ADDENDUM TO THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT FOR THE ESTABLISHMENT OF A POLE TREATMENT PLANT – MIRO FORESTRY (SL) LIMITED

Draft

22 August 2020

Table of Contents

List of Tables

List of Figures

LIST OF ACRONYMS

CBO	Community-based Organization
CCA	Chromated Copper Arsenate
CDAP	Community Development Action Plan
CITES	Convention on the International Trade of Endangered Species
EPA-SL	Environment Protection Agency - Sierra Leone
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GoSL	Government of Sierra Leone
IFC	International Finance Corporation
MDA	Ministries, Departments and Agencies
MLHE	Ministry of Lands, Housing and Environment
N	North
NGO	Non-Governmental Organization
PPE	Personal Protective Equipment
TOR	Terms of Reference
WHO	World Health Organization
WMP	Waste Management Plan

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EXECUTIVE SUMMARY

In the expansion of its operations, MIRO FORESTRY (SL) LIMITED proposes to establish a Pole Treatment Plant at its Mile 91 site in Yoni chiefdom in Tonkolili District and has submitted an application to the Environment Protection Agency (EPA). The application included a site plan, an Environmental Social Impact Assessment Report, technical details and a risk assessment of the proposed Treatment Plant. In response, the EPA requests a detailed impact and risk assessment analyses of the proposed treatment plan to help them process the application for licenses.

The proposed location of the Pole Treatment Plant is at one of its current operational sites in Yoni Chiefdom, Tonkolili district in northern Sierra Leone. The site is about 1.38 hectares in size, and it is located near the Sawmill at latitude 8º28ˈ16.30ˈˈN and longitude 12º18ˈ20.24ˈˈW.

The topography is generally gentle, rising between 250 m and 275 m above sea level. The original vegetation was classified as forest regrowth, but it is now covered by acacia trees cultivated by the company.

The pole plant size will be 75m x 15m and the number of poles Miro intends to supply per month in the first year of production will be approximately 1000. The total treating capacity will be 20,000 poles per annum. The capacity of the operational storage tank is approximately 72,000 litres of CCA and the total pole capacity of impregnation plant is 50 poles.

The chemicals in the treatment plant are reused within the plant. There is normally no discharge of chemicals from the plant; Freshly treated wood is placed on a special drip pad where any drip-off of chemicals can be collected together with any rainwater that has been in contact with the freshly treated wood. The solution collected at the drip pad is used for making fresh impregnation solution; to minimize sludge produced when using the solution from the drip pad, the drip pad is kept free from wood waste and the solution is filtered before it is returned to the impregnation plant.

The operations of MIRO FORESTRY (SL) LIMITED, establishment and operation of the pole treatment plant is been influenced by several environmental policies, laws, regulations and multi-lateral environmental conventions that Sierra Leone has signed up to. These policies, legal and institutional frameworks with respect to Miro Forestry (SL) Limited operations in Sierra Leone have been reviewed and presented in Chapter 3 of this document.

The establishment and operations of the pole treatment plant triggers some international environmental conventions and guidelines. These are also presented in chapter 3.

Chapter 4 presents baseline survey of operations and impacts of CCA plant sites to give an indication of prevailing site conditions prior to operations.

Chapter 5 presents a comprehensive impact analysis and mitigation procedures for the proposed pole treatment plant within the Miro concession. The actual impacts of any emission depends on many factors, including the location of the wood preservation facility relative to ground or surface waters, the amount associated with the releases, the frequency of releases, and contingency measures in place at the facility.

Chapter 6 presents a comprehensive Chemical and Waste Management Plan for the operation of the Pole Treatment Plan. This plan includes requirements for protection of employee health and the environment, and requirements for monitoring.

1 CHAPTER

1.1 INTRODUCTION

MIRO FORESTRY (SL) LIMITED is a green-field and profit-oriented forestry group that grows mainly Eucalyptus and Acacia for the future production of transmission poles, plywood, biomass, charcoal and sawn timber. It aims ultimately to supply sustainable value-added timber products to local and regional markets. It is registered as a private limited liability company under the laws of Sierra Leone. The company originally operated within a land area of 21,000 hectares leased in 2011 for a period of 50 years from the Chiefdom Council of Yoni Chiefdom in Tonkolili District, but it has recently acquired additional land areas from neighbouring communities in Yoni and Masimera Chiefdoms in Tonkolili and Port Loko districts respectively to expand on their original leasehold in northern Sierra Leone.

In the expansion of its operations, the company proposes to establish a Pole Treatment Plant at its Mile 91 site in Yoni chiefdom in Tonkolili district and has submitted an application to the Environment Protection Agency (EPA). The application included a site plan, an Environmental Social Impact Assessment Report, technical details and a risk assessment of the proposed Treatment Plant. In response, the EPA requests a detailed impact and risk assessment analyses of the proposed treatment plant to help them process the application for licenses.

This document therefore is an addendum to the ESIA, comprising of comprehensive impact and risk assessment analyses, and mitigation procedures for the proposed pole treatment plant. The details as required by the EPA include the following:

- Baseline ground water and soil analyses
- Chemical waste management plan
- Description of the topography of the proposed site
- Details of the chemical store
- Detailed Occupational and Health Impact analyses.
- Proposed market for the treatment plant.

Following submission of the first addendum the EPA has requested more information on the following:

1) Errors in typing – corrected. Errors in District reference – corrected. Variation in font in the report – corrected.
2) Details of the Miro staff that compiled their ESIA have been added to their Risk Assessment Report. A Table of authors has been added at the beginning of this report.
3) Table titles and number has been added into the report.
4) Baseline analytical results for ground water, initial information in the report was not clearly stated to indicate that Miro's risk assessment and mitigation of the potential impacts to ground water focused and reducing the potential of this impact occurring by bunding any areas where there is potential for chemical spillage and drip-off. Further to this the entire are where CCA treated timber will have a concrete base to prevent contamination of soils and potential secondary impacts of contamination of ground water. Based on international best practices if these measures are undertaken, the potential of soil and ground water become minor. In this instance the testing of ground water in the singe borehole may be considered as a precautionary measure to check and monitor ground water.
    a. Certificate of Analysis (COA) for underground water is now attached.
5) Baseline of soil sample analysis for key elements of Chromium, Copper and Arsenate have been taken by Miro in August 2020 and sent for analysis, results are now included in this report under sections 4.1.2 and 5.2.2.1.

