (CO_2) from emission-producing processes and industries to be recycled for further use, such as conversion into commercial chemicals. Carbon capture systems are essentially filters attached to carbon emitting producers that capture excess carbon dioxide.
- ✓ Carbon capture utilization and storage technologies aim to reduce the rates of CO_2 emissions and the cumulative amount of CO_2 in the atmosphere to help limit impacts on the global climate.

5.3.4 Conclusion

Whereas steel production from steel scrap emits greenhouse gases, generation and emission of a significant amount of greenhouse gases is prevented when producing steel from scrap using electric arc technology when compared to steel production from other methods. Steel production from steel scarp is one way of recycling and promotion of circular economy a measures of mitigating greenhouse gasses generation and emission. Steel production in electric arc furnaces (EAF) is almost completely based on scrap steel that facilitates recycling of steel to make new steel. In the electric furnace, electrical energy is provided via graphite electrodes to melt the scrap. Recycled steel accounts for significant energy and raw material savings including over 1400 kg of iron ore, 740 kg of coal and 120 kg of limestone saved for every 1000 kg of steel scrap made into new steel.

6. BACKGROUND TO ELECTRIC ARC FURNACE

An electric arc furnace (EAF) is a furnace that heats charged materials through an electric arc for melting certain metals such as scrap steel without changing the electrochemical properties of that metal. Heating through high electric voltage currents is the primary heating element of the furnace. EAF is the central part of the production. EAF are extremely hot enclosed spaces widely used in the steel production industry. They also play a crucial role in iron & steel recycling operations and are used in mini-mills that recycle iron scrap. These furnaces are available in varied sizes, with the smallest having a capacity of 1 tonne and the largest approx. 400 tonnes. The temperature can range between 3,000 degrees and 3,500 degrees Celsius.

6.1 Components of an electric arc furnace

Powered by three graphite spikes, an electric arc furnace is like a giant heat-resistant kettle. It consists of a refractory-lined vessel with a removable water-cooled lid that holds the graphite spike and connects it to large power lines that act as electrodes. The furnace has three parts namely the shell (body), the hearth (bottom) and the roof. The body (shell) consists of the lower steel bowl and sidewalls. The bottom (hearth) contains the refractory that lines the lower bowl. The roof, most likely to be shaped as a section of the sphere, is either refractory-lined or water-cooled. The EAF is made from alumina and magnesite-chromite bricks. When the lid is lifted, the furnace can be loaded with any combination of solid fuel, iron ore, flux, or iron scrap. The electrodes can be lowered once the lid is securely closed to begin the process of melting.

6.2 Classification of an EAF process

The electric arc furnace process can be classified into three categories; charging the electrodes, melting the metal or ore, and refining.

6.2.1 Charging the electrodes

The heavy & light scrap is first loaded into the large basket and preheated via the exhaust gas. To speed up the slag formation, burnt lime and spar are added. Next, the roof of the furnace is oscillated to charge the furnace.

6.2.2 Meltdown process

This process uses electrodes that are moved down (or loaded) onto the scrap. Initially, low voltage is used. Once the electric arc is properly shielded (between the electrode and the metal) the voltage is gradually increased. This speeds up the melting process. For large arc production, low current is used, which helps minimise heat loss.

6.2.3 Refining

The process of refining begins during the meltdown process itself. During the single oxidising slag, only phosphorus is removed. Whereas, in the double oxidising slag, both phosphorus and sulphur are removed. The next process is de-oxidisation, following which the molten metal is obtained.

6.3 Types of Electric Arc Furnaces

6.3.1 Direct Arc Furnace

As the name suggests, in the direct arc furnace, the arc is in direct contact with the charge. Heat is also produced via the charge itself. Hence, the charge can be heated to the highest temperature.

6.3.2 Indirect Arc Furnace

In an indirect arc furnace, an arc is formed between the two electrodes above the charge, while heat is slowly transmitted to the charge by radiation. In this type, the temperature of the charge is lower compared to the direct arc furnace.

6.3.3 Submerged Arc Furnace

Submerged Arc Furnace is a cylindrical furnace. It forms an arc between the carbon electrodes (top) and the hearth electrodes (bottom). The hearth lining is made from magnesite, which is a good conductor of heat. The number of electrodes taken from the roof depends on the type of supply required.

Table 8: Difference between direct arc furnace and indirect arc furnace

Direct Arc Furnace	Indirect Arc Furnace
Heat is subjected directly to the material	Since the arc burns above charge, it is not direct and doesn't form a part of the electric circuit
Lined with acid or basic refractories, this furnace consists of a cylindrical steel shell	Lined with basic refractories, this furnace consists of a barrel-shape steel shell
It is used for melting alloy steels	It is suitable for melting a range of alloys, particularly copper-base alloys

Sizes vary from a few kilograms for laboratory units to 100 tonnes per batch	These are relatively smaller units
The temperature of the charge is extremely high	Temperature of the charge is lower compared to a direct arc furnace
The current that passes through the charge develops an electromagnetic field. Thus, necessary stirring action is automatically obtained by it	There is no stirring action as the furnace is rocked mechanically
It is generally used for steel production	It is used for melting of non-ferrous metals such as brass, copper, etc.
It operates on a high tension three-phase power supply	It operates on a single-phase power supply

6.4 Advantages & Disadvantages of an Electric Arc Furnace

The following are the advantages of an Electric Arc Furnace:-

- This system makes it easy to produce steel from 100% scrap metal feedstock. Compared to steel-making from ores, this process is more energy-efficient.
- As a highly efficient and flexible system, EAF is not dependent on any specific type of charge.
- The entire melting process can be automated.
- It helps produce a wide range of steel grades.
- Electric arc furnaces are easy to use and require low capital investment.

The following are disadvantages of an electric arc furnace:-

- The arc could cause uneven heat distribution in the furnace.
- By reacting to the furnace gases & vapour, the arc could release large amounts of hydrogen and nitrogen.

7. PROJECT DESIGN

The design of the proposed project of a steel mill for melting of steel scrap to generate molten metal that is continuously casted to produce billets will encompass godown construction and associated support facilities, and installation and operation of a billet manufacturing plant. The billet manufacturing plant that will be installed will consisting of an induction melting furnace, continuous billet casting machine and a pollution control system.

7.1 The Godown and associated support facilities

The proposed godown will house the steel scrap melting and billet casting and production plant. Support facilities that will be constructed and installed will include sanitary facilities, offices, weighbridge & weighbridge house. Appendix 7 is the site layout plan while appendix 8 is the godown design.

7.2 Billet manufacturing process description

The proposed billet manufacturing plant will consist of an induction melting furnace, continuous billet casting machine and a pollution control system. The proposed steel melting is one of the best systems to make required size and quality of billets from the scrap. The main raw material that will be used in billet manufacturing process will be mild steel scrap which will be procured from local and international markets. The scrap will be mixed in pre-determined proportions in the scrap yard and fed to the furnaces in charging buckets and melted by Electric Arc using Graphite Electrodes. The molten metal will then be processed to remove the impurities like sulphur and phosphorous and then subjected to slag off and further refining by adding Ferroalloys and other fluxes to bring it to the required standard specifications. Liquid metal samples will be analyzed at frequent intervals to ensure quality of the product. The molten steel will be tapped at the required temperature to the pre-heated ladles. Steel ladles will be equipped with latest slide gate opening system. Temperature of the molten metal in the ladle will be measured to ensure correct temperature at the continuous casting machine. The liquid metal will then be poured from ladle to the tundish and then to the water cooled copper mold on continuous casting machine. This will allow for billet formation by solidification of the molten steel due to water cooling. Billets coming out of the continuous casting machine will then be cut to the required length by gas cutting. Figure 9 is a schematic flow process of billet production from steel scrap using electric arch furnace technology. The steel scrap melting will be mainly in two sections namely induction furnace and continuous casting machine.

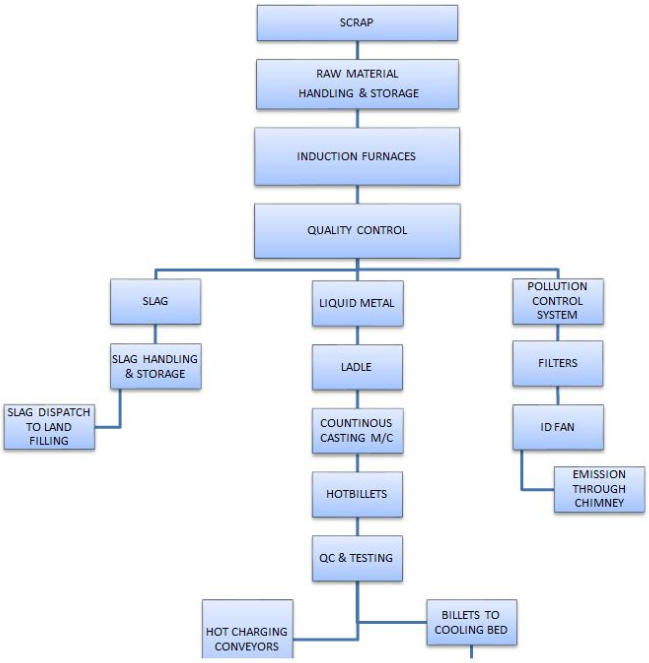

Figure 9: Steel scrap process flow diagram

7.3 Induction melting furnace

Induction furnace is the primary section of the steel melting process where the different types of scrap convert into liquid form by induction heating in the furnace crucible. The induction melting furnace consist; scrap, raw material handling and storage, furnace, ferroalloy addition sampling and quality control, slag handling storage and dispatch, pollution control system.

7.3.1 Scrap

Energy consumption pattern for induction furnace depends significantly on the nature & quality of the scrap charged in to the furnace.

7.3.2 Raw material handling and storage

The main raw material that will be used in billet manufacturing process will be mild steel scrap. Charging of scrap to the furnace crucible should be done only after proper segregation and preparation. Scrap should be free from sand, dirt, rubber, glass, high carbon steel, any chemical coated material, plastic and oil grease. Rusty scrap not only takes more time to melt but also contains less molten metal per charging. Clean scrap made in a bundle shape by hydraulic bailing machine. The maximum single piece of metal or scrap is not more than a third of diameter of furnace crucible. At least 10 heat materials should be at the storage before start the furnace.

7.3.3 Furnace

Furnace is the important equipment of the steel scrap melting plant. There are two type of heat process in induction furnace namely sintering heat and running heat. Sintering heat is the first heat after new lining of the crucible while the rest called running heats. Scrap charging during the heat is by hand and magnet crane. Hydraulic pusher is the equipment used to press the loose scrap in to the crucible for fast melting for energy efficient heating. During the heat cycle formation of slag in furnace wall should be avoided as it leads to increase in energy consumption and decrease of furnace life. Carryout de-slagging once the furnace is full with molten metal and has attained temperature of 1350 – 1400 degree Celsius.

7.3.4Ferro alloy addition sampling and quality control

After de-slagging sample should be taken and sent to chemical laboratory for analysis. Generally, take two samples during the heat. First one called a pre-sample sampled at 65% to 75% furnace full by the molten metal. After testing the pre-sample, according to the result add the required ferroalloys like silicon, manganese as per calculation and after addition of ferroalloys and increase the temperature up to 1400 degree Celsius then take the final sample.

7.3.5 Slag handling storage & dispatch

During the de- slagging process, collect all slag in a slag pot and transfer to the slag storage. Segregate metallic parts from the slag which can be disposed as land fill.

7.4 Pollution control system (fume extraction system)

Fume extraction system consist of the following systems working together; movable fume collection hood, pipeline, cyclone, bag house, sanction blower, bag house cleaning system, chimney, liquid metal and ladle.

7.4.1 Dog house

A special movable fumes collection hood (dog house) is designed based on the specifications of the furnace. The dog house is made movable in order to use the same hood for both the crucibles in the furnace. The hood is moved to the crucible of the furnace in which the metal is being melted. The hood is supported by the rails and the wheels making is easy to move the hood from one crucible to the other using a geared motor to provide energy to the wheels for movement.

7.4.2 Pipeline

The fumes collected in the dog house are transported in the pipeline with which the dog house is connected using branch pipes. The pipeline collects the fumes through dog house from both the chambers of the furnace.

7.4.3 Cyclone

The spark arrestor cyclone is required before the bag filter in order to arrest the sparks arising from the furnace which may damage the bag filters. the cyclone also arrests the heavy particles in the fumes in order to increase the efficiency of the bag filters.

7.4.4 Bag house

The bag house is designed to collect maximum amount of dust from the fumes. the bag house is made of an arrangement of bag filters which are covered by the outer body. these bag filters collect the dust while the fumes are passed through them. the dust is removed from the bags using air pulse and the dust is then collected using automatic discharge valves.

7.4.5 Suction blower

Suction blower is required to create positive pressure in the system so the fumes directly enter the system while being released from the furnace. the suction blower is powered through Variable Frequency Drive (VFD) in order to use the required amount of energy based on the pressure.

7.4.5.1 Bag house cleaning system

The bag filters are required to be cleaned time to time in order to maintain the efficiency of the system. Automatic compressed air system helps clean the bags automatically while maintaining the efficiency of the system. the pulse jet arrangement of compressed air shakes the bags using jets of air to remove the dust collected from the bag, which is then collected.

7.4.5.2 Chimney

The chimney is used to release the clean air into the atmosphere after it has been cleaned by bag filters. The chimney is to be designed as per nation standards. The chimney usually stands 5 m higher than the tallest building in the vicinity.

7.4.5.3 Liquid metal

Determining the correct tap temperature plays a significant role in energy consumption. Unnecessary superheating of metal bath at times has detrimental impact on the furnace performance. Decision on superheating temperature should be based on final pouring temperature of a component and temperature loss during transfer of metal to pouring zone. Unnecessary superheating of metal is to be avoided. Measure and monitor metal bath temperature in every heat before pouring the molted metal in ladle.