6) Research on the potential impacts to air quality have now been included to indicate that where the plant is operated in compliance with operational procedures air quality standards within the plant remain within WHO standards for air quality. As this research indicates this at a plant level the risk assessment would not indicate any value of testing air quality in managing and mitigating risks associated with operating this type of plant.
7) National Environmental Standards for Sierra Leone. Miro had a meeting on 28 August 2020 with the Deputy Director of the Sierra Leone Standards Bureau (SLSB) where Deputy Director Bah said thatno standards are currently available to the public. Therefore, WHO standards have been used in this report.
8) A description fo the drying methods has been included in the report under chapter 2.
9) Commitment of Miro. Miro completed the attached Technical Details and Risk Assessment. Miro has policy commitments to responsible management and a Management System of policies, procedures, work instructions and guidelines to ensure that their commitments to responsible management are implemented. Miro have adapted international best practice in the type, design and construction of the plant to mitigate identified potential impacts. Miro have also gone beyond relying on their own perception of this responsible management by undertaking annual 3rd party audits against international best practice certification standards for both their forests and processing plants. For their plantations their choice of international certification is the Forest Stewardship Council (FSC)© Forest Stewardship standard, while for their sawmill they currently have certification to the FSC© Chain of Custody standard that also verifies compliance to local legislation, environmental and health and safety standards. Following the EPA concerns they have also employed the services of Forestry Solutions Africa to review all documentation relating to this ESIA.
10) The wood to preservation ratio is now stated under Chapter 2.
11) Refer to Miro Technical Details and Risk Assessment section 4.3.1. Further references in this regard are also listed int this report that cover international information on use of CCA globally. The relevant section of the report has also been updated to reflect the South Africa standards in this regard.
12) The section on the disposal of solid wastes has been updated to reflect approval is sort from EPA.
13) Miro have done the initial Risk Assessment in their attached Technical Details and Risk Assessment, this report only reflects where it was believed that additional information to their report is required. This report has been totally reviewed and revised as per the EPA request.
14) Miro acknowledge the EPA concerns around the Life Cycle approach and this is one of the reasons that any CCA sludges and contaminated liquids are returned to suppliers for appropriate treatment and disposal.
15) A new section 2.2 has been added to consider alternatives and reasons for ultimate selection of options.

1.2 Topography of the proposed location of the Treatment Plant including slopes and elevation

The proposed location of the Pole Treatment Plant is at one of its current operational sites in Yoni Chiefdom, Tonkolili district in northern Sierra Leone. The site is about 1.38 hectares in size, and it is located near the Sawmill at latitude 8º28ˈ16.30ˈˈN and longitude 12º18ˈ20.24ˈˈW. The coordinates in the location description given here is different from the coordinates originally given to EPA due to change of location. It is accessible by the main Masiaka – Mile 91 Highway, about 0.67 miles from Royanka village.

The topography is generally gentle, rising between 250 m and 275 m above sea level. The original vegetation was classified as forest regrowth, but it is now covered by acacia trees cultivated by the company.

1.3 Details of the chemical store including its location and mode of accessibility

The pole treatment plant will be located near the Sawmill at 8º28ˈ16.30ˈˈN, 12º18ˈ20.24ˈˈW. The plant has been moved to this new location. See diagram of the plant below. There is no extra chemical store.

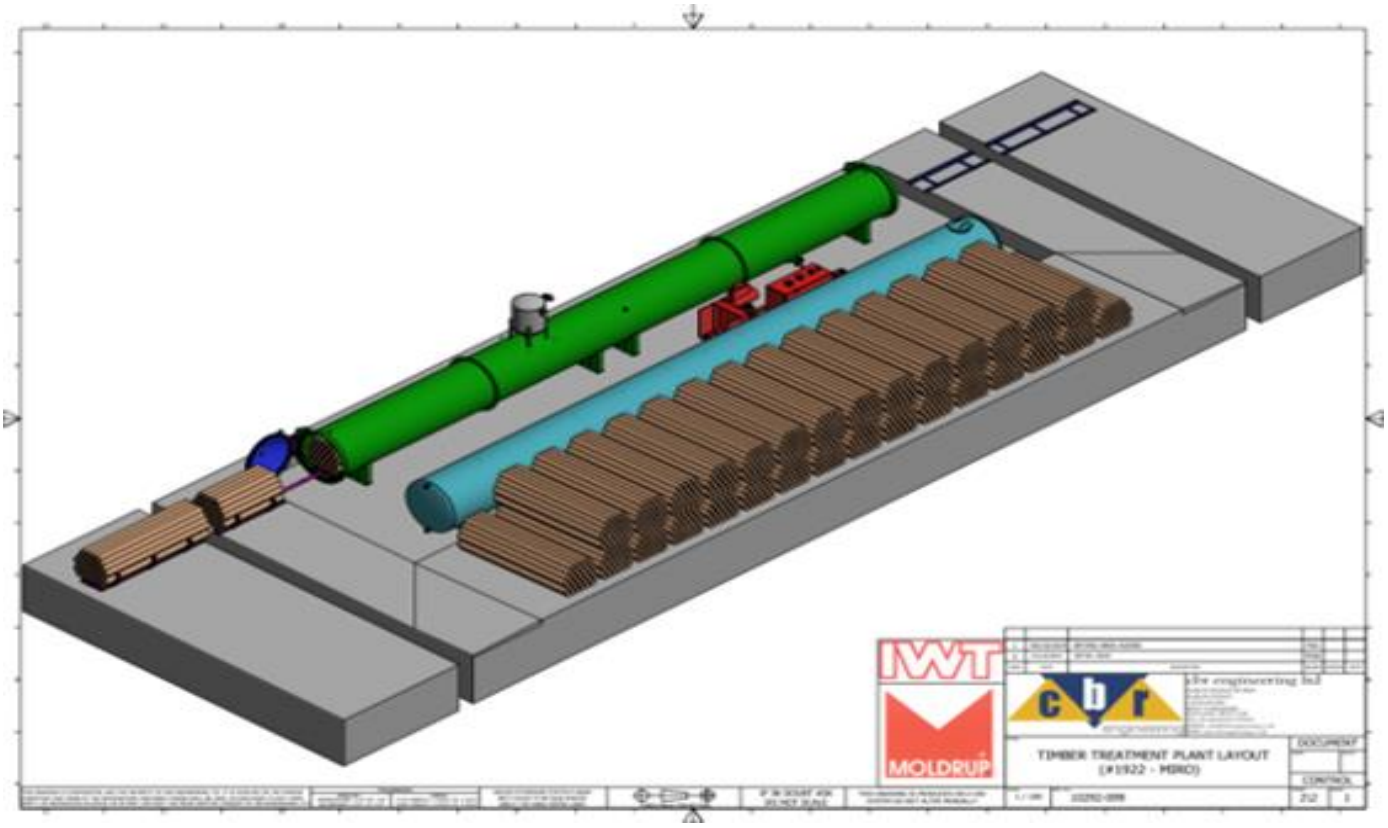

Figure 1: Diagram of the CCA Plant

All CCA is stored in the Operational Storage Tank which is within the same bunded area as the treatment plant. A pump skid is connected between the Operational Storage Tank (blue tank in the picture) and the Treatment Vessel (green tank in the picture). CCA flows between the two.

All staff working within the pole treatment plant will undergo training from experts about how to properly handle chemicals. The type of chemicals and preservatives used will include Copper Oxide, Chromic Acid and Arsenic Pentoxide.

The pole plant size will be 75m x 15m and the number of poles Miro intends to supply per month in the first year of production will be approximately 1000. The total treating capacity will be 20,000

poles per annum. The capacity of the operational storage tank is approximately 72,000 litres of CCA and the total pole capacity of impregnation plant is 50 poles.

The chemicals in the treatment plant are reused within the plant. There is normally no discharge of chemicals from the plant; Any leakage of solution from the door etc is normally collected and re-used for preparing fresh impregnation solution; the only significant discharge of chemicals from the plant is the collection of saw dust etc in the filters in the plant and from the bottom of the pressure vessel, but the quantity of such sludge is minimized by ensuring poles are clean before treatment; Freshly treated wood is placed on a special drip pad where any drip-off of chemicals can be collected together with any rainwater that has been in contact with the freshly treated wood. The solution collected at the drip pad is used for making fresh impregnation solution; to minimize sludge produced when using the solution from the drip pad, the drip pad is kept free from wood waste and the solution is filtered before it is returned to the impregnation plant.

2 CHAPTER

2.1 DESCRIPTION OF OPERATIONS

The pole production process at Miro Forestry Company Limited can be described in eight main steps:

- Debarking: At the initial stage, newly harvested poles from the plantation sites arrive at the treatment plant are debarked. The debarked poles are then sorted into varying customer specifications and grades. Waste from debarking can be used to fuel the drying plant
- Dressing: This is the stage the pole is subjected to peel to remove the inner bark in order to make the surface smooth and even.
- Drying: The debarked poles are stacked in the open air according to grades or customer specification to dry. Depending on the size of the pole and weather conditions, open air drying is generally six weeks. The timber is then placed into kilns and dried to below 28% moisture content then removed and stacked. Drying is done in industrial timber dryers where timber is placed into a closed chamber, moisture and hot air is circulated through the chamber to gradually reduce the moisture content in the timber while at the same time preventing warp and deformation in the timber. Drying times vary depending on external weather factors, products being dried and initial moisture content of the timber to be dried. However, average dryings are 7 – 14 days.
- Fabrication: In this phase, all customer specifications are executed before finally treating the pole. Examples are pole markings, drilling and any other fabrication required by the customer. Pole dimensions, moisture content and quality are also checked in accordance with acceptable standards.
- Impregnation: The poles are treated with chemicals that will prevent the poles from insect attack and to last longer. The chemical to be used to treat wood would be Chromated Copper Arsenate. The ratio of preservative to timber is 18 to 20 kg of CCA per 1 m3 of treated wood.
- Fixation: The Poles are then left to stand for between 5 and 12 hours on a chemical drip pad to allow the fixation process to be completed. This process ensures that the Copper and Arsenic are fixed into the wood cells by the Chromium. Once this fixation process is completed the products may be considered safe to handle and the potential for leaching of chemicals from wood is considered negligible.
- Storage is then done on the concrete pad using safe stacking procedures until such time as it is ready to be transported to customer.
- The transport of finished products will be done in compliance with the Road Traffic Act, 2007.

The full-cell treatment process, used to apply the preservatives in CCA treatment plants, consists of the following steps:

- application of an initial vacuum to remove air from the wood cells;
- flooding with CCA working solution and pressurization (up to 1040 kPa) until the target CCA retention level is achieved;
- draining of the excess CCA working solution (to the working tank for reuse with subsequent charges)
- application of a final vacuum

The specific treatment times and pressures are dictated by the species of wood, the type of wood product (e.g. plywood or poles) and the moisture content of the wood. A predetermined range of process parameters is defined by the applicable treatment standards and quality control tests are carried out to ensure that a minimum treated product quality is achieved. Once the treated wood

is withdrawn from the treating chamber, it is either subjected to a fixation process or stored on-site for periods that generally range from days to months.

2.2 OPTIONS AND JUSTIFICATION FOR CURRENT SITE AND METHODOLOGY

2.2.1 Site Options

The first site option was to place the treatment plant in an industrial area close to labour and markets, for example in Mile 91 or in Freetown. This option was rejected due to costs of transporting raw materials verses finished products; the option of placing a treatment plant in semi-urban areas was rejected due to security risks, extended management control and the risks of chemicals in close proximity to urban areas as against in rural locations away from human settlement.

The second site option was to place the treatment plant along the main highway (see map in the Miro Technical Details and Risk Assessment Report), this would be advantageous from the perspective of access to road transport for movement of finished products to the market. This option was rejected when compared to the current site option below due to the advantages of that site option.

The final site option and current proposed site was selected for the following reasons:

1) This consolidates Miro's processing plants and management locations into a single site.
2) As a result of 1 above, the treatment plant would have access to existing sources of electrical power supplies and Miro's new solar farm.
3) Management is able to exercise better management control over the process and ensure risk mitigation is properly implemented.
4) The site is generally flat with a slight gradient facilitating spill and run-off control over liquids to mitigate potential contamination of soils, surface and ground water.
5) Access to clean water is assured as existing supplies of water is a known factor.
6) Existing security at Miro's site would assist in general security, but specifically security of chemicals and treated products reducing risk of theft of chemicals and chemically treated product before fixation has occurred.
7) Locating the plant in a rural location away from human settlement is also viewed as a best practice mitigation to ensure that impacts from accidental spillage and contamination of soils and water supplies is kept away from human settlements.

2.2.2 Methodology Options

The first option that was considered is a no treatment option where timber products would be supplied untreated into the market. This would be advantageous as the risks of chemically treated products would then not be applicable. This is still an option that Miro will utilize where products being supplied do not need to be protected fungal, insect attack and rotting of products. This option also has potential where timber properties have self-protecting properties in the timber species, these are generally indigenous hardwoods and hardwood species with specific properties. The species that Miro grows are fast growing exotic hardwoods intended to supply strategic markets in the region that would reduce pressure on indigenous natural forests, these species do not have natural protection properties and therefore is Miro is address market demands for timber products that have a long term durability then these products need to be treated to protect the products.

The second option consider was a surface application of chemicals that treat timber against fungal, insects and rotting. These methods include painting and timber dipping. This option was rejected as it is not an effective method of treating timber for long term use in applications demanded by the market.

The option selected is to pressure treat the timber where chemical penetration is achieved deeper into the timber and wood structure. This offers far greater protection of the products as demanded by the markets. This option is far safer and offers greatly reduced risk to both human health and safety and to the environment. As chemicals are contained, pressure applied and then vacuumed out the timber back into the containment vessels there is far less chemical available that could potentially escape into the environment. With this being a mechanical process that is automated the risk of human exposure to chemicals is almost eliminated.