7.4.5.4 Ladle

Ladle is large bucket specially design for the liquid metal carrying one section to other section of steel scarp melting plant. Ladle is a vertical cone shape & fitted with a refractory lining. With the arrangement of slung from an over head crane and will be tilted using the second over head lifting device. Also, there is a pneumatics or hydraulics operated slide gate valve at the bottom of the ladle for pouring the molted metal to the continuous casting machine (CCM).

7.5 Continuous casting machine

Continuous casting (Figure 10) is a process whereby molten metal is solidified in to a semi-finished billet for subsequent rolling in finishing mills. It has evolved to achieve improved yield, quality, productivity, and cost efficiency. It allows lower-cost production of metal sections with better quality, due to the inherently lower costs of continuous, standardized production of a product, as well as providing increased control over the process through automation.

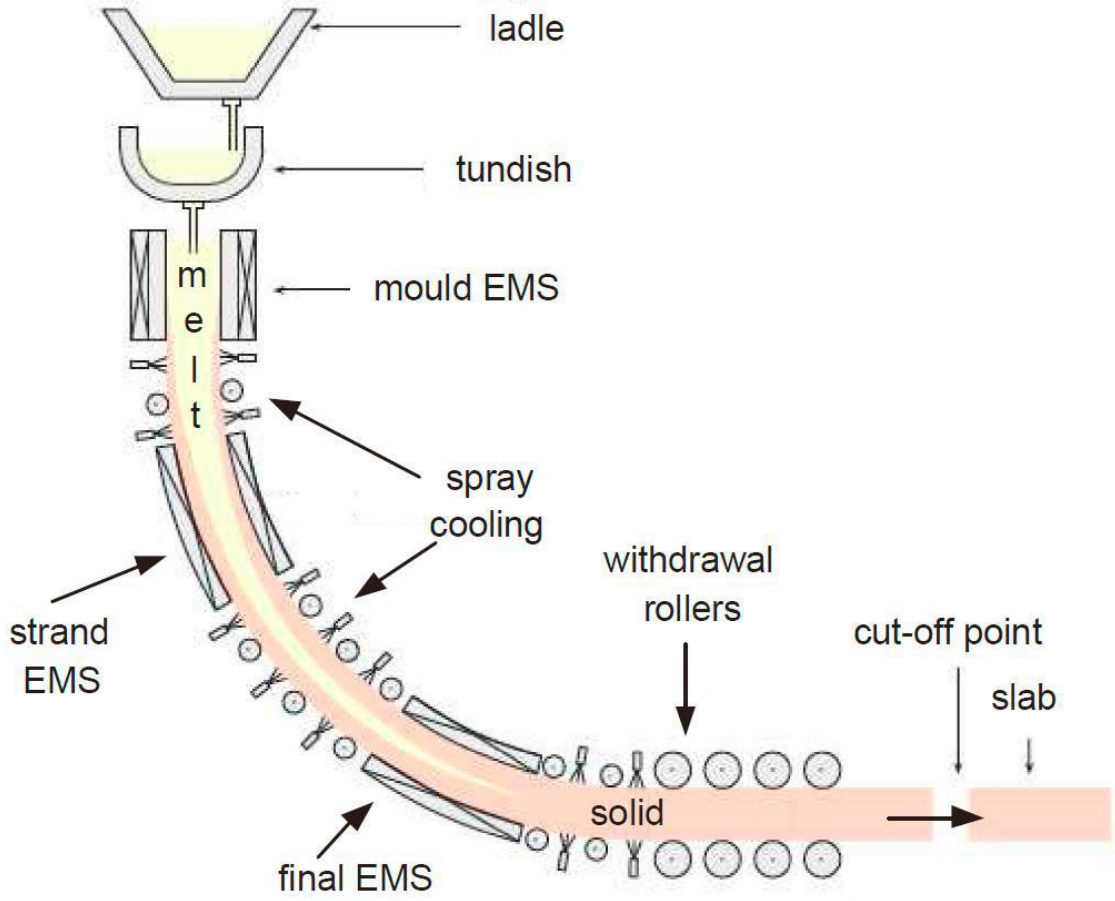

Figure 10 Continuous casting process

7.6 Finished products

Billets are the finished product of the steel melting process. It should be the uniform size as per the requirement. The standard sizes are 90 x 90, 100 x100 ,130 x 130 & the length of 12 meters. Quality control of billets are only in terms of physical size and the surface temperature of the billets it should be 925^0C to 1050^0C and required length online cutting by the hydraulic shear for the direct rolling. This billets transfer to the rolling mill for direct rolling by the mechanical conveyors. The billets which are not transfer to direct rolling set on the cooling bed and then after cooling the billets transfer to the storage yard.

7.7 Waste

The main waste that will be generated from the proposed project will be slag. Electric arc furnace residues that will be generated will likely contain valuable metals such as zinc and heavy metals such as Lead. Generated slag if not treated appropriately to recover valuable metals from the dust and to make the residue harmless for disposal can result in environmental pollution when disposed in landfills.

7.8 Project cost

The bills of quantities prepared for the proposed project indicated that, the estimated cost of the project will be KSH 426, 731, 088.36. Appendix 9 is the detailed bills of quantities.

8. ANALYSIS OF ALTERNATIVES

A Project Alternative is another combination of the project's costs, schedules, resources, and risks that allow achieving the same results as compared to the project baseline. It is one or more ways to produce the project and address its need while using the same resource base yet operating in a new way and facing new working conditions. Project alternatives considered for the proposed project are the Yes-project alternative, the No-project alternative, alternative project site and alternative project technology. Evaluation of each of the projection options is as follows.

8.1 The Yes-project alternative

The Yes-project alternative means that the proposed project be implemented as currently proposed without alterations. This implies that the proposed project location, proposed project design to be implemented as currently proposed. The proposed project is a steel mill for the melting of steel scrap to generate molten metal that is continuously casted to produce billets. The proposed project location is at Kokotoni area of Kilifi County off Mombasa-Nairobi Highway. The proposed project site is adjacent to other industrial installations such as the Pickling Division, the Bitumen Division and Standard Rolling Mills. Billets produced from the proposed project will be used within the proposed project site in the existing hot rolling mills to produce hot rolled steel products. In view of this the proposed project site is ideal owing to its close proximity to the existing hot rolling mill.

8.2 The No-project alternative

The no project alternative means that the project be rejected in its entirety as currently proposed. This means that implementation of the proposed project as currently proposed will not be realized. This implies that the current design of the project be rejected, the proposed location and the proposed technology all be rejected. This project alternative will deny the project proponent the opportunity for onsite manufacture of billets that will be used in the existing hot rolling steel mill to manufacture hot rolled steel products.

8.3 Alternative project site

Within the CSL Pickling division, there are other vacant spaces that the proponent can select from and place the proposed project. Likewise within the Standard Rolling Mills Limited which is owned by the project proponent, there are open spaces which can be utilized for the proposed project. Likewise the proponent can procure new sites within the wider Kaliangombe area where the proposed project can be sited. Whereas there are alternative sites where the proponent can choose from for the implementation of the proposed project, it is prudent to

consider the current location of the target end-user of the billets that will be generated from the proposed project. The proponent is targeting to use the billets that will be generated in the production of hot rolled steel production from an existing hot rolling mill which is adjacent to the proposed site for the proposed project. In view of this the proposed project site is the most suited for the proposed project.

8.4 Alternative technology

The proposed project proposes to utilise electric arc furnace to heat and melt steel scrap using graphite electrodes to generated molten metal that will be cast continuously to produce steel billets. Other alternative technologies that can be used include bassemer converter, basic oxygen furnace, open hearth furnace and blast of furnace.

8.4.1 Bessemer converter

Steel can be produced from pig iron using the Bessemer process. This steelmaking process involves the oxidation of impurities in the pig iron which is achieved by blow air through the molten iron in a Bessemer converter, at this point; the heat of oxidation raises the temperature and keeps the iron molten. Air plays an important role as it reacts with molten pig iron and makes the impurities from oxides, carbon monoxide burns off, and other impurities from slag.

8.4.2 Basic oxygen furnace

A basic oxygen furnace is a pear-shaped steel vessel with refractory lining and an open top. The charge consists of about 75% molten iron and 25% scrap steel. Steel is produced in a basic oxygen furnace by the following steps:

- ✓ The charge is dumped into the furnace.
- ✓ An oxygen lance (pipe) is lowered and pure oxygen blows into the furnace at high pressure.
- ✓ The oxygen reacts with the carbon and impurities that are in the molten iron.
- ✓ When the carbon reaches the desired amount (up to 0.9%) the process is finished.

This is a low-cost process, as it does not use electricity or fuel, and makes steel quickly (in about 45 minutes), but it does not allow full control over the chemical composition of the steel.

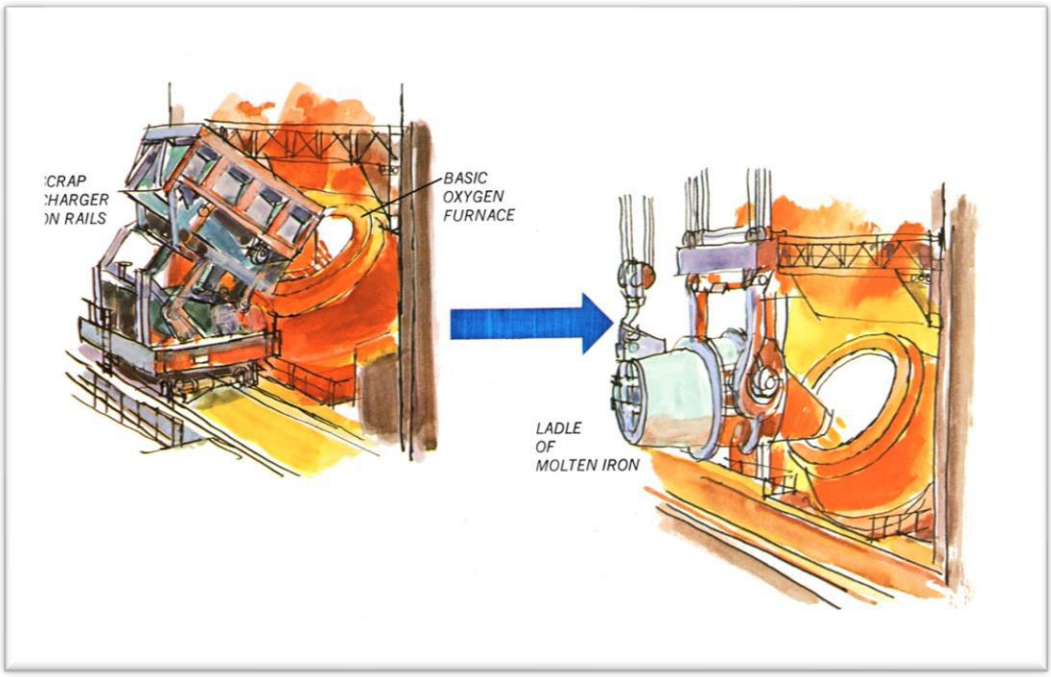

Figure 11: Illustration of steel making using basic oxygen furnace
(Source: The Graystone Society, Inc. 2012)

8.4.3 Open hearth furnace

An open hearth furnace has a lining of refractory and a low, arched roof that covers the hearth, which is open directly to flames that melt the charge. This process uses about equal amounts of iron and scrap. Steel is produced in an open hearth furnace by the following steps:

- ✓ A machine dumps limestone and scrap steel (the charge) into the furnace.
- ✓ After the charge melts, molten or cold iron is added.
- ✓ Heating continues. Carbon from the iron becomes carbon monoxide gas. Impurities are separated and form slag.
- ✓ The remaining product is molten steel, which flows into a large ladle where alloying materials may be added.

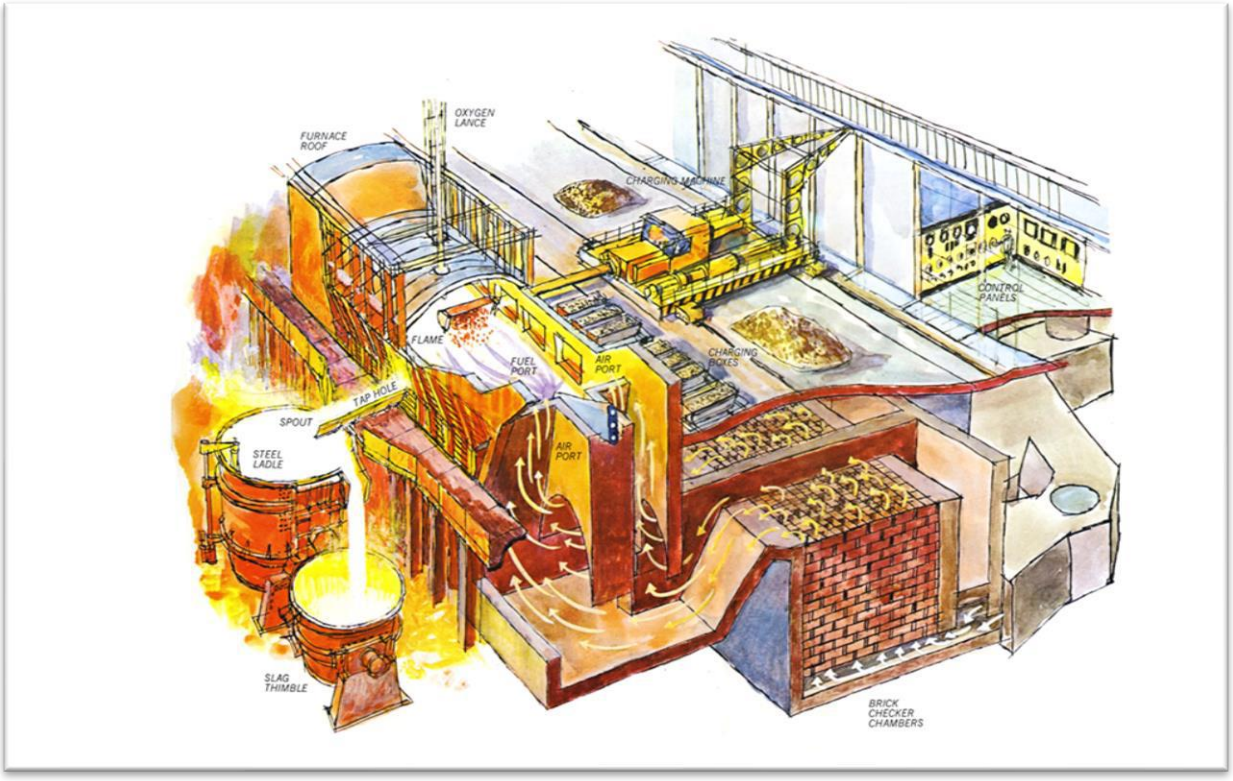

Figure 12: An illustration of open hearth furnace
(Source: The Graystone Society, Inc. 2012)

8.4.4 Blast of furnace

Blast of furnace in an alternative technology to electric arc furnace. A blast furnace is a steel cylinder lined with refractory. It operates continuously until the lining wears out, which takes many years to occur. The term blast furnace comes from the blast of hot air that is blown into the lower part of the furnace at between 1400º to 2100ºF. Molten iron is produced in a blast furnace by the following steps:

- Charge is constantly dumped into the top of the furnace.
- A blast of hot air is blown into the furnace from the bottom.
- Coke is the fuel that supplies additional heat, increasing the temperature of the charge.
- Chemical reactions occur: coke reacts with oxygen from the air, creating the reducing agent (carbon monoxide), which removes oxygen from the ore.
- Limestone reacts with impurities in the furnace, forming slag, which floats to the top of the furnace vessel.
- Every hour or so the molten iron is removed and sent on for further processing.