2.2.1 Chemical Options

There are three primary options accepted as part of international best practice for chemical treat and protection of timber products:

a) Creosote Treatment – this option was rejected as it is less acceptable when compared to CCA treatment, run-off of creosote is greater, and it is "dirtier" process with employees being exposed to creosote that does not penetrate the timber products. While this is still a potential option for treatment of timber products CCA is viewed as a better option for most applications in the market and is also a safer option.
b) The new generation inorganic alternatives used in applications similar to CCA are Copper Azole (CuAz), and Alkaline-Copper Quaternary (ACQ) preservatives. These are much newer options, with associated unknown risks when compared to CCA long history and research of use and impacts, some of the active ingredients still remain the same. These products are not widely available and are not as widely accepted in the market place, further to this these are more expensive options which does not meet Miro's objectives of being able to supply high quality products at a reasonable price into 3rd markets.
c) CCA treatment was ultimately selected due to is known impacts and risks and long history of risk mitigation that has been developed over many years of use. As it is a widely known treatment process it is also widely accepted across regions and markets as a low risk efficient treatment process.

As a result of the above assessment of alternatives the current site, methodology and inputs where selected as being the lowest risk, impact option with the most widely accepted markets in the country, region and global markets.

3 CHAPTER

3.1 POLICY, LEGAL, REGULATORY and INSTITUTONAL CONTEXT

The legal, policy and institutional framework governing ESIA usually provide guidelines to development proponents with a view of ensuring the protection of the environment, health and wellbeing of workers and to ensure sustainable development.

The operations of MIRO FORESTRY (SL) LIMITED, establishment and operation of the pole treatment plant is been influenced by several environmental policies, laws, regulations and multi-lateral environmental conventions that Sierra Leone has signed up to. These policies, legal and institutional frameworks with respect to MIRO FORESTRY (SL) LIMITED operations in Sierra Leone have been reviewed and presented in this Chapter.

Considering the volume of requests for utility poles in Sierra Leone and the West African sub-region, Miro Forestry (SL) Ltd has considered the establishment of a pole treatment plant. It is in this regard that Miro is doing this addendum to the ESIA that was submitted for the operations of the company. Chromated Copper Arsenate (CCA) in treating timber may have effects on the bio-physical environment as well as the health and safety of workers. It is important to present an in-depth analysis of the use of CCA in the treatment of timber at Miro Forestry (SL) Limited.

This chapter presents the legislative and policy instruments that guide the operations of the pole treatment plant that the company proposes to establish at its plantation site.

Principally, the Sierra Leone Environment Protection Agency Act, 2008 and its 2010 amendment require an Environmental Impact Assessment for projects that would have a significant impact on the environment. Conversion of land to forestry plantations and its ancillary activities including the treatment of timber using toxic chemicals are listed in the First Schedule of the Sierra Leone Environment Protection Agency Act, 2008 and its 2010 amendment as requiring an Environmental Impact Assessment. Thus, there is a statutory requirement for conducting an EIA for this project.

Similarly, provisions in national legislation and their regulations as well as international conventions that Sierra Leone has signed up to have relevance to the establishment and operations of this project. An overview of all such legal instruments and the competent authorities vested with the mandate to implement these instruments is provided in this Chapter.

3.2 National Legislation

Legislation governing environmental management issues in so far as establishment and operations of a forestry company are concerned is found in Acts and Regulations of the various government line ministries or institutions. Such legislation includes:

- The Environment Protection Agency Act, 2008 as amended in 2010
- Renewable Energy Policy, 2016
- The Factories Act, 1974

As timber is a key input into the process the following legislation would apply to the timber sources:

- The Forestry Act, 1988
- The Forestry Regulations, 1989
- The National Protected Area Authority Act, 2012

- The National Lands Policy (2015)
- Voluntary Guidelines on Responsible Governance of Land Tenure

Miro has had ESIA's completed for the plantation development where the timber will be sourced under EPA certificate: EPA-SL008

Since timber is sourced in compliance with Sierra Leone legislation, this will not be discussed further in this report.

These documents are available locally or online and can be obtained from the institutions to which the Acts refer to for consultation by potential users of the land and communities on whose lands the company's operations are going to be impacted and have an effect on the environment.

3.3 Extracts from the Acts pertinent to the use of the environment for establishment and operations of Miro Forestry (SL) Limited.

3.3.1 The Environment Protection Agency Act, 2008 and its 2010 Amendment.

This Act was enacted by the President and Members of Parliament as a legal instrument on the 11th September, 2008 and amended on the 23rd July, 2010. The Act established the Sierra Leone Environment Protection Agency to provide for the effective protection of the environment and for other related matters. Following the enactment of this Act, a National Environment Protection Agency Board was established within the Agency. The Board facilitates coordination, cooperation and collaboration among Government Ministries, Departments and Agencies, Local Councils and other Civil Society Organizations in all matters relating to environmental protection. The Agency, subject to this Act, is also the focal point for the implementation of the multi-lateral environmental conventions Sierra Leone has signed up to.

3.3.1.1 Projects Requiring an Environmental Impact Assessment (EIA) Licence

According to this Act, an EIA Report is demanded for certain types of project activities. The EIA Report should be submitted to the Agency and after a review has been done by the Agency, the Agency would submit its review to the Board. The Board may approve or disapprove the issuance of an EIA Licence if it envisages that the company's activities would have a significant adverse effect on the environment and the community/ies where it is carrying out its operations.

Projects requiring an EIA are those as given in the First Schedule of the Act, whose activities involve or include the following with respect to the conversion of land to forestry plantation:

- Infrastructure activities (e.g. metallurgical plants, wood processing plants, chemical plants, power plants, cement plants, refinery and petro-chemical plants, agro-industries);
- Waste management and disposal (e.g. sewage systems and treatment plants, landfills, treatment of plants for household and hazardous waste).

3.3.1.2 Other Sections of the EPA Act, 2008/2010 Relevant to the Operations of the Company

Subject to the Sierra Leone Environment Protection Agency Act, 2008 and as amended in 2010, other conditions relevant to guide the operations of the company are also provided in this Section.

Section 34 states that where (1) (a) the terms and conditions of a licence are not being complied with or have been contravened; or (b) there is substantial changes in the operations of a project resulting in an adverse effect on the environment, the Executive Chairperson may, after consultation with the Board, (i) cancel the licence; (ii) suspend the licence for such a time as he/she thinks appropriate; or (iii) impose additional or modified conditions for the licence. (2) The Executive Chairperson shall notify the holder of a licence which has been cancelled, suspended or on which additional conditions have been imposed, of such cancellation, suspension or imposition of additional conditions. (3) The Executive Chairperson may, in addition to subsection (1) require the holder of the licence to take measures to abate such adverse effects on or remedy any damage to the environment where necessary. (4) Any person aggrieved by a decision to cancel or suspend a licence may, within thirty days of the notification of the cancellation or suspension appeal to the High Court.

Section 35 (1) also states that EIA Licences are not transferable. Section 35 (2) further states that where prior to the issue of a licence in respect of a project the ownership, control or management of that project changes, the previous owner and the new owner shall notify the Executive Chairperson in writing within fourteen days of the transfer of ownership, control and management. Section 35 (3) states that upon notification pursuant to subsection (2), the new owner shall be deemed to be the applicant for a licence and subsection (4) states that where after the issue of a licence in respect of a project the ownership, control or management of that project changes, the previous owner and the new owner shall notify the Executive Chairperson of the transfer within fourteen days of the change of ownership, control or management.

3.3.1.2 Compensation

The President, as amended in the EPA 2010 Act, has the authority as stated in Section 33 to prescribe fees for licences issued under this Act. This is to guarantee payment of compensation for any damage, resulting from the operations of the company/project, or to guarantee payment for the preventive measures for rehabilitation where necessary.

3.4 Forestry Policy and legal Framework relevant to Miro Forestry (SL) Limited Operations

3.4.1 The Forestry Act, 1988

This Act was approved by Parliament, signed by the President and came into operation on the 1st July, 1988. In this Act, the Chief Conservator of Forestry, with the directives from the Minister of Agriculture, Forestry and Food Security, is responsible for the implementation of the Act and its Regulations. He therefore has the mandate of promoting and assisting the practice of forestry in agricultural, pastoral and other areas of the country in order to ensure the continued local supply of forest products and the protection of soil and water resources.
Part 1 of this Act provides a definition of a “Concessionaire” as a holder of a forest utilization concession or a forest plantation concession. Miro Forestry (SL) Limited clearly falls under this definition and as such can be referred to as a concessionaire.

3.4.1.1 Details required for Concession Areas

The initial operation of a forestry plantation is normally initiated by the concessionaire securing an agreement with the Minister, by extension the Government, and the land owning families. Part

IV, Section 13 (1) states that the Minister may enter into an agreement with any person for a concession to utilize any area of national forest classified for production forestry. Section 13 (3) of Part IV states that every concession agreement shall specify:

(a) the boundaries of the concession area;
(b) the customary and other rights affecting the concession area
(c) the right granted to the concessionaire;
(d) the type and size of the wood conversion and processing facilities to be operated by the concessionaire and the schedule of their operation;
(e) the quantity of logs, if any, that may be exported and the conditions under which they may be exported;
(f) a programme for the training and employment of Sierra Leoneans in all phases of the operation;
(g) the payment, in addition to any fees imposed under this Act, which the concessionaire agrees to pay in respect of operations pursuant to the concession agreement;
(h) the amount of the bond or other security that the concessionaire agrees to guarantee his performance under the concession;
(i) the compensation to be paid by the concessionaire for any failure to fulfill the terms of agreement.

3.4.1.2 Details of the time limits in a Concession Agreement

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.4.1.3 Reforestation Fee

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.4.2 The Forestry Regulations, 1989

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.4.3 The National Protected Area Authority (NPAA) and Conservation Trust Fund (CTF) Act, 2012

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.4.3.1 Sections of the NPAA/CTF Act, 2012 relevant to the operations of Miro Forestry (SL) Limited

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.4.4 The National Lands Policy (NLP), 2016

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.4.4.1 The Guiding principles of the NLP as it relates to Miro Forestry (SL) Limited

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.4.5.2 The Guiding Principles of the NLP as it relates to Access to Land for Responsible Investment for companies such as Miro Forestry (SL) Limited

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.4.5 The National Renewable Energy Policy, 2016

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.4.6 The Voluntary Guidelines on Responsible Governance of Tenure of Land, Forestry and Fisheries

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.4.7 The Factories Act, 1974

This Act was signed by the President on the 22nd May, 1974 and the date of commencement was on the 30th May, 1974. It deals with the health and safety measures as they concern any worker in a place of work that can be considered as a factory. The interpretation of a "factory" in Part 11, Section 3 as any premise where persons are employed in manual labour for the purpose of making gains makes it applicable to the operations of Miro Forestry (SL) Limited.

Part IV, Section 17 makes provision for the establishment of a Factories Appeal Board and has the duty of hearing and determining any appeal submitted by factory owners, thus giving right where it is due. Factories shall be registered. The Act protects the workers through demands for all aspects of cleanliness, reports of all injuries, accidents, diseases and death. The Act also provides for inspections and prescribes offences. The necessary environment conditions of the Act are therefore stated or highlighted below.

Powers of Inspectors

Section 14 of Part IV of this Act states that an inspector shall, in executing this Act, have the power to do the following:

- To enter, inspect and examine a factory and its environs at any time, as long as he has reasonable cause to believe that explosives or any inflammable materials are stored or used;
- To take with him during an inspection, a police officer, if he has a reasonable cause to expect any serious obstruction during the execution of his duty;
- To require the production of all documents and to examine and copy them in pursuance of this Act;
- To make necessary inquiries and examinations to ascertain whether the provisions of the Act are complied with;
- To prohibit the use of any machinery, if he is reasonably of the opinion after examination, that it is not in good and safe condition.

If anyone wilfully delays or obstructs the inspector in the exercise of any of his duties under this Act, then such a person shall be guilty of an offence and be liable to a fine not exceeding twenty leones or to imprisonment for a term not exceeding one month or both. The owner of the factory shall also be guilty of such an offence and be liable to punishment in like manner, even though he has not caused the obstruction.

Rules for the implementation of the Factories Act, 1974

As stated in Section 16, the Minister may make rules for the effective implementation of this Act as such rules may provide:-

- For the safety of persons employed in such trades and occupations as may be declared to be dangerous trades;
- For imposing obligations for the better safeguarding of persons against accidents from dangerous parts of any machinery;
- For the construction and maintenance of fencing to the dangerous parts of any machinery;
- For the proper maintenance and safe-working of raising and lowering;
- For prescribing the duties of inspectors appointed for the purpose of this Act;
- For prescribing the qualifications to be possessed by engineers and other persons, for them to be placed in charge of, or entrusted with the care or management of any specified machinery;
- For the appointment of persons to hold enquiries under this Act, and prescribing powers and duties of such persons;
- For the fixing of penalties not exceeding a fine of one hundred leones or imprisonment for a term of six months or both such fines and imprisonment for the contravention of any rule.

Appeal to Board Following Decision of Chief Inspector

If the holder of the lease, or any other person of the factory is aggrieved by a decision of the Chief Inspector, under the provisions of this Act, then Section 18 states that a person may within fourteen days from the date of such decision send to the Board through the Chairman and to the Chief Inspector written notice of his intention to appeal against a decision stating the grounds of the appeal. On hearing the appeal, the Board may confirm, verify or reverse the decision of the Chief Inspector and this shall not be questioned in court.

Safety, Security and Welfare of Employees

Part V of this Act deals with the aspect of health and stipulates that every factory shall be kept in a clean state and free from effluent arising from any drain, sanitary convenience or nuisance. This part of the Act also states that for the overall safety of all employees, the Factory must not be overcrowded, must be effectively ventilated and provided with suitable lighting systems. Every care must be taken by the Factory holder to secure the health, safety and welfare of all employees.

As indicated in Section 38, it is incumbent on the company to notify the District Inspector in writing of any accident or death in the Factory. It is also stated in Section 39 that all factory contracted diseases identified by a medical practitioner must be brought to the notice of the Chief Inspector in Freetown.