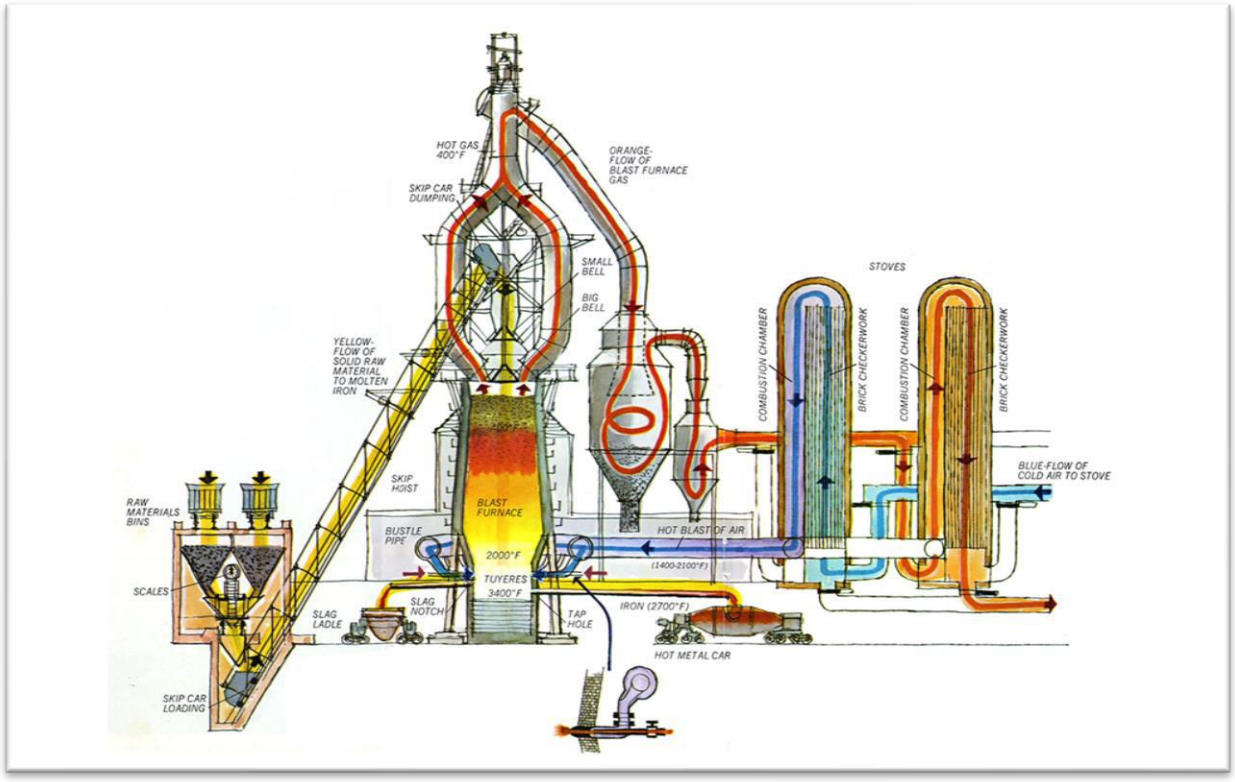

Figure 13: An illustration of blast of furnace
(Source: The Graystone Society, Inc. 2012)

9. OCCUPATIONAL SAFETY AND HEALTH

The steel industry is known to be involving hazardous processes. Toxic gases, explosive gases, extreme temperature, fire, electrocution, working at height, and confined space are some of the major hazards in the steel industry. Implementing occupational safety measures in the steel industry has several benefits. Accidents and injuries affect all workers equally and failure to prevent these accidents can lead to loss of life as well as materials. The loss of reputation and customers are also major consequences.

9.1 Introduction

Occupational Health and Safety (OHS) is of importance at project sites. It is important for mechanisms to be put in place to predict potential risks, incidents and hazards in the said working environment. This is because the occupational environment directly affects employees involved in the project, the neighborhood, visitors, contractors, sub-contractors and the general public. Therefore before commissioning commencement of project implementation, a number of safety measures have to be in place to ensure the safety of employees, neighbors and the general public. Employees and visitors to the project site may be exposed to potential occupational safety and health risks. The type and level of exposure is generally related to factors controlled by the employer/ developer. Such factors include design, equipment, tools, work procedures, project, and employee training. Occupational health and safety risks that should be considered by the employer arise from normal functions and operations and during unusual circumstances such as accidents and incidents. The employer/ developer is responsible for:

- Implementation of appropriate national and internal recognised OHS standards, practices and guidelines.
- Inclusion of meaningful participation of employees in implementation and maintenance of procedures and processes.
- Implementation of a programme to change employee culture and altitudes regarding health and safety.
- Planning, implementing and monitoring programs required to ensure OHS at the workplace.
- Provide and maintain workplace, plant, equipment, tools and machinery and organise work so as to eliminate or control hazardous ambient work factors.
- Provide appropriate occupational health and safety training for all employees.
- Provide adequate personal protective equipment to all employees.

- Record and report occupational injuries and illness.
- Ensure contract specifications include demands for service providers, contractors, and sub-contractors to have or establish enabling them to meet the OHS requirements of the employer.

9.2. Occupational Health and Safety Management

An Occupational Health and Safety Management system (OHSMS) will be established, managed and operated for the proposed project. The system will contain the following features:

1. Occupational Health and Safety Policy for the company
2. Organizational framework of the OHSMS
   - ✓ Staffing of OHSMS
   - ✓ Competence requirements
   - ✓ Operating procedures
   - ✓ Training programs
   - ✓ Documentation
   - ✓ Communication
3. OHSMS objective (documentation)
4. Hazard prevention
   - ✓ Risk assessment
   - ✓ Prevention and control measures (active and negative)
   - ✓ Management of changes
   - ✓ Emergency preparedness and response
   - ✓ Procurement (tools, equipment, services, contractors)
5. Performance monitoring and measurements
   - ✓ Hazard prevention measures
   - ✓ Ambient working environment
   - ✓ Work related injuries, ill health, disease and injuries
6. Evaluation
   - ✓ Feedback
   - ✓ Corrective measures
   - ✓ Action plan

9.3. Employee safety

In addressing requirements and needs to ensure employee safety, the following will be in place:

-

- Provision of adequate personal protective equipment.
- Enforcement and proper use of personal protective equipment by all employees.
- Provision of first aid and emergency services on site.
- In case of injury of employee during work; management must have a clear policy on treatment of the injured employee.
- In case of permanent disability arising from injury at work place, adequate compensation should be available within the provisions of applicable national law.
- Appropriate plant, machinery, tools and equipment in sound working condition must be provided to employees to enable them work safely.
- All practical measures must be in place to ensure that the work place does not have high heat levels, dust and excessive noise.

9.4. Safety of neighbours and general public

Project sites are associated with incidents and accidents that can be a safety concern to neighbors and general public. The contractor must ensure the safety of all neighbors and the general public is taken care of by putting the following measures in place: -

- ✓ All neighbours to be informed of the date of commencement of project.
- ✓ Heavy vehicles and trucks that will be ferrying in plant and equipment to the project site to observe required minimum speed limit when approaching the site to avoid accidents.
- ✓ There should be notices and warning prominently displayed at entry of project site and strategically around the project boundaries informing other workers and general public of on-going activity and safety requirements.

9.5 Machine use and Electrical Safety

During the implementation of the proposed project, it is expected that different machines, tools and equipment will be used. In regard to electrical safety, the following will have to be undertaken: -

- Installation and fitting of proper electrical appliances to enable supply of electrical energy to utility point.
- All electrical installations and fittings are done according to electrical safety rules.
- All electrical wires must be safely insulated.
- Sockets and other electrical outlets must be securely fitted.
- When not in use all machines should be shut down.

- Qualified and well-experienced electrician should be hired to carry out all electrical work.
- Safety slogans should be strategically posted as a reminder to employees.
- Operating manuals of equipment should be available for use whenever needed.

9.6. Internal Safety

During the entire project implementation and operation cycle, safety of the employees on the site should be taken care of. Some of the things that need to be in place include:-

- ✓ Emergency preparedness
- ✓ First aid
- ✓ Welfare facilities
- ✓ Personal protective equipment

9.7. First-Aid

i. Contractor to ensure qualified First Aiders are available to administer first aid to affected employees at all times.
ii. An appropriately equipped First-Aid station to be easily accessible at the project site.
iii. The First Aid station to be adequately equipped to meet first aid needs at the project site.
iv. A written Emergency Procedure to be in place.

9.8. Welfare facilities

i. Changing rooms for workers to be provided.
ii. Shower rooms and washing facilities to be provided.
iii. Contractor to avail potable drinking water to all employees at site.
iv. Appropriate and adequate Personal Protective Equipment to be provided
v. The enforcement on the consistence of the correct use of PPE provided
vi. The PPE provided are to maintain clean and replaced when damaged or worn out.

9.9. Ambient factors in the project site

9.9.1 Noise

Management will put in place a comprehensive noise conservation programme which will include the following:-

i) Training of workers in noise prevention, control and management.
ii) Provision of appropriate noise protective devices to workers.

iii) Training of the workers on the importance of making appropriate use of the protective devices provided.

iv) Monitoring of noise levels through periodic noise survey.

v) Use of appropriate noise attenuators.

vi) Audiometric test of workers

9.9.2 Dust

- ✓ Exposure to dust to be controlled by ensuring dust accumulation at project site is controlled.
- ✓ Equipment to be selected, especially that with in-built dust extraction.
- ✓ Employee exposed to dust to be provide with disposable dust masks.

9.10 Carbon Monoxide Explosions

Workers can be protected from Carbon Monoxide Explosion Hazards in EAFs by:

- ✓ Ensuring that engineering controls (e.g., shields or shelters) adequately protect workers from maximum potential blast overpressure, heat gradients, and struck by hazards from explosions.
- ✓ Developing and implementing written procedures for workers to stand behind shields or shelters when on the furnace floor or to remain in the control booth, to the maximum extent possible. •
- ✓ Developing and implementing written procedures to detect and control excess carbon monoxide concentrations in the EAF headspace.
- ✓ Ensuring that procedures for alarms or signals to workers on the furnace floor alert them when potentially hazardous conditions occur (e.g., if off-gas analyses indicate carbon monoxide build-up).

9.11Common causes of serious safety incidents and preventative measures

- ✓ Moving machinery: Isolate, lock or pin all energy sources before any machinery is accessed.
- ✓ Falling from height: Provide regular training, appropriate harnessing equipment and ensure checks are in place when working at height.
- ✓ Falling objects: Ensure regular checks are in place to remove or secure objects in risk areas.
- ✓ On-site traffic: Ensure all traffic on the site is operated safely, including road, and pedestrians, and remove all unnecessary traffic.
- ✓ Process safety incidents: Identify potential process safety hazards that could cause explosions or fires and introduce and maintain adequate barriers and controls.

10. STAKEHOLDER CONSULTATION

Consultation with stakeholders that are likely to be affected and those that are likely to have an interest in the proposed project was conducted as provided for in Regulation 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003. The consultation was vital and served to:-

- Inform local community especially those drawn from the proposed project site of the proposed development within their locality.
- Explain to the local community the nature of the proposed project, its objectives and scope.
- Give local community especially those drawn from the proposed project site an opportunity to present their views, concerns and issues regarding the proposed.
- Obtain suggestions from the local community and other stakeholders on possible ways potential negative impacts can be effectively mitigated and how the local community can be part of the proposed project.

The consultation was two-fold, namely;

- Questionnaire survey
- Public meetings /*Barazas*

10.1 Questionnaire survey

A detailed questionnaire survey was carried out that targeted to reach out to primary stakeholders at the grassroots level. This included local learning institutions, local faith based institutions, among others. Appendix 10 is detailed questionnaire responses.

10.1.1 Respondents

The following respondent to the questionnaire:-

Administration

1. Ramadhan Chisubi Nyoka –Ass. Chief, Kaliang'ombe Sub-Location
2. Charo Tsuma Maranza –Manager –MCA Office, Rabai Kisurutini Ward

Religious & Social Groups

1. Masjid Hidaya (Boyani Mosque) –Abubakar Juma (Imam)
2. Masjid Taufig, Kokotoni Muslim Association -Sheikh Amir H. Gonga

Educational Institutions

1. Kaliang'ombe Primary School
2. Boyani Primary School
3. Al Angels Academy
4. Umoja Nursery School

Community Members

1. Mwanajuma Mjeni
2. Mbega Zilla
3. Nyau Tsuma
4. Ramadhan Chengo Tsui
5. Andrew Ndaro Mairi
6. Mazuri Tsama
7. Tsungu Jonathan
8. Truphena Olweywe
9. Konde Muta Ndaro
10. Job Tsuma
11. Mariamu Luvuno
12. Karisa Joseph Kahindi
13. Mangale Mwadiga
14. Emmanuel Jana Tsuma
15. Elizabeth Mwaura
16. Mutuku Mynyoki
17. Solomon Muture
18. Samson Kolitiang
19. Ali Saha
20. Abdalla Jaka
21. Shaban Tsuma
22. Andrew Tsungu
23. Francis Fondo

10.1.2 Summary of Issues, views and concerns presented by questionnaire respondents

- ✓ Air pollution form smoke emission.
- ✓ The projects will generation noise polluting the environment.
- ✓ Effluent discharge into the environment.
- ✓ Road damage due to heavy loads on trucks/lorries plying the roads in the area.
- ✓ Corrosion of roofs
- ✓ Project production processes may result into injuries and accidents (occupational hazards).
- ✓ Health hazards like respiratory diseases.
- ✓ Low agricultural production

- ✓ Employment opportunities for people.
- ✓ Improved living standards resulting from economic empowerment of people.
- ✓ The project will spur development in the area e.g. trade, infrastructural developments like roads and communication services as well as social services.
- ✓ Increased population and social integration.
- ✓ There will be increased community related development programs in the area.

10.1.3 Measures proposed by stakeholders to address issues and concerns raised

- ✓ The project proponent to fully comply to environmental laws and regulations.
- ✓ Project proponent to provide appropriate personal protective equipment to all workers.
- ✓ Pollution control mechanism should be put in place to curb emissions.
- ✓ Proper waste disposal mechanism should be instituted.
- ✓ Scheduled maintenance of plant and equipment to be adhered to strictly. .
- ✓ Plant more trees in the area.
- ✓ The proponent to scale up corporate social responsibility projects in the area.
- ✓ Locals should be given priority for the available employment opportunities.

10.2 Public Barazas

Public consultation through public meetings involved carrying out three public meetings within the neighbourhood of the proposed project site.

10.2.1 First Public Baraza

The first stakeholder consultation & public participation public baraza was held at pipeline area Kokotoni on 19th April 2023. The following were the main issues that emanated from the first public meeting.

- ✓ Potential emission of carbon dioxide from the proposed project will contribute to ozone layer depletion and overall affect the environment negatively.
- ✓ Potential exposure to fine dust will negatively affect local people.
- ✓ Projects known to course negative impacts to the community and environment should be located in areas away from human settlement as a way of mitigating the negative impacts.
- ✓ Corrugated Sheets Limited should prioritise implementing significant corporate social responsibility (CSR) projects for Kokotoni community.
- ✓ The proposed project will contribute to water scarcity in the area.

- ✓ Corrugated Sheets Limited should build and equip a modern technical institute at Kokotoni for local youths to train in technical courses to enable them compete favourable for technical employment opportunities in the companies in the area which are better remunerated that the unskilled casual jobs.
- ✓ An audit should be done to establish how many local youths are actually employed in each company carrying out business in Kaliangombe area.
- ✓ An implementation committee to be put in place that will push investors in the area to implement each proposal put forward and agreed on.

Appendix 11 is the attendance list of participants and detailed minutes of the proceedings of the first public baraza, plate 1 captures attendees of the baraza.

Plate 1: Stakeholder deliberations during the proceedings of the first public baraza

10.2.2 Second Public Baraza

The second stakeholder consultation & public participation public baraza was held at Boyani Sub-Chief Office Grounds on 20th April 2023 in the morning. The following were the main issues that emanated from the second public meeting:-

- ✓ Lack of some of the community consultations by some of the existing projects in Kokotoni before they started.
- ✓ The use of old technology results in environmental pollution such as dust, smoke and other emissions.
- ✓ Measures being put in place to address negative impacts of existing projects in the area are not sufficient; due to this the community has reservations concerning proposals of new projects in the area.
- ✓ Investors have not put in place appropriate facilities such as well-equipped hospitals to help the local community from the negative effects of their projects nor helped develop local schools.
- ✓ The investor has invested in Kaliangombe yet the CSR activities of the company are in Mombasa County and other parts of Kilifi County ignoring Kaliangombe area.
- ✓ Water scarcity is a real concern in Boyani area; the investors should address this challenge.
- ✓ CSL should consider addressing water challenges in the area by extending piped waterline to some common water collection points for the community to fetch water.
- ✓ Investor should consider sinking freshwater boreholes for the community as an intervention to address water scarcity in the community.
- ✓ The investor should consider building a technical institution/polytechnic in the area to equip youths with relevant technical skills, besides constructing a modern equipped hospital for the community to meet community medical challenges including respiratory infections.

Appendix 12 is the attendance list of the participants and detailed minutes of the proceedings of the second public baraza, plate 2 captures attendees of the baraza

Plate 2: Stakeholder deliberation during the second public baraza

10.2.3 Third Public Baraza

The third stakeholder consultation & public participation public baraza was held at Kaliangombe area on 20th April 2023 in the afternoon. The following were the main issues that emanated from the third public meeting:-

- ✓ What are the mitigation measures of potential negative impacts of the proposed project?
- ✓ Kaliangombe community to be given first employment opportunities in the project.
- ✓ Water scarcity problem in the community need to be addressed.
- ✓ Proponent to support improvement of education and health facilities in Kaliangombe.

Appendix 13 is the attendance list of the participants and detailed minutes of the proceedings of the third public baraza, plate 3 captures attendees of the baraza

Plate 3: Stakeholder deliberation during the third public baraza

11. POTENTIAL ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION MEASURES

11.1 Construction phase

The construction phase of the proposed project will involve the following:

- ✓ Construction of a godown like structure that will house the steel scrap melting and billet casting and production plant.
- ✓ Construction of support facilities such as sanitary facilities, offices, weighbridge & weighbridge house.

The construction phase of the proposed project will potentially result in both positive and negative impacts.

11.1.1 Potential positive impacts during construction phase

- ✓ Employment opportunities for the local community
- ✓ Support to existing local businesses
- ✓ On job training opportunities for local people

11.1.1. Employment opportunities for the local community

Construction phase of the proposed project will likely create direct employment opportunities. Direct labour force will be required in all site construction activities. Other direct employment opportunities will include in the area of equipment operators such employees who will be hired to operate equipment used on site. This and other construction activities will create employment to the local community. The project also will provide indirect employment opportunities, in terms of service providers such as food outlets who will benefit from clientele drawn from workers at the proposed project site, other service providers such as transporters who will be hired to ferry construction materials into the site and construction waste out of the site.

11.1.1.2 Support to existing local businesses

Once the implementation of the proposed project begins and local people and others get hired at the construction phase, they will be remunerated for their work. This will translate to more money available in the pocket hence improved purchasing power. Local businesses are likely to benefit from improved purchasing power of people in the area as a result of their remuneration. There is likelihood that there will be more money in the pockets of people who will be directly or indirectly employed in the project and that part of the money will be spent in the local economy hence benefits local businesses.

11.1.1.3 On-job training opportunities for local people

Implementation of the proposed project will present an opportunity for non-skilled local people to be involved in the project and acquire skills through on-job training.

11.1.2 Potential negative impacts during construction phase

Potential negative impacts likely during the construction phase of the proposed project could include:

- ✓ Waste generation
- ✓ Local air pollution
- ✓ Occupational injuries and accidents to construction workers
- ✓ Labour influx

11.1.2.1 Waste generation

Waste will be generated during construction phase. The waste will include excavated overburden (soil and rock material), offcuts of steel and timber among others. Generated waste if poorly handled and disposed can turn out to be safety hazard especially scrap which means will compromise safety situation on site and hence expose workers on site to injuries and accidents. Further poorly handled and disposed waste will result in poor housekeeping onsite.

11.1.2.2 Local air pollution

Implementation of the proposed project will involve a number of site activities that could potentially result in release of particulate matter into the surroundings. These activities will include ground exaction and trenching works, handling and use of construction material such as ballast, cement and building blocks that are dusty in nature. Execution of these activities will potentially contribute in release fugitive dust that will potentially result in local air pollution. Various equipment will be used during site excavation and trenching activities. Hydrocarbon releases from equipment exhaust emission on site will also potentially contribute in local pollution However, these activities and potential pollution will be localized and limited to the construction phase.

11.1.2.3 Occupational injuries and accidents to construction workers

Construction workers at the proposed project site will potentially be exposed to risks associated with the construction occupation. Some of the risks include exposure to fugitive dust, exposure to noise and vibrations, working in height, working in confined spaces, exposure to hot works. Some of these risks may result to accidents and or injuries to the workers. Injuries can arise from use of tools and equipment and from the construction process. The injuries can include

cuts and bruises, falling from height and colliding. Impacts associated with occupational injuries and accidents will include the following:-

- ✓ Injury to and or loss of family breed winner translating to diminished family income which translates to reduced family purchasing power and ability to meet family financial obligations.
- ✓ Ailment/sickness to affected worker that negatively affects the productivity of such a worker hence reducing financial earnings of such a worker which translates to reduced purchasing power of such a worker.
- ✓ Loss of productive workforce resulting in reduced productivity.
- ✓ Increase in down time resulting in diminished productivity.

11.1.2.4 Labour influx during construction phase

Construction phase of the proposed project will require both skilled and unskilled labour force to be involved in the construction and supply of associated goods and services to the project. In the event that the required skilled workforce and associated goods and services cannot be obtained locally either because of lack of technical skills, capacity and or lack of the required goods and services locally, in such a scenario, the required labour force and or required goods and services may be sourced outside the project area. In such a scenario, there is a potential for potential construction workers together with other people who will be supplying goods and services to the proposed project in the short term to migrate and settle at the project area resulting in a labour influx into the project area. Social impacts associated with such labour influx will include the following:-

- ✓ Local inflation of commodity prices: Labour influx may result in an increase in demand of goods and services at local centres such as Kokotoni Cetre and its environs; this may result in local price hikes and/or crowding out of community consumers.
- ✓ Increased pressure on local accommodation facilities and rent hiking. Sourcing of construction labour outside the project area will necessitate that they seek for convenient accommodation close to the project site. This will increase pressure on available accommodation facilities. Further due to increased demand for accommodation there may be increase of accommodation prices and crowding out of local residents.
- ✓ Incidence of child labour and school dropout the proposed project will potentially increase opportunities for the host community to sell goods and services to the incoming workers. Depending on the nature of the social fabric and individual local family dynamics, such an opportunity can be a temptation to parents who can allow their children to produce and

deliver these goods and services at the expense of attending school. This will lead to school dropout.

- ✓ Gender-based violence: Construction workers in construction sites such as that of the proposed project are young males although more recently young females are now joining the construction workforce. Based on this it is likely that construction staff to the proposed project site may be male dominated. Young males who are away from home on the construction job will be separated from their family and act outside their normal sphere of social control. This can lead to inappropriate behavior, such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors from the host community.

11.2 Installation phase

The installation phase of the proposed project will involve the following:

- ✓ Installation of heavy duty overhead cranes in the godown
- ✓ Installation of weighbridge
- ✓ Installation of furnace
- ✓ Installation of continuous casting machine.
- ✓ Installation of pollution control system

The installation phase of the proposed project will potentially result in both positive and negative impacts.

11.2.1 Potential positive impacts during installation phase

- ✓ Technical expertise employment opportunities
- ✓ Support to existing local businesses
- ✓ On job training opportunities for local people

11.2.1.1 Employment opportunities for technical experts

The installation phase of the various components of the proposed steel scrap melting and billet casting and production plant will provide employment opportunities for highly skilled, technical and expertise workforce. These will include installation engineers, electrical engineers, pollution control engineers, certified inspectors of pressurised vessels and heavy lifting equipment. These highly skilled and technical experts will be sourced locally, national and were necessary internationally.

11.2.1.2 Support to existing local businesses

The installation phases of the various components of the proposed steel scrap melting and billet casting and production plant will provide will require service provides such as

transporters. Local transport companies who will be hired to transport the various components of the plant from the port to the proposed project site will gain from such a business opportunity.

11.2.1.3 On-job training opportunities for local people

Installations of the various components of the proposed steel scrap melting and billet casting and production plant will provide opportunity for inexperienced local professionals to be part of the installation team to observe and learn how the various components are assembled and installed. In this way such inexperienced professionals gain variable experience in their profession.

11.3 Production phase

Potential negative impacts during the operation phase of the proposed steel scrap melting and billet casting and production plant will include the following:

- ✓ Explosions from decarburization
- ✓ Dust pollution
- ✓ Exposure to heat
- ✓ Air pollution by noxious odours and dioxins in exhaust gas from bag house
- ✓ Soil and ground water contamination from toxic EAF dust
- ✓ Noise and vibration pollution
- ✓ Oils and lubricants spills
- ✓ Traffic congestion
- ✓ Pollution from waste disposal
- ✓ Water scarcity
- ✓ Injuries and accidents

11.3.1 Explosions from decarburization

The decarburization process begins when the EAF operators inject oxygen via burners in the furnace to convert excess carbon in “the heat” to carbon monoxide. The carbon monoxide is converted to carbon dioxide by the oxygen in the headspace as well as by oxygen entering through furnace openings. The EAF’s ventilation system is designed to remove the carbon dioxide from the headspace. However, if oxygen is rapidly injected into the hot steel bath, decarburization can proceed so rapidly that carbon monoxide overwhelms the ventilation system and may accumulate in the headspace. The increased carbon monoxide generation consumes all available oxygen, which is necessary to convert carbon monoxide to carbon dioxide. The unreacted carbon monoxide can become highly concentrated in the EAF

headspace. If the carbon monoxide concentration in the headspace reaches the explosive range, between 12.5% to 74.2%, any sudden addition of oxygen-containing air into the enclosed furnace can react with the excess carbon monoxide and form an explosive mixture. The high temperature from "the heat" helps cause such a sudden oxidation reaction and provides a ready ignition source.