Where injury immediately results in death, Section 40 states that the site of the accident must be left undisturbed after the removal of the corpse until inspected by a police officer or an inspector.

On receipt of the report of an accident, the inspector shall, if he considers it necessary or if directed by a higher authority, immediately proceed to the scene of the accident, as indicated in Section 41, and shall make enquiry, the inspector is free to use any one under oath, any document, and forward fees for giving evidences, as may be fixed by the Minister.

Any person, who, without reasonable cause, fails to comply with the terms of summons of the inspector, or refuses to be examined or to answer questions other than that which may incriminate him, or anyone who obstructs an Inspector or any person acting under his directions in the execution of his duty under Section 41, shall be guilty of an offence.

The owner of every factory, according to Section 45, must within 24 hours report in writing to an Inspector every dangerous occurrence caused by any machinery or electrical abnormality. Section 26 of Part VI stipulates that there shall be kept posted in prominent position in every Factory:

- The prescribed abstract of this Act;
- The address of the Chief Inspector and of the nearest Inspector
- Printed copies of any regulations made under any Part of this Act which are for the time being in force in the Factory; or the prescribed abstracts of such regulations.

Offences and Penalties

Part VIII of this Act deals with offences, penalties and legal proceedings. Section 47, subsection 1 of this part, states that in the event of any contravention of the provisions of this Act or any Regulation or Order made there, the occupier or owner of the Factory, shall, be guilty of an offence under the Act.

Regarding offences for which there are no penalties provided, Section 48 stipulates that any person guilty of an offence under this Act for which no express penalty is provided by or under the Act, shall be liable to a fine not exceeding fifty leones or to imprisonment for a term not exceeding one month or both. If the contravention for which he was convicted continues, he shall be guilty of a further offence and liable to a fine not exceeding ten leones for each day on which the contravention is continued.

Section 50 states that if anyone is killed, or dies, or suffers any bodily injury, in consequence of the occupier or owner of a factory having contravened any provision of this Act, the occupier or owner of the factory, shall without prejudice to any other penalty, be liable to a fine not exceeding two hundred leones or to imprisonment for a term not exceeding three months or to both.

All offences committed under this Act shall, Section 56 states, be prosecuted in a magistrate court.

3.5 INTERNATIONAL ENVIRONMENTAL REQUIREMENTS

3.5.1 United Nations Convention on Biological Diversity (UNCBD)

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.5.2 United Nations Convention to Combat Desertification/Land Degradation (UNCCD/LD)

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.5.3 Convention on the International Trade of Endangered Species (CITES)

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.5.4 The Stockholm Convention on Persistent Organic Pollutants.

This Convention was adopted on the 22nd May, 2001 in Stockholm and Sierra Leone became a signatory on the 27th August, 2001.

Persistent Organic Pollutants (POPs) are chemicals that are persistent bio-accumulators found in fatty tissues. They are bio-magnified through the food chain, and adversely affect health and the environment.

This convention recommends the elimination or restriction of production and use of all internationally produced POPs (i.e. Industrial chemicals and pesticides) The chemicals to be eliminated are Aldrin, Chlordane, Dieldrin, Endrin, Heptachlor, Hexachlorobenzen (HCB), Mirixtexaphene, Polychlorinated Biphensylsis (PCBs).

The convention also seeks to continue minimization and, where feasible, ultimate elimination of the release of POPs, such as Dioxins and Furans. Stockpiles and waste containing POPs must be managed and disposed of in a safe, efficient and environmentally friendly manner with regards for international rules, standards and guidelines.

3.6 WORLD BANK REQUIREMENTS

3.6.1 World Bank Guidelines

This would apply to Miro's plantation areas and is therefore not directly considered under this ESIA for the Pole Treatment Plant.

3.6.2 Consultation and Disclosure Requirement (World Bank Policy on Disclosure of Information).

The World Bank requires clients to identify and consult groups in forest areas likely to be affected by World Bank-financed investment projects in and beyond the forest sector.

The disclosure requirements set out in Environmental Assessment (EA) Policy (OP 4.01) apply to all projects affecting forests. Aside from the required EA documentation, there is no freestanding document that is automatically required for all projects affecting forests. However, many forest-related projects will generate freestanding reports (such as Forest Management Plans), which should be made publicly available as a matter of good practice. This is important for good forest governance and good development outcomes, and full disclosure of forest related information should be encouraged wherever feasible. Additional requirements apply whenever such projects involve Involuntary Resettlement.

3.6.3 World Bank (WB) Environmental, Health and Safety Guidelines for Forest Plantations Operations

Miro operations may involve the manufacture of plywood, sawn logs, electricity poles and finger joints. The following section provides a summary of EHS issues associated with the manufacture of plywood, sawn logs, electricity poles and finger joints products along with recommendations for their management.

Environmental issues associated with board and particle-based product manufacturing (identified potential impact has also been identified for pole treatment) include:

- Sustainable forestry practices – minor potential impact from pole treatment processing
- Emissions to air – minor potential impact from pole treatment processing
- Wastewater – moderate potential impact from pole treatment processing
- Hazardous materials – moderate potential impact from pole treatment processing
- Solid wastes – moderate potential impact from pole treatment processing
- Noise – minor potential impact from pole treatment processing

3.6 Responsible Forest Management and Timber Processing Practices

With the levels of global forest degradation and depletion there is global concern to reduce or eliminate forest conversion and degradation. Sierra Leone has also addressed these concerns through the legislation mentioned above as being applicable to Miro's forest operations. As forest products are a key input into the pole treatment plant there is a potential for natural forest resources to be depleted to satisfy the national and regional demand for forest products.

International Best Practice acknowledges that there is a need to ensure traceability of forest products from supply area to end user, and this would include poles transiting through treatment plants.

While Miro has already had SEIA's done on the plantations and other forest product processing plants that will ensure compliance with these international best practice standards, these

standards would also include health and safety standards applicable to the operation of such plants.

Currently the international standards most widely accepted regarding this are:

1) Forest Stewardship Council (FSC)© Forest Stewardship standards for responsibly managing forests; and,
2) Forest Stewardship Council (FSC) © Chain of Custody standards for tracing of forest products. This includes verification of legal compliance, employee and community health and safety.

3.7 Emissions to air

Pole treatment plants have the potential to release Chrome, Copper and Arsenate elements into the air during a number of operations in the process of treating poles. Current research indicates that these emissions would primarily be in the form of vapours and would be released during vacuum and venting phases of the operation.

The Wood preservation facilities, chromated copper arsenate: chapter B-9 of the Canadian Government (https://www.canada.ca/en/environment-climate-change/services/management-toxic-substances/publications/environmental-recommendations-wood-preservation-facilities/chromated-copper-arsenate/chapter-9.html) under section 9.5 states:

Air emissions at CCA facilities are normally localized; effects, if any, would be restricted to workers at the facilities. Air emissions from CCA facilities include the following:

- exhaust from tank vents
- mists from vacuum pump discharge
- mists from opening of retort chamber doors
- mists from accelerated fixation facilities

Monitoring of mists (20, 21) in the vicinity of several CCA retort chamber door openings has shown that, at the studied sites, arsenic, chromium and copper concentrations were below published American Conference of Governmental Industrial Hygienists (ACGIH) TLVs (22). Emissions from vacuum pump discharges have not been evaluated. However, evidence of CCA releases from such discharges was reported in an Environment Canada study (19). Some facilities discharge vacuum pumps through simple traps to condense and collect emissions (19). This practice is highly recommended.