11.3.2 Dust pollution

The proposed project will use electric arc furnace technology to melt the scrap in the furnace. An electric arc furnace (EAF) is a typical batch melter with repeated cycling of operations that include roof opening, scrap charge, roof closing, melting, refining, tapping, and repair during a period of about one hour. Steel scrap contains up to 2% of such combustibles as oils, plastics, and paints. Such scrap when melted in an EAF, air pollution contained in off-gas emissions from the EAF can sometimes become a serious problem due to the floating dust loading of the workspace atmosphere that will contribute to deteriorating environment of the in-plant workspace. If the suspended (floating) dust concentration including iron oxide dust concentration in the workplace is 5 mg/m^3 and the particle size is less than 0.00707 mm then particles of that size are capable of reaching the human lung.

11.3.3 Exposure to heat

Hot dusty gas is generated from the furnace which causes strong heat convection. Dusty hot gas generated during scrap charge forms a strong ascending stream caused by buoyancy. As this stream ascends, the air around the furnace is involved in the stream, reducing the dust concentration in this period. The dust concentration reaches its peak immediately after the commencement of carbon injection. In this period, the off-gas temperature from the furnace becomes very high. Due to these employees working at the EAF will be exposed to heat as they will be working in a hot environment. Exposure to heat for prolonged period in the workplace may result in heat illness such as heat stroke, heat exhaustion, heat cramps and heat rash. Heat stroke occurs when the body's temperature regulating system fails and body temperature rises to critical levels. The signs of heat stroke are confusion, loss of consciousness, and seizures. Workers experiencing heat stroke have a very high body temperature and may stop sweating. The signs and symptoms of heat exhaustion are headache, nausea, dizziness, weakness, irritability, confusion, thirst, heavy sweating and a high body temperature. Heat cramps are muscle pains usually caused by the loss of body salts and fluid during sweating. Heat rash is caused by sweating and looks like a red cluster of pimples or

small blisters. Heat rash may appear on the neck, upper chest, groin, under the breasts and elbow creases.

11.3.4 Air pollution by noxious odours and dioxins in exhaust gas from bag-house

As the scrap contains organic matter such as oils, paints, rubber, and plastics, incompletely combusted organic matter during the low temperature phase generates pollutants. When the performance of the de-dusting system is insufficient, noxious odours and dioxins are emitted through the stack which will result in air pollution. However, when gas temperature is low, dioxin is easily captured on the bag filter system. Most of the dioxin generated during the early melting stage is captured at the filter, as the bag-house temperature is low. However, when the process shifts to the refining stage, where the dioxin emission from the furnace is small, the bag-house temperature becomes higher and the once-captured dioxin is released from the filter, resulting in a higher concentration at the bag-house outlet. This phenomenon is called "hysteresis". In order to reduce dioxin emissions efficiently, these characteristics of the EAF process should be understood.

11.3.5 Soil and ground water pollution from toxic EAF dust

When scrap is melted and refined by an arc furnace, the generated dust is equivalent to 2% of the produced steel. This dust contains many toxic organic substances in addition to metal oxides and chlorides. Depending on the quality of scrap used, the main components of EAF dust will include 30% zinc, 20% iron, and 5% chlorine in addition to dioxins. If EAF dust is disposed in landfills it can leach and result in pollution of local soils and groundwater resources.

11.3.6 Noise and vibration

Production phase activities of the proposed steel melting and casting for billet production plant will potential contribute to noise and vibration. The use of heavy equipment such as cranes and forklift trucks to move heavy raw materials and produced billets could also result in noise and vibration on site. Noise is unwanted or undesirable sound derived from point sources while vibration is the transmission of low frequency energy through the medium of ground or buildings. Noise travels through the air as waves of minute air pressure fluctuations caused by vibration, and travels away from the noise source as an expanding spherical surface. As a result, the energy contained in a sound wave is spread over an increasing area as it travels away from the source. This results in a decrease in loudness at greater distances from the noise source. Noise levels at different distances can be affected by factors such as topographic features, structural barriers and atmospheric conditions (wind speed and direction, humidity levels, and temperatures). Vibration consists of rapidly fluctuating motions; human response to vibration

is a function of the average motion over a longer (but still short) time period, such as 1 second. The use of heavy equipment and actual billet production process could result in noise and vibration limited to the time and duration of the scrap steel melting and billet production process. Potential impacts of noise and vibration during production phase of the proposed project could include the following:-

- ✓ Interfere with conversation and communication at the workplace
- ✓ Negate general work performance, thought and concentration.
- ✓ Negate relaxation.
- ✓ Causes annoyance.
- ✓ Induces hearing loss if exposure is continuous for a long time.

11.3.7 Oils and lubricants spills

Oils and lubricants will be used in fuelling and lubricating of the steel mill. Various mill lubricants will also be used. These oils and lubricants will be stored in tanks and drums. Spills during re-filling of the tanks and drums and during dispensing of the oils and lubricants could result in environmental pollution. Potential negative impacts from oil and lubricant spills could include:-

- ✓ Contamination of local soil where the spillage occur
- ✓ Contamination of surface and ground water bodies if the spilled oils and lubricants flow into a water body
- ✓ Burning effect of vegetation if the spilled oils and lubricants flow into vegetation area.

11.3.8 Traffic congestion

During production phase of the proposed project heavy raw materials such as steel scrap will be ferried to the steel plant for melting. The finished product manufactured will be billets; the billets which are very heavy and bulky will be ferried out of the steel plant to the market. The ferrying in of raw materials and evacuation of produced billets out of the steel mill could potentially contribute to increase in traffic in and out of the steel mill during production phase. Potential negative impacts that could result from such increase in traffic could include:-

- ✓ Increase in exhaust emissions from the trucks that will have an effect on local air quality
- ✓ Increase in time required by other users of the access road into and out of the facility
- ✓ Increase in wear and tear of the access road hence more environmental resources such as gravel will be required to maintain the access road.

- ✓ Increase in the volume of water that will be required to sprinkling the access road to arrest fugitive dust during dry periods.

11.3.9 Pollution from generated waste

The main waste that will be generated from the proposed project will be slag. EAF residues contain valuable metals such as zinc and heavy metals such as Lead. Generated slag if not treated appropriately to recover valuable metals from the dust and to make the residue harmless for disposal can result in environmental pollution when disposed in landfills.

11.3.10 Water scarcity due to increase use

Water will be used as a coolant to cool plant and equipment. This will require significant amounts to meet cooling needs of the mill. Water being scarce commodity in the area, extracting water from available sources such as the local pipeline for industrial use could contribute to a reduction of available water in the area for other uses including domestic use. Potential negative impact of increase demand of water to the plant will be increased competition for the already limited water resource in the project area by the various water users in the area including domestic users. Increase in competition for the infinite water resources could result in reduced available water for local domestic use.

11.3.11 Injuries and accidents

Workers in the production line and those handling finished products are potentially exposed to risks that can result in injuries and accidents. Some of the risks include exposure to fugitive dust, exposure to noise and vibrations, working in height, working in confined spaces, exposure to hot works. Some of these risks may result to accidents and or injuries to the workers. Injuries can arise from use of tools and equipment and from the billet production and handling process. The injuries can include cuts and bruises, falling from height and colliding. Impacts associated with occupational injuries and accidents will include the following:-

- ✓ Injury to and or loss of family breed winner translating to diminished family income which translates to reduced family purchasing power and ability to meet family financial obligations.
- ✓ Ailment/sickness to affected worker that negatively affects the productivity of such a worker hence reducing financial earnings of such a worker which translates to reduced purchasing power of such a worker.
- ✓ Loss of productive workforce resulting in reduced productivity.
- ✓ Increase in down time resulting in diminished productivity.

11.4 Decommissioning phase

Potential negative impacts during decommissioning phase of the proposed steel scrap melting plant will include the following:

- ✓ Noise and vibration
- ✓ Injuries and accidents
- ✓ Dust pollution
- ✓ Waste generation

11.4.1 Noise and vibration

Decommissioning of the steel plant will involve dismantling of all components of the steel plant including the go-down housing the plant, induction furnace, the continuous casting and other support facilities. During demolition and dismantling noise and vibration is likely to be generated. Potential receptors of the noise and vibration will include the workers involved in the demolition and dismantling process, neighbors and visitors to the site. Potential impacts of noise and vibration during decommissioning phase of the proposed project could include the following:-

- ✓ Interfere with conversation and communication at the workplace
- ✓ Negate general work performance, thought and concentration.
- ✓ Negate relaxation.
- ✓ Causes annoyance.
- ✓ Induces hearing loss if exposure is continuous for a long time.

11.4.2 Injuries and accidents

Decommissioning of the components of the steel plant will involve use of heavy equipment and machinery. Further the decommissioning will involve working at height and in confined areas. This will expose the workers involved in the decommissioning to injuries and accidents. Factors that will contribute to employee exposure to injuries and accidents will include:

- ✓ Use of poorly serviced equipment
- ✓ Equipment operation by inexperience operators
- ✓ Fatigue due to long working hours without breaks and or rest
- ✓ Destructions and poor construction while working
- ✓ Lack of use of appropriate personal protective equipment
- ✓ Inappropriate use of personal protective equipment.
- ✓ Lack of or poor site supervision
- ✓ Poor site housekeeping

11.4.3 Dust pollution

Fugitive dust will likely be generated during demolition of godown housing the steel plant and various components of the steel mill. The fugitive dust will potentially affect workers on site, visitors to the site and neighbours. Factors that will likely contribute to fugitive dust emission will include:-

- ✓ Lack of or poor site enclosure with appropriate dust screens.
- ✓ Lack of or poor water sprinkling on dusty surfaces before and during demolitions to arrest fine particles.
- ✓ Lack of use of appropriate personal protective equipment
- ✓ Inappropriate use of personal protective equipment.
- ✓ Lack of or poor site supervision

11.4.4 Waste generation

Waste will be generated from the decommissioning of the steel plant. The waste will include concrete rubbles, steel scrap, and slag from the furnace among others. Depending on how the waste will be handled and disposed, it can impact the environment negatively. Poor handling of steel scrap will potential cause injuries and or accidents on site. Poor disposal of remnants of furnace slug can pollute local soils

11.5 Proposed enhancement and mitigation measures

To maximize on potential positive impacts, measures will be put in place that will enhance potential positive impacts to ensure maximum benefits (Table 9). To mitigate identified potential negative impacts, appropriate mitigation measures will be put in place either to mitigate the potential negative impacts to acceptable levels or where possible eliminate and or avoid the impact (Table 10).

Table 9: Proposed measures to enhance potential positive impacts

Potential positive impacts	Proposed enhancement measures
Employment opportunities	- Priority to be given to local people when recruiting required workforce at all phases of the project - Local youths to be given adequate consideration when employing - People with disability to be considered were possible - Men and women to be proportionately considered.

Potential positive impacts	Proposed enhancement measures
Support to existing local businesses	- Were possible local business that can supply required building materials to be given first priority - Local transporters to be given first priority for transport services - Local steel scrap dealers to be given priority to supply steel scrap
On job training opportunities	- In experienced youths from the local community to be given on job training opportunities
Increased local production of billets	- Expand production capacity of the billet production plant to increase billet production - Increase purchase of steel scrap to increase production of billets
Reduced importation of billets	- Increase local production of billets to surpass local demand to ensure no billets importation - Use high quality scrap to ensure high quality billets are produced to meet local and export market standards. - Explore ways to reduce billet production cots to cater for all local market segments
Contribution to billet exports	- Increase the production capacity of the plant to cater for domestic and export markets - Use high quality scrap to ensure high quality billets are produced that meet local and export market standards

Table 10: Proposed mitigation measures of potential negative impacts

Potential negative impacts	Proposed mitigation measures
Construction & installation Phase	
Impacts resulting from waste generation	The Project Proponent will: j) Ensure that all generated waste will be managed and disposed as provided for in the Sustainable Waste Management Act 2022 and the Environmental

Potential negative impacts	**Proposed mitigation measures**
	Management and Coordination (Waste Management) Regulations, 2006. k) Ensure that all generated steel scrap generated to be collected and safely kept at a designated location on site from where it will later be recovered for onsite recycling to produce billets l) Ensure that excavated overburden (soil and rock material) to be reused in landscaping within the CSL RSD and also in the rehabilitation of quarry pits of the adjacent sister company Kavee Quarries Limited m) Ensure that timber offcuts generated to be donated out to local food vendors as firewood. n) Segregate non-hazardous waste into organic and non-organic fractions. o) Provide facilities that are properly labeled and color-coded receptacles, bins, containers and bags for the placement of the segregated waste. p) Hire the services of a licensed waste collector to collect, handle and transport the waste. q) Ensure any hazardous waste generated is handled and managed as prescribed in the Environmental Management and Co-ordination Act, 1999 (No. 8 of 1999) and dispose of the hazardous waste in a facility provided by the County Government of Kilifi or the Authority.
Local air pollution	The Project Proponent will: d) Install a functional and efficient air pollution control system (fume extraction system) consisting of movable fume collection hood, pipeline, cyclone, bag house, sanction blower, bag house cleaning system, chimney, liquid metal and ladle a system that will be working

Potential negative impacts	Proposed mitigation measures
	together to ensure air quality standards prescribed in the Environmental Management and Coordination (Air Quality) Regulations 2014 are strictly adhered to. e) Carry out quarterly (every three months) monitoring of local air quality as provided for in the Environmental Management and Coordination (Air Quality) Regulations 2014. f) Monitor noise and vibrations as provided for in the The Environmental Management and Coordination ((Noise and Excessive Vibration Pollution) (Control) Regulations 2009.
Injuries and accidents	The Project Proponent will: q) Register the workplace as per the provisions of the Occupational Safety and Health Act, 2007. r) Hire well trained and experienced plant and equipment operators. s) Only use and operate serviceable plant and equipment t) Ensure all plant and equipment are timely serviced and maintained as per manufacturer's instructions. u) Carry out daily safety briefings and or tool box meetings to all workers on site. v) Carry out safety trainings to all new staff and refresher trainings to existing staff. w) Ensure appropriate safety information, signs and slogans are strategically placed throughout the workplace. x) Develop and document an emergency evacuation plan for the workplace y) Provide all workers appropriate personal protective equipment (PPEs). z) Enforce the appropriate use of all provided PPEs by all workers.

Potential negative impacts	**Proposed mitigation measures**
	aa) Maintain a record of all injuries and accidents at the workplace. bb) Promptly report accidents at the workplace to the Directorate of Occupational Safety and Health as provided for in the Occupational Safety and Health Act, 2007. cc) Promptly and accurate investigate and document all accidents and injuries reported at the workplace. dd) Provided appropriate resting facilities for workers to use during breaks. ee) Maintain a well-stocked first aid box at the workplace ff) Ensure there is at least one trained first aider at the workplace to handle first aid cases.
Labour influx	The Project Proponent will: d) Prioritize hiring all required skilled, semi-skilled and unskilled workers from the local community. e) Consider hiring outside the local community when such required skill is not available in the local community. f) Only hire internationally required expatriates who will not be available locally and nationally.
Production phase	
Prolonged exposure to heat results in heat illness such as heat stroke, heat exhaustion, heat cramps and heat rash	The Project Proponent will: l) Identify and designate someone trained in heat hazards, physiological responses to heat, and controls. This person will develop, implement and manage heat stress program. m) Identify heat hazards at the workplace through recognition of heat hazards and the risk of heat illness due to high temperature, humidity, sun and other thermal exposures, work demands, clothing or PPE and personal risk factors.

Potential negative impacts	**Proposed mitigation measures**
	n) Ensure that cool drinking water is available and easily accessible. o) Encourage workers to drink a litter of water over one hour, which is about one cup every fifteen minutes. p) Provide or ensure that fully shaded or air-conditioned areas are available for resting and cooling down. q) New workers and those returning from a prolonged absence support for gradual acclimatization to work environment should begin with 20% of the workload on the first day, increasing incrementally by no more than 20% each subsequent day. r) Schedule altering work schedules to reduce workers' exposure to heat. s) Provide training in a language and manner workers understand, including information on health effects of heat, the symptoms of heat illness, how and when to respond to symptoms, and how to prevent heat illness. t) Establish a system to monitor and report the signs and symptoms of heat stroke, heat exhaustion, heat cramps and heat rash to improve early detection and action. u) Have an emergency plan in place and communicate it to supervisors and workers. v) Utilise engineering controls specific to indoor workplaces to reduce indoor temperature such as providing reflective shields to redirect radiant heat, insulating hot surfaces, and decreasing water vapour pressure.
Explosions from decarburization	The Project Proponent will: g) Train workers on how to recognize and avoid unsafe EAF operations associated with excess carbon monoxide concentrations during decarburization.

Potential negative impacts	**Proposed mitigation measures**
	h) Verify that the off-gas analyser system accurately measures off-gas accumulation in the furnace. i) Use off-gas composition analyses to control the oxygen injection rate and ensure that gas mixtures above "the heat" stay well below the lower limit of the carbon monoxide explosive range, between 12.5% to 74%. j) Ensure that proper furnace ventilation along with off-gas composition analyses are used to help control chemical reactions in the EAF headspace. k) Not consider smaller explosions as acceptable and immediately investigate their cause to modify furnace process controls to prevent them. l) Control furnace tilting during EAF operations to help avoid creating potentially explosive gas mixtures.
Dust pollution	The Project Proponent will: f) Fully enclose the EAF g) Install a large capacity bag house to capture all dust as part of the pollution control system h) Continually monitor floating dust loading of the workspace atmosphere and were necessary systematically change design and operation criteria based on the relationships between off-gas emission pattern, in-house gas stream, operational sequence of the de-dusting system, and floating dust loading of the workspace atmosphere i) Install an isolation wall for the yard, properly arrange ventilation air inlet positions and increase flow rate of air through the canopy hood to decrease dust loading. j) Dust treatment by either solid reduction process or smelting reduction process to recover valuable metals from the dust and to make the residue chemically

Potential negative impacts	**Proposed mitigation measures**
	harmless for disposal. The solid reduction process partially reduces iron oxide to FeO, whereas, the smelting reduction process melts down and reduces almost all the metal oxides in the dust.
Noxious odours and dioxins in exhaust gas	The Project Proponent will: e) Increase EAF temperature to achieve complete combustion of organic matter during the low temperature phase to avoid generation of pollutants. f) Ensure performance of the de-dusting system is optimally sufficient to ensure no noxious odours and dioxins are emitted through the stack. g) Employ gas treatment technology for dioxin reduction by ensuring that gas temperature in furnace is over 850°C, hot gas retention time in furnace is over 2 seconds, quick gas cooling to avoid dioxin regeneration and use of a catalyst to decompose dioxins or activated carbon injection or bed to absorb dioxins. h) Use a semi-continuous charging type EAF as opposed to continuous charging type to ensure that the exhaust gas temperature from the furnace is relatively high and is stable to attain over 850°C gas temperature in furnace and over 2 seconds hot gas retention time in furnace.
Noise and vibration	The Project Proponent will: g) Develop and implement a comprehensive noise conservation programme that includes training, equipment maintenance, engineering controls, use of PPEs and noise level measurements. h) Ensure the site is secured by appropriate noise attenuators. i) Provide all employees with appropriate PPEs such as ear plugs and ear mufflers and ear plugs

Potential negative impacts	**Proposed mitigation measures**
	j) Enforce proper use of the provided PPEs by all workers. k) Ensure equipment used is well maintained and serviceable. l) Employee appropriate engineering controls to minimise noise production from plant and equipment
Oils and lubricants spills	The Project Proponent will: c) Provide appropriate containment structures /banding to collect any spills. d) Provide for oil spill absorbents for quick absorption of any accidental spills
Traffic congestion	The Project Proponent will: c) Develop and implement a traffic marshal plan. d) Provide sufficient parking/ holding area for traffic delivering raw materials and collecting finished from the steel mill
Waste related impacts	The Project Proponent will: r) Ensure that all generated waste will be managed and disposed as provided for in the Sustainable Waste Management Act 2022 and the Environmental Management and Coordination (Waste Management) Regulations, 2006. d) Provide appropriate receptacles for dropping waste e) Ensure only NEMA licenced vehicles collect waste from the hot rolling steel mill. f) Management to try to minimise waste generation during operational phase by reusing and or recycling most of generated waste.
Water scarcity	The Project Proponent will: d) Explore alternative sources of water that can be used such as roof catchment, rock catchment and collection

Potential negative impacts	Proposed mitigation measures
	from neighbouring quarry pits to minimise drawing water from local pipeline for industrial use. e) Provide adequate water storage tanks on site to store water from roof catchment from the extensive roofs of the godowns during rainy season that can be used in cooling of plant and equipment. f) Minimise water demand by ensuring used water from the cooling circuit is routed through an adequately sized and effective cooling tower and pressure filter to filter the water for recycling purpose
Injuries and accidents	The Project Proponent will: g) Ensure all workers are given appropriate PPEs. h) Ensure hired workers are first trained on the appropriate use of the provided PPEs. i) Ensure all workers and visitors to the project site also use the provided PPEs appropriately. j) Ensure that tools and equipment provided for use are well serviced and maintained. k) Ensure that at least four workers are trained first aiders. l) Ensure there is a fully equipped first aid station at various sections of the steel mill.
Decommissioning phase	
Noise and vibration	The Project Proponent will: f) Develop and implement a comprehensive noise conservation programme that includes training, equipment maintenance, engineering controls, use of PPEs, noise measurements. g) Ensure the decommissioning site is secured by appropriate noise attenuators. h) Provide all decommissioning staff with appropriate PPEs such as ear plugs and ear mufflers.

Potential negative impacts	**Proposed mitigation measures**
	i) Enforce proper use of the provided noise protective PPEs by all workers. j) Ensure equipment used is well maintained and serviceable.
Injuries and accidents	The Project Proponent will: i) Ensure all decommissioning workers are given appropriate PPEs. j) Ensure all decommissioning workers are trained on the appropriate use of the PPEs before use. k) Ensure each decommissioning worker and visitors to the decommissioning site also use the provided PPEs. l) Ensure that tools and equipment provided for use at the decommissioning site are well serviced and maintained. m) Ensure that the decommissioning site is free of hazards. n) Ensure that among the decommissioning workers at least one is a trained first aider. o) Ensure there is a fully equipped first aid station at the decommissioning site. p) Ensure appropriate measures are put in place to minimize fugitive dust by regularly sprinkling water on dusty ground.
Dust pollution	The Project Proponent will: f) Secure the entire decommissioning site with appropriate dust screens to trap fine dust particles. g) Sprinkle water to arrest fugitive dust. h) Provide all decommissioning staff with appropriate PPEs such as dust masks, overalls, helmet, dust coats, safety boots and goggles. i) Ensure all decommissioning workers make proper use of the PPEs provided.

Potential negative impacts	**Proposed mitigation measures**
	j) Periodically monitor air quality levels at the decommissioning site by measuring local particulate matter
Waste generation	The Project Proponent will: d) Ensure all waste generated at the site being decommissioned is managed and disposed as provided for in the Sustainable Waste Management Act 2022 and the Environmental Management and Coordination (Waste Management) Regulations, 2006. e) Provide appropriate receptacles for dropping waste. f) Ensure only NEMA licenced vehicles collect waste from the site being decommissioned.

12. ENVIRONMENTAL MANAGEMENT PLAN

12.1 Working policies to be developed and documented by the proponent to guide project implementation

Implementation of the proposed project will require careful and sound environmental planning to ensure that all issues and concerns raised by all stakeholders are fully addressed and that all potential negative impacts are appropriately mitigated to ensure environmental sustainability. To achieve this; Corrugated Sheets Limited who is the project proponent will upgrade existing policies and develop new ones where there is no existing policy to guide the implementation of the proposed project. The policies once upgraded and or developed will be vital in the following ways among others:

- ✓ The policies will enable management to develop and maintain sound relations with construction workers and the neighbouring community.
- ✓ The policies will enable management put in place measures and structures that will care for the safety, health and welfare of all workers on site and the neighbouring community residents.
- ✓ The policies will provide a framework for management to plan for, and put in place, monitoring programmes that will ensure conservation and protection of the environment, appropriate waste management and disposal.
- ✓ The policies will provide a framework for Corrugated Sheets Limited to assume its corporate social responsibility for its activities with regard to conservation of the environment as well as for the well-being of the local community.

The following policies will need to be developed and documented by the project proponent:-

- Environmental and sustainability policy
- Occupational Health and safety policy
- Stakeholder engagement and involvement policy
- Training and development policy
- Risk Management policy

12.1.1 Environmental and sustainability policy

Corrugated Sheets Limited has an existing environmental policy. Management will be required to updated and enhance this policy to an environmental and sustainability policy. The enhanced policy will guide the project proponent to carry out the proposed project activities with the highest regard to the natural environment, social environment and sustainable utilization of environmental resources. The policy will be in line with applicable national legislations,

international guidelines, standards and best practices. The environmental and sustainability policy will therefore cover the following, among other issues: -

- ✓ All national statutory requirements that the proponent will have to comply with before commencement of project implementation.
- ✓ Systems to be put in place to ensure continuous environmental improvement and performance throughout the project lifecycle.
- ✓ Comprehensive measures to be adopted by the proponent to ensure that utilization of natural resources are optimal with measures in place to ensure resource availability for future generation.
- ✓ Awareness creation to the surrounding community regarding sustainable utilization of natural resources, protection of sensitive ecosystems and bio-diversity maintenance for communal livelihood.
- ✓ Measures that provide for and ensure balancing between natural resource use, environmental conservation and economic development.

12.2.2 Occupational Health and safety policy

The project proponent has an existing Occupational Health and Safety Policy in place. However, management will be required to update this policy to meet the expanded requirement of the proposed project. This will ensure that the project proponent put in place appropriate measures that will ensure that the health, safety and welfare of all employees is cared for. Further the policy will also ensure and safeguard the health and safety of the local community within the project catchment. In addition to this the policy will safeguards the health and safety of visitors to the project site and all other stakeholders. The policy will highlight the following, among others: -

- ✓ Identity health and safety requirements of employees that need to be safeguarded in line with requirements and provisions of national legislations, international guidelines of best practices.
- ✓ Identity health and safety requirements of local community within the project catchment area that need to be safeguarded in line with requirements and provisions of national legislations, international guidelines of best practices.
- ✓ Identity health and safety requirements of visitors to the project site that need to be safeguarded in line with requirements and provisions of national legislations, international guidelines of best practices.

- ✓ Identity health and safety requirements of all other stakeholders that need to be safeguarded in line with requirements and provisions of national legislations, international guidelines of best practices.
- ✓ Identify ways and means of safeguarding health and safety of employees, local community, visitors to the project site and all other stakeholders.
- ✓ Identify safety measures that need to be put in place for all machines and equipment to be used.
- ✓ Identify required appropriate safety and rescue equipment to be availed in all work places within the project site.
- ✓ Document an elaborate emergency procedures and actions.
- ✓ Identify ways of ensure risk is eliminated and or minimized within the project site
- ✓ Document required training needs in safety.