4 CHAPTER

4.1 BASELINE SURVEY

Miro have done their own report on Technical Details and Risk Assessments and this report forms an addendum to their report. This Miro Report identifies the following as moderate or high risk:

1) Occupational Health and Safety;
   a) Chemical storage – spills and leaks of toxic liquids
   b) Chemical handling – exposure to Chromium, Copper and Arsenic, some of which are carcinogenic
   c) Loading and unloading of impregnation chamber -– exposure to Chromium, Copper and Arsenic, some of which are carcinogenic
   d) Stacking and storage -– exposure to Chromium, Copper and Arsenic, some of which are carcinogenic
   e) Transport of timber, supplies and finished products – risk of vehicle accidents (own staff and public)
   f) Fire Risk – risks associated with fires and potential of toxic gas releases from burning treated timber and wastes.
2) Environmental Impact;
   a) Chemical storage - Spills and leaks on soil / water
   b) Impregnation – Spills and leaks to soil / water
   c) Pole storage – Spills and leaks on soil / water
   d) Plant lifetime – Waste Management – toxic sludges and waste treated products and fire.

Based on the Miro risk assessment further analysis of certain elements was required and these are detailed below.

4.1.1 Water Analyses

The nearest water body to the proposed site is the Kasokia stream running about 0.3 miles south from Masetle village through Nwala village. Water sample was however collected from a borehole located at a point about 0.1 mile from the proposed site at latitude 8.4717825 and longitude -12.3072495, this borehole is 60 metres deep and therefore any contamination of ground water should be detectable in this borehole. The analyses included a bacteriological assessment for the existence or non-existence of E-Coli, faecal and non-faecal coliforms, determination of physical parameters (temperature, turbidity, conductivity, and total dissolved solid), and chemical parameters (Ammonia, pH, Iron, Flouride, Nitrate, Nitrite, Magnesium, Potassium, Copper, Calcium, Sulphate, Arsenic and Chromium).

The physical, chemical and bacteriological analyses conducted on the water sample revealed that the water at the sample site is within the World Health Organisation (WHO) recommended standard for drinking water. The arsenic and chromium contents of the water are within the WHO recommended limits

The following are the results of key potential contaminants (for full analysis refer to annex 2) of the analyses:

No.	Parameter	Measured Value	Maximum Limit Value
	Copper (mg/l)	0.09	< 2.0

	Arsenic	0.0	0.01
	Chromium	0.01	<0.05

Table 1: Results of CCA elements in Water Quality Analysis of Borehole Water

Adverse health effects associated with Cr(VI) exposure include occupational asthma, eye irritation and damage, perforated eardrums, respiratory irritation, kidney damage, liver damage, pulmonary congestion and edema, upper abdominal pain, nose irritation and damage, respiratory cancer, skin irritation, and erosion and .

Chromium can also be released into the environment from the burning of natural gas, oil, or coal. Chromium does not usually remain in the atmosphere but is deposited into the soil and water. Chromium can change from one form to another in water and soil, depending on the conditions present.

4.1.2 Soil Analyses

The detailed baseline results of soil tests conducted on soil samples collected on 24th January 2020 are shown in Annex3. Following EPA recommendations further soil samples have been taken in late August 2020:

No.	Parameter	Measured Value
	Copper (mg/kg)	0.40 (1.0-meter soil sample)
	Arsenic (mg/kgl)	0.10 (Topsoil sample)
	Chromium (mg/kg)	0.30 (Topsoil sample)

Table 2: Results of CCA elements in Soil Analysis at the site

Results reflected in table 2 above indicate that background levels of Copper, Chromium and Arsenic are within normal ranges.

4.1.3 Production and Use of Chromated copper arsenate (CCA)

Chromated copper arsenate (CCA) is sold throughout the world as dry mixtures of crystalline powders, as pastes or as liquid concentrates. The mixtures are prepared with a variety of different ratios of chromium, arsenic and copper. The only CCA formulation currently in use is known as a Type C oxide formulation, which is prepared from copper oxide and chromic and arsenic acids. The composition of a Type C formulation is represented in the table below.

Feature	Characteristics
Proportion of active ingredients	50% as CrO_3 19% as CuO 31% as A_2O_5
Concentration of work solutions	1% to 5% as total oxides 2% solution:4900 ppm Cr 3000 ppm Cu 4,400 ppm As
Typical preservative retention in treated wood	4.0 to 12.8 kg/m³ treated wood (0.25 to 0.8 lb/ft³
Major products treated with CCA in the world	Dimensional lumber, foundation lumber and plywood, fence boards, fence posts, utility

	poles, construction timbers, shingles and shakes, siding.

Table 3: Features and characteristics of CCA

The use of CCA-treated products over the last 20 years has increased significantly, particularly in the residential markets. The ability to stain or paint CCA-treated wood, as well as the ease of handling treated products, has resulted in widespread acceptance by homeowners for uses such as deck and patio construction, playground equipment, land-scaping, foundation lumber and plywood, and fence posts. Industrial uses of CCA, such as the treatment of utility poles and construction timbers, have also become very popular and increased in volume.

Table **4** shows the South African SANS 10005 (South African National Standard) detailing the Hazard classes in which CCA treated timber can perform.

HAZARD CLASS SYMBOL	HO-i	H2	H3	H4	H5	H6
END USE APPLICATION	**Internal**	**Internal**	**External Above Ground**	**In Ground Contact**	**In Fresh Water / Wet Soils**	**In Sea Water**
	Mouldings Ceilings Joinery Flooring Boards	Laminated Beams Roof Trusses Structural Timber Ceiling Boards Flooring Panelling Doors Cupboards Skirting Window frames Plywood	Balustrades Fencing bearers and slats Outdoor decking and beams Garden furniture Laminated beams Weather board Steps Cladding Stairs Log Homes Gates Plywood	Agricultural posts Landscaping structures Playground structures Fencing Pergolas Carports Flower boxes Decking Garden Edging Transmission Poles	Piling Retaining Walls Slipways Culverts Flood Gates Jetties Drains Walkways	Piling Retaining Walls Slipways Jetties Walkways

Table 4: South African CCA Hazard Class Table

4.1.3.1 Physical and Chemical Properties

The components of CCA (copper, chromium and arsenic) were selected for wood preservation use because of their biocidal properties and their ability to be retained within the wood for long-term protection. The fixation mechanism of CCA within wood is complex and the reactions involved depend on the preservative formulation and concentration, wood species, temperature and humidity conditions. Reaction products include insoluble chromates and insoluble arsenates of copper and chromium.