12.1.3 Stakeholder engagement and involvement policy

The project proponent will develop and document a comprehensive stakeholder engagement and involvement policy that will ensure that the project proponent develops and maintains sound relations with all stakeholders. The policy will identify all the project stakeholders including those who have an interest in the project and those that are affected by the project. In additions the policy will provide a broad framework on how each of the stakeholders will be engaged and involved in the project. The policy will highlight the following, among others:-

- ✓ Identify all project stakeholders and potential stakeholders
- ✓ Identify the stake/interest/role of each of the identified stakeholder
- ✓ Outline how management will address each stakeholder needs/requirements/interests
- ✓ Document how project management will engage and involve each of the stakeholders
- ✓ Document how the stakeholders will interact among themselves and with the project

12.2.4 Training and development policy

The project proponent will develop and document a comprehensive training and development policy to meet project environmental protection and sustainability needs, project occupational safety and health needs, community health and safety safeguard needs, and other training and development needs that will be necessitated by project activities. The training and development policy will be aligned to applicable national legislations, international guidelines and best practices. The policy will highlight the following among other issues: -

- ✓ In-house training and capacity development for project workforce to address and meet required project environmental protection and sustainability threshold.
- ✓ In-house training and capacity development for project workforce to address and meet required project occupational safety and health threshold.
- ✓ In-house training and capacity development for project workforce to address and meet required community health and safety safeguard threshold.

12.1.5 Risk Management policy

The project proponent will develop and document a comprehensive risk management policy to address all potential risks that are likely to be associated with the project. The policy will document guidelines of addressing each potential risk with the aim of preventing the risk from occurring while spelling out measures to be taken to address the risk should it occur. The risk management policy will cover project related environmental risks, project related social risks, and project related occupational risks among other risks. The risk management policy will highlight the following among others:-

- ✓ Identify all project related risks to the natural environmental and social environment.
- ✓ Spell out measures to be made to prevent identified project risks
- ✓ Spell out remedial measures that will be taken should the risk occur

12.2 Environmental management plan action plan

Environmental management plan action plan is presented in table, the plan covers the following:

- ✓ Waste management
- ✓ Local air quality
- ✓ Injuries and accidents
- ✓ Labour influx
- ✓ Exposure to heat
- ✓ Decarburization
- ✓ Oils and lubricant spills management
- ✓ Traffic management
- ✓ Water scarcity
- ✓ Noise and vibrations

Table 11 is a detailed environmental management action plan

Table 11: Environmental Management action plan

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
CONSTRUCTION & INSTALLATION PHASE						
Waste management	- If poorly handled and disposed can turn out to be safety hazard exposing workers on site to injuries and accidents - Poorly handled and disposed waste will result in poor housekeeping onsite.	The Project Proponent will: s) Ensure that all generated waste will be managed and disposed as provided for in the Sustainable Waste Management Act 2022 and the Environmental Management and Coordination (Waste Management) Regulations, 2006. t) Ensure that all generated steel scrap generated to be collected and safely kept at a designated location on site from where it will	- Duly completed waste tracking forms - Feedback from workers and visitors to the site	- General manager for CSL's RSD - CSL Environmental Safety and Health Officer - Contractors - Workers	Throughout construction and installation phase	400, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		later be recovered for onsite recycling to produce billets u) Ensure that excavated overburden (soil and rock material) to be reused in landscaping within the CSL RSD and also in the rehabilitation of quarry pits of the adjacent sister company Kavee Quarries Limited v) Ensure that timber offcuts generated to be donated out to local food vendors as firewood. w) Segregate non-hazardous waste into organic and non-organic fractions. x) Provide facilities that are properly labeled and color coded				

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		receptacles, bins, containers and bags for the placement of the segregated waste. y) Hire the services of a licensed waste collector to collect, handle and transport the waste. z) Ensure any hazardous waste generated is handled and managed as prescribed in the Environmental Management and Co-ordination Act, 1999 (No. 8 of 1999) and dispose of the hazardous waste in a facility provided by the County Government of Kilifi or the Authority.				

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
Alteration of local air quality	- Fugitive dust pollution - Local air pollution from hydrocarbon releases from equipment exhaust emission - Local air pollution from equipment noise and vibration	The Project Proponent will: g) Secure the construction site with fine dust screens during excavation and construction of godown. h) Timely service and maintain all construction equipment. i) Carry out quarterly (every three months) monitoring of local air quality as provided for in the Environmental Management and Coordination (Air Quality) Regulations 2014. j) Monitor noise and vibrations as provided for in the The Environmental Management and Coordination ((Noise and	- Site observations - Physical checking of construction site to ensure dust screens are in place - Air quality monitoring report	- General manager for CSL's RSD - CSL Environmental Safety and Health Officer - Contractor - Workers	Throughout construction and installation phase	500, 00.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		Excessive Vibration Pollution) (Control) Regulations 2009.				
Injuries and accidents	- Loss of family breed winner translating to diminished family income. - Loss of productive workforce resulting in reduced productivity. - Increase in down time resulting in diminished productivity.	The Project Proponent will: gg) Register the workplace as per the provisions of the Occupational Safety and Health Act, 2007. hh) Hire well trained and experienced plant and equipment operators. ii) Only use and operate serviceable plant and equipment jj) Ensure all plant and equipment are timely serviced and maintained as per manufacturer's instructions.	- Injuries and accidents records on site - Feedback from workers - Safety training records - Equipment maintenance records - PPE provision records	- General manager for CSL's RSD - CSL Environmental Safety and Health Officer - Contractor - Workers	Throughout construction and installation phase	500, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		kk) Carry out daily safety briefings and or tool box meetings to all workers on site. ll) Carry out safety trainings to all new staff and refresher trainings to existing staff. mm) Ensure appropriate safety information, signs and slogans are strategically placed throughout the workplace. nn) Develop and document an emergency evacuation plan for the workplace oo) Provide all workers appropriate personal protective equipment (PPEs).				

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		pp) Enforce the appropriate use of all provided PPEs by all workers. qq) Maintain a record of all injuries and accidents at the workplace. rr) Promptly report accidents at the workplace to the Directorate of Occupational Safety and Health as provided for in the Occupational Safety and Health Act, 2007. ss) Promptly and accurate investigate and document all accidents and injuries reported at the workplace. tt) Provided appropriate resting facilities for workers to use during breaks.				

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		uu) Maintain a well-stocked first aid box at the workplace vv) Ensure there is at least one trained first aider at the workplace to handle first aid cases.				
Labour influx	- Increase in competition with local people for employment - Local inflation of commodity prices - Increased pressure on local accommodation	The Project Proponent will: g) Prioritize hiring all required skilled, semi-skilled and unskilled workers from the local community. h) Consider hiring outside the local community when such required skill is not available in the local community.	- Site hiring and employment records - Feedback from local leaders - Feedback from local community - Feedback from local	- General manager for CSL's RSD - Human Resources Manager for CSL - Contractor	Throughout construction and installation phase	50, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
	facilities and rent hiking. - Incidence of child labour and school dropout. - Gender-based violence	i) Only hire internationally required expatriates who will not be available locally and nationally.	business community			
PRODUCTION PHASE						
Prolonged exposure to heat	- Heat stroke - Heat exhaustion - Heat cramps - Heat rash	- Identify and designate someone trained in heat hazards, physiological responses to heat, and controls. This person will develop, implement and manage heat stress program. - Identify heat hazards at the workplace through recognition of heat hazards and the risk of heat	- Monitoring internal workplaces temperature - Monitor implementation of heat stress programme	- General manager for CSL's RSD - Environment Health and Safety Officer for CSL	Continuously throughout production phase	3, 000, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		illness due to high temperature, humidity, sun and other thermal exposures, work demands, clothing or PPE and personal risk factors. - Ensure that cool drinking water is available and easily accessible. - Encourage workers to drink a litter of water over one hour, which is about one cup every fifteen minutes. - Provide or ensure that fully shaded or air-conditioned areas are available for resting and cooling down. - New workers and those returning from a prolonged absence support for gradual acclimatization to work environment should begin		- Line Manager - Line Supervisors - Individual workers		

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		with 20% of the workload on the first day, increasing incrementally by no more than 20% each subsequent day. - Schedule altering work schedules to reduce workers' exposure to heat. - Provide training in a language and manner workers understand, including information on health effects of heat, the symptoms of heat illness, how and when to respond to symptoms, and how to prevent heat illness. - Establish a system to monitor and report the signs and symptoms of heat stroke, heat exhaustion, heat cramps and heat rash to improve early detection and action.				

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		- Have an emergency plan in place and communicate it to supervisors and workers. - Utilise engineering controls specific to indoor workplaces to reduce indoor temperature such as providing reflective shields to redirect radiant heat, insulating hot surfaces, and decreasing water vapour pressure				
Decarburization Process	- Carbon Monoxide Explosion Hazards in Electric Arc Furnace	- Train workers on how to recognize and avoid unsafe EAF operations associated with excess carbon monoxide concentrations during decarburization. - Verify that the off-gas analyser system accurately measures off-gas accumulation in the furnace.	- Monitor for carbon monoxide concentration in the EAF headspaces - Feedback from workers	- General manager for CSL's RSD - Environment Health and Safety Officer for CSL	Continuously throughout production phase	5, 000, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		- Use off-gas composition analyses to control the oxygen injection rate and ensure that gas mixtures above "the heat" stay well below the lower limit of the carbon monoxide explosive range, between 12.5% to 74%. - Ensure that proper furnace ventilation along with off-gas composition analyses are used to help control chemical reactions in the EAF headspace. - Not consider smaller explosions as acceptable and immediately investigate their cause to modify furnace process controls to prevent them. - Control furnace tilting during EAF operations to help avoid		- Line Manager - Line Supervisors - Individual workers		

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		creating potentially explosive gas mixtures				
Alteration of local air quality	- Air pollution due to off-gas emissions from the EAF - Floating dust loading at the workspace atmosphere that will contribute to deteriorating environment of the in-plant workspace - Emission of noxious	The Project Proponent will: k) Install a functional and efficient air pollution control system (fume extraction system) consisting of movable fume collection hood, pipeline, cyclone, bag house, sanction blower, bag house cleaning system, chimney, liquid metal and ladle a system that will be working together to ensure air quality standards prescribed in the Environmental Management and Coordination (Air Quality) Regulations 2014 are strictly adhered to.	- Quarterly air quality monitoring reports	- General manager for CSL's RSD - CSL Environmental Safety and Health Officer	Throughout production phase	5, 000, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
	odours and dioxins through the stack which will result in air pollution	l) Fully enclose the EAF m) Install a large capacity bag house to capture all dust as part of the pollution control system n) Continually monitor floating dust loading of the workspace atmosphere and were necessary systematically change design and operation criteria based on the relationships between off-gas emission pattern, in-house gas stream, operational sequence of the de-dusting system, and floating dust loading of the workspace atmosphere o) Install an isolation wall for the yard, properly arrange ventilation				

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		air inlet positions and increase flow rate of air through the canopy hood to decrease dust loading. p) Dust treatment by either solid reduction process or smelting reduction process to recover valuable metals from the dust and to make the residue chemically harmless for disposal. The solid reduction process partially reduces iron oxide to FeO, whereas, the smelting reduction process melts down and reduces almost all the metal oxides in the dust.				

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
Alteration of local air quality	Noxious odours and dioxins in exhaust gas	The Project Proponent will: i) Increase EAF temperature to achieve complete combustion of organic matter during the low temperature phase to avoid generation of pollutants. j) Ensure performance of the de-dusting system is optimally sufficient to ensure no noxious odours and dioxins are emitted through the stack. k) Employ gas treatment technology for dioxin reduction by ensuring that gas temperature in furnace is over 850°C, hot gas retention time in furnace is over 2 seconds, quick gas cooling to avoid dioxin	Quarterly air quality monitoring reports	- General manager for CSL's RSD CSL - Environmental Safety and Health Officer	Throughout production phase	5, 000, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		regeneration and use of a catalyst to decompose dioxins or activated carbon injection or bed to absorb dioxins. l) Use a semi-continuous charging type EAF as opposed to continuous charging type to ensure that the exhaust gas temperature from the furnace is relatively high and is stable to attain over 850°C gas temperature in furnace and over 2 seconds hot gas retention time in furnace.				
Alteration of local air quality	- Noise and vibration o Interfere with conversation and	The Project Proponent will: m) Develop and implement a comprehensive noise conservation programme that	- Noise and vibration measurements reports	- General manager for CSL's RSD CSL	Throughout production phase	2, 000,000 .00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
	communication at the workplace o Negate general work performance, thought and concentration. o Negate relaxation o Causes annoyance. o Induces hearing loss if exposure is continuous for a long time.	includes training, equipment maintenance, engineering controls, use of PPEs and noise level measurements. n) Ensure the site is secured by appropriate noise attenuators. o) Provide all employees with appropriate PPEs such as ear plugs and ear mufflers and ear plugs p) Enforce proper use of the provided PPEs by all workers. q) Ensure equipment used is well maintained and serviceable. r) Employee appropriate engineering controls to minimise		- Environmental Safety and Health Officer		

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		noise production from plant and equipment				
Oils and lubricants spills	- Contamination of local soil where the spillage occur - Contamination of surface and ground water - Burning effect on vegetation	The Project Proponent will: e) Provide appropriate containment structures /banding to collect any spills. f) Provide for oil spill absorbents for quick absorption of any accidental spills	- Site observations - Oil and lubricant spill records - Feedback from employees	- General manager for CSL's RSD CSL - Environmental Safety and Health Officer - Individual employees	Throughout production phase	500, 000.00
Traffic congestion	- Increase in exhaust emissions from the trucks	The Project Proponent will: e) Develop and implement a traffic marshal plan.	- Observations on affected access road - Traffic marshal plan	- General manager for CSL's RSD CSL	Throughout production phase	250, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
	- Delays on affected roads - Increase in wear and tear of the access road	f) Provide sufficient parking/ holding area for traffic delivering raw materials and collecting finished from the steel mill	- Feedback from employees and community	- Transport manager CSL		
Waste generation	- Poor housekeeping - Safety hazards - Environmental pollution	The Project Proponent will: aa) Ensure that all generated waste will be managed and disposed as provided for in the Sustainable Waste Management Act 2022 and the Environmental Management and Coordination (Waste Management) Regulations, 2006. g) Provide appropriate receptacles for dropping waste	- Duly completed waste trucking documents - Daily checks and observations at workplaces - Feedback from workers and	- General manager for CSL's RSD CSL - Environmental Safety and Health Officer	Throughout production phase	1, 000, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		h) Ensure only NEMA licenced vehicles collect waste from the hot rolling steel mill. i) Management to try to minimise waste generation during operational phase by reusing and or recycling most of generated waste.	visitors to the workplace			
Water scarcity	- Extracting water from the local pipeline for industrial use could contribute to a reduction of available water for domestic use	The Project Proponent will: g) Explore alternative sources of water that can be used such as roof catchment, rock catchment and collection from neighbouring quarry pits to minimise drawing water from local pipeline for industrial use.	- Feedback from local leaders on water availability and access for local community	- General manager for CSL's RSD CSL - CSL's RSD Production manager	Throughout production phase	5, 000, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		h) Provide adequate water storage tanks on site to store water from roof catchment from the extensive roofs of the godowns during rainy season that can be used in cooling of plant and equipment. i) Minimise water demand by ensuring used water from the cooling circuit is routed through an adequately sized and effective cooling tower and pressure filter to filter the water for recycling purpose				
Injuries and accidents	✓ Injury to and or loss of family breed winner translating to	The Project Proponent will: m) Ensure all workers are given appropriate PPEs.	- Injuries and accidents records at the workplace	- General manager for CSL's RSD CSL	Throughout production phase	3, 000, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
	diminished family income which translates to reduced family purchasing power and ability to meet family financial obligations. ✓ Ailment/sickness to affected worker that negatively affects the productivity	n) Ensure hired workers are first trained on the appropriate use of the provided PPEs. o) Ensure all workers and visitors to the project site also use the provided PPEs appropriately. p) Ensure that tools and equipment provided for use are well serviced and maintained. q) Ensure that at least four workers are trained first aiders. r) Ensure there is a fully equipped first aid station at various sections of the steel mill.	- Feedback from workers - Safety training records - Plant and Equipment maintenance records - PPE provision records	- CSL's RSD Production manager - CSL's Environmental Safety and Health Officer - Duty Supervisors		

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
	of such a worker hence reducing financial earnings of such a worker which translates to reduced purchasing power of such a worker. ✓ Loss of productive workforce resulting in reduced productivity.					

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
	✓ Increase in down time resulting in diminished productivity					
DECOMMISSIONING PHASE						
Noise and vibration	✓ Interfere with conversation and communication at the workplace ✓ Negate general work performance,	The Project Proponent will: k) Develop and implement a comprehensive noise conservation programme that includes training, equipment maintenance, engineering controls, use of PPEs, noise measurements.	- Monitoring records of Noise and vibrations - Feedback from decommissioning workers	- General manager for CSL's RSD CSL - Contractor undertaking the decommissioning	Throughout the decommissioning phase period	200, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
	thought and concentration. ✓ Negate relaxation. ✓ Causes annoyance. ✓ Induces hearing loss if exposure is continuous for a long time.	l) Ensure the decommissioning site is secured by appropriate noise attenuators. m) Provide all decommissioning staff with appropriate PPEs such as ear plugs and ear mufflers. n) Enforce proper use of the provided noise protective PPEs by all workers. o) Ensure equipment used is well maintained and serviceable.		- CSL's Environmental Safety and Health Officer		
Injuries and accidents	- Loss of family breed winner translating to diminished family income.	The Project Proponent will: q) Ensure all decommissioning workers are given appropriate PPEs.	- Injuries and accidents records at the workplace	- General manager for CSL's RSD CSL - Contractor undertaking	- Throughout the decommissioning phase period	200, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
	- Loss of productive workforce resulting in reduced productivity. - Increase in down time resulting in diminished productivity.	r) Ensure all decommissioning workers are trained on the appropriate use of the PPEs before use. s) Ensure each decommissioning worker and visitors to the decommissioning site also use the provided PPEs. t) Ensure that tools and equipment provided for use at the decommissioning site are well serviced and maintained. u) Ensure that the decommissioning site is free of hazards.	- Feedback from workers - Safety training records - Plant and Equipment maintenance records - PPE provision records	the decommissioning - CSL's Environmental Safety and Health Officer		

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
		v) Ensure that among the decommissioning workers at least one is a trained first aider. w) Ensure there is a fully equipped first aid station at the decommissioning site. x) Ensure appropriate measures are put in place to minimize fugitive dust by regularly sprinkling water on dusty ground.				
Alteration of local air quality	- Dust pollution o Interfere with conversation and communication at the workplace	The Project Proponent will: k) Secure the entire decommissioning site with appropriate dust screens to trap fine dust particles.	Noise and vibration measurements reports	- Contractor undertaking the decommissioning - CSL's Environment	Throughout the decommissioning phase period	200, 000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
	○ Negate general work performance, thought and concentration. ○ Negate relaxation ○ Causes annoyance. ○ Induces hearing loss if exposure is continuous for a long time.	l) Sprinkle water to arrest fugitive dust. m) Provide all decommissioning staff with appropriate PPEs such as dust masks, overalls, helmet, dust coats, safety boots and goggles. n) Ensure all decommissioning workers make proper use of the PPEs provided. o) Periodically monitor air quality levels at the decommissioning site by measuring local particulate matter		al Safety and Health Officer		
Waste generation	- Poor housekeeping - Safety hazards	The Project Proponent will: g) Ensure all waste generated at the site being decommissioned is	- Duly completed waste	- Contractor undertaking the	Throughout the decommissioning phase period	500,000.00

Issue/concern	Potential negative impacts	Proposed mitigation measures	Monitoring	Responsibility	Timeframe	Budget
	- Environmental pollution	managed and disposed as provided for in the Sustainable Waste Management Act 2022 and the Environmental Management and Coordination (Waste Management) Regulations, 2006. h) Provide appropriate receptacles for dropping waste. i) Ensure only NEMA licenced vehicles collect waste from the site being decommissioned.	trucking documents - Daily checks and observations at workplaces - Feedback from workers and visitors to the workplace	decommissioning - CSL's Environmental Safety and Health Officer		

12.3 Environmental Monitoring

12.3.1 Noise and excessive vibrations monitoring

The noise levels will be monitored quarterly to ensure they are in line with the provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 as shown in the table 12.

Table 12: Maximum permissible noise levels for constructions sites (Measurement taken within the facility).

Facility		Maximum Noise Level Permitted (Leq) in dB(A)	
		Day	Night
i.	Health facilities, educational institutions, homes for disabled etc.	60	35
ii.	Residential	60	35
iii.	Areas other than those prescribed in (i) and (ii)	75	65

Timeframe: Day; 6:01am-6:00pm & Night; 6:01pm-6:00am

Source: Second schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

12.3.2 Air Quality Monitoring

Monitoring of particulate matter to ensure that the project activities adhere to the Ambient Air Quality requirements at Property Boundary for General Pollutants. Part (b) of the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014 require that the particulate matter for at a property boundary should not exceed 70µg/m^3. The proponent will be monitoring particulate matter from the project site during construction phase to ensure they are within the legal limits. During operation phase the proponent will monitor stuck emissions from all stuck of the steel mill, Pollutants that will be monitored are those stated in the fourth schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014. The pollutant that will be monitored on a quarterly basis will include opacity, particulate (dust), sulphur oxide, nitrogen oxides and carbon monoxide.

12.3.3 Solid waste disposal monitoring

Waste generated and disposed from the steel mill will be managed and disposed as provided for in the Environmental Management and Coordination (Waste Management) Regulations, 2006 and the Sustainable waste management Act 2022. To ensure that the provisions of the regulation and Act are adhered to, the proponent will monitor the type of solid waste generated, quantity of solid waste generated, frequency of collection and disposal, where the waste is disposed and proof of waste tracking documents in the format provided in FORM III schedule one of the Environmental Management and Co-ordination (Waste Management) Regulations 2006. This monitoring is to be done monthly.

12.4 Training and capacity building

The following training and capacity building is proposed: -

- Sensitization of the Proponent, and Contractor who will undertake the implementation of the proposed project on the importance of the EMP, its contents, how it is applied and who is responsible for the implementation of each part of the EMP.
- Training and capacity building for contractor and the construction labour on the importance and proper use of PPEs.
- Training and capacity building for Contractor and construction labour on acceptable waste management practices.
- Training and capacity building of the construction site occupational safety and health committee on construction site occupational safety and health requirements and individual safety obligations.
- Training and capacity building of construction site first aiders.
- Training and capacity building on construction site fire safety team
- Sensitization on HIV and AIDS and other communicable diseases to site construction workforce.

12.5 Institutional arrangements for safeguard implementation and reporting

12.5.1 Institutional arrangement

The responsibility of implementation of the safeguards proposed in this EMP is vested on the project proponent who is Corrugated Sheets Limited. The National Environment Management Authority (NEMA) and other relevant leas agencies will enforce compliance. There will be

periodic site visits by NEMA and relevant lead agencies to assess and enforce compliance. During the construction phase, the contractor will be required to prepare monthly progress reports and submit the progress reports to the proponent on the contractor's contractual obligations on safeguards implementation responsibilities specified in the EMP. The contractor will be supervised on the ground directly by the proponent or proponent representative as will be determined by the proponent. The proponent will be required to promptly respond to improvement orders issued by NEMA and other lead agencies by compiling a report on the issues raised in the orders. The proponent will be required to prepare periodic monitoring reports and annual environmental audit reports and submit these reports to NEMA and other relevant lead agencies.

12.5.2 Reporting obligations

The following reports will be prepared:

- ✓ Monthly progress reports by the contractor on the implementation status of every obligation of the contractor on safeguards implementation specified in the EMP. These monthly reports will be submitted by the contractor to the Proponent.
- ✓ Periodic monitoring reports to be prepared by the proponent and submitted to NEMA on the status of:-
  - i) Air quality as prescribed in the Environmental Management and Coordination (Air Quality) Regulations, 2014.
  - ii) Noise and excessive vibration as prescribed in the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.
  - iii) Waste management as prescribed in the Environmental Management and Coordination (Waste Management) Regulation, 2006.
- ✓ Initial Environmental Audit report to be prepared by the proponent and submitted to NEMA in the first year of operation of the project to confirm the efficacy and adequacy of the EMP.
- ✓ Self-environmental audit report to be prepared annually by the proponent and submitted to NEMA to report on the progress of implementation of the EMP.

- ✓ Reports responding to NEMA improvement orders to be prepared by the proponent and submitted to NEMA as and when such improvement orders are issued.

12.6 Environmental auditing

The project proponent will carry out an initial environmental audit and Annual Environmental Audit for the project activities as provided for in the Environmental (Impact Assessment and Audit) Regulations 2003. The Audits will serve to confirm the efficacy and adequacy of the proposed Environmental Management Plan.

12.7 Decommissioning

Decommissioning of the project will involve terminating project operations, dismantling of all project equipment and allied infrastructure and rehabilitating the site to the original status. Before decommissioning will be done, the Project Management will communicate in writing to the National Environment Management Authority stating their intension to decommission and provide a detailed decommissioning plan for approval.

13. FINDINGS, CONCLUSION AND RECOMMENDATIONS

13.1 Key findings

The following are the main findings:

- ✓ The proposed project proponent is Corrugated Sheets limited, the proposed project site is within the the Reinforced Steel Division of the Corrugated Sheets Limited at Kokotoni on plot number 24606.
- ✓ Within the Reinforced Steel Division of the Corrugated Sheets Limited, there is an existing hot rolling mill and a TMT mill.
- ✓ The neighbors of the proposed project site are factories owned by Corrugated Sheets Limited
- ✓ The proposed project will involve construct and installation of a steel mill for the melting of steel scrap to generate molten metal that is continuously casted to produce billets.
- ✓ Electricity will power the EAF while water will be the coolant.
- ✓ Raw materials that will be used will be mild steel scrap which will be procured from local and international markets.
- ✓ Expected waste to be generated will be slag.
- ✓ Potential positive impacts will include employment opportunities for the local community, support to existing local businesses, on job training opportunities for local people, technology transfer, support for development of local community through company CSR programme, taxes to National Government, taxes to County Government of Kilifi, foreign exchange earnings through exports.
- ✓ Potential negative impacts will include explosions from decarburization, dust pollution, eexposure to heat, air pollution by noxious odours and dioxins in exhaust gas from bag house, Soil and ground water contamination from toxic EAF dust, Noise and vibration pollution, Oils and lubricants spills, Traffic congestion, Pollution from waste disposal, Water scarcity and Injuries and accidents

- ✓ Measures have been identified and proposed to mitigate predicted potential negative impacts and appropriate environmental management action plans outlined.

13.2 Conclusions

The predicted potential positive impacts can be maximised to reap maximum benefits by implementing proposed measures of enhancing each positive impacts. Likewise, fully implementation of identified mitigation measures of each potential negative impact can ensure minimization of potential negative effects to acceptable levels.

13.3 Recommendations

- ✓ To ensure environmental sustainability, the proposed environmental management plan to be fully implemented once the proposed project is approved and licenced for implementation. The project proponent to provide an adequate budget for the full implementation of the proposed environmental management plan.
- ✓ The implementation of the proposed project to adhere to all legal provisions.
- ✓ Issues, concerns and suggestion raised during the stakeholder consultation (public barazas and questionnaire survey) to be addressed.
- ✓ Waste generated during the cycle of the project to be strictly handled as stipulated in the Environmental Management and Coordination (Waste Management) Regulations, 2006. And the Sustainable Waste Management Act 2023.
- ✓ All air emissions to adhere to the provisions of the provisions of Environmental Management and Coordination (Air Quality) Regulations, 2014.
- ✓ Noise and vibrations to be within the limits stipulated in the Environmental Management and Coordination (Noise and Excessive Vibration) (Pollution Control) Regulations, 2009.
- ✓ Proposed measures to mitigate on potential climate change effects to be implemented.
- ✓ All occupation and safety issues to be addressed and managed as provided for in the Occupational Safety and health Act, 2007.