Physical and Chemical Properties		
Physical State: Liquid (20°C, 1 atm.) Solubility: Freely soluble (water); pH: Strongly acidic (pH 1.6 to 3.0) Vapour pressure: Non-volatile	Flottability: Dissolves readily in water Freezing point: -30ºC Flash point: Not flammable Explosive limits: Not explosive or flammable Specific gravity: 1.64 (50% concentrate)	Appearance: Heavy liquid dark brown Colour: Dark brown (concentrate) to yellow-green (dilute) Odour: Odourless

Table 5: Physical and Chemical Properties of CCA

5 CHAPTER

IDENTIFICATION OF POTENTIAL IMPACTS

5.1 Introduction

Miro Forestry SL Ltd Yoni Plantation has 10,000 hectares of standing forest established through its own planning activities located in the Tonkolili District of Sierra Leone, 90 miles from Freetown, the country's capital, and adjacent to the county's major highway into Freetown. Miro plans to expand at a rate of 1,500 hectares per year. The Company is growing short-rotation species including Eucalyptus and Acacia. Due to the proximity of the land to Freetown, and substantial deep-water port facilities, the Company has good access to timber export markets.

The Company is focused on fast growing, high-yield plantation timber for the production of sawn timber, poles (electricity utility poles, fence posts and building poles, treated and untreated upon demand), plywood, and energy biomass (wood biomass for power production, charcoal and firewood) for both local and international markets. Miro Plantations are Forest Stewardship Council (FSC) certified meaning the company voluntarily complies with international gold standard of responsible forest management. The company sells electricity poles, building poles and fence posts from its plantations in small and large quantities for local and export markets. The timber will be able to be CCA treated upon request. Based upon the rising market demands for utility poles in the country, Miro Forestry intends to establish a pole treatment plant within its concession area to meet rising demands.

Miro has conducted their own Technical Details and Risk Assessment Report, the purpose of this chapter is to expand on their impact analysis and mitigation procedures for the proposed pole treatment plant within the Miro concession. Miro's report covers the following:

1) Site plan including proposed CCA plant location, topography and water body locations
2) Information about the treatment plant, including;
    a. Machinery information,
    b. the process,
    c. Information on CCA
    d. International restrictions and regulations
3) Occupational Health Risk Assessment, including suggested risk mitigation
4) Environmental Risk Assessment, including suggested risk mitigation
5) Environmental and Occupational Health Considerations, including:
    a. Personal Protective Equipment
    b. Training
    c. Environmental Safeguards
    d. Chemical storage
    e. Waste Management
    f. Post treatment storage and drying
    g. Monitoring and Documentation

Areas identified as requiring further detail in this report were assessed as follows:

- Production process
- Environmental Effects
- Occupational and health impact analysis
- Mitigation Measures
- Environmental Monitoring
- Chemical waste management plan
- Proposed market for the treated poles.

- Details of the importation procedures of CCA including manufacturers, mode of transportation and storage procedures.

5.2 Identified impacts on the biophysical and human environment

5.2.1 Production Process of treated wood poles

The pole production process at Miro Forestry Company Limited can be described in eight main steps:

- Debarking
- Dressing
- Drying
- Fabrication
- Impregnation
- Fixation
- Storage
- Transport

5.2.2 Environmental Effects

The actual impacts of any emission depends on many factors, including the location of the wood preservation facility relative to ground or surface waters, the amount associated with the releases, the frequency of releases, and contingency measures in place at the facility. Soil properties also have the potential to influence impact on surround environs.

Improperly designed and/or operated facilities do have the potential to contaminate yard, soil and ground waters to levels that would disallow the use of such ground waters for drinking purposes. Miro's treatment plant will use the latest CCA treatment design, proper procedures and work instructions will be put in place. Staff and employees will be trained on the plant operation by the supply of the equipment and CCA.

5.2.2.1 Distribution in the Natural Environment

Copper, chromium and arsenic, the components of CCA, are natural elements that at normal background concentrations do not have discernible adverse effects on biota.

Typical background concentration (copper, chromium, arsenic) in non-polluted environments					
Element	**Permissible Surface waters(mg/L)**	**Miro Baseline Water**	**Soils (mg/kg)**	**Miro Baseline Soils (mg/kg)**	**WHO Permissible Limits (mg/kg)**
Copper	< 0.001 to 0.04	0.09	2 to 100	0.40	3.50
Chromium	0.003 to 0.04	0.01	5 to 1000 (50 mg/kg is normal)	0.30	1.30
Arsenic	< 0.001 to 0.01	0	1 to 50 (up to 500 mg/kg found in	0.10	2.50

			sulphide deposits)		

Table 6: Typical background and Miro Baseline levels for CCA elements

Considerable variability in natural concentrations of copper, chromium and arsenic occurs in soils and waters. Therefore, Miro has taken soil and water samples at the site of the operational tank to determine background levels prior to operations of the facility to enable meaningful future assessments of pollution control at the facility. These results of this analysis are detailed in Chapter 4 above.

5.2.2.2 Potential Chemical Discharges on the Environment

CCA wood preservation plant designs and operational practices do vary and within each plant there are various potential emission sources that may affect the adjacent environment and/or worker health. Miro's entire treatment plant and treated timber storage will be on a concrete pad, with any potential slippage and drip run-off being captured and recycled.

5.2.2.3 Liquid Discharges

The CCA process at Miro uses water as solvent. Therefore, drippage collected on the pad or rainwater collected in the process areas can be reused within the process. The toxicity and economics of the process chemicals have led Miro Forestry Ltd to use closed treatment systems that contains, collects and reuses the chemical mixture to the greatest possible extent. The elements that may be used for CCA containment and recycling include:

- Paved containment surfaces and bunding of major process components including the treatment chamber, CCA storage tanks;
- Containment surfaces for chemical drips from treated wood on the chamber discharging track, that is, in the freshly treated wood storage area and fixation area;
- A collection sump to receive residual preservative from the chamber (following the treatment cycle) and the accumulated contaminated precipitate runoff from other containment concrete surfaces.

Contaminated liquids entering the sump are pumped through cartridge filters to remove dust and wood debris. The filtered solution is stored in a holding tank and returned to the process as makeup water for preparing fresh working solution for subsequent charges.

Under normal operating practices, liquid discharges from the CCA treatment facilities are confined to liquids that are not contained and reused within the process. For example, storm water runoff from unpaved and unroofed treated-product storage areas is the most common liquid discharged from many CCA treatment facilities. The quantity of copper, chromium, or arsenic in such waters depends on many factors such as quantity of precipitation, the degree of chemical fixation in the treated wood as determined by fixation time and temperature prior to the precipitation event, and soil characteristics of the storage yard. Potential for groundwater contamination exists in locations where drip pads are not used in discharging areas, where the pad areas are inadequate to hold the treated wood until fixation is accomplished. Miro has considered these potential impacts and the drip and fixation areas are concreted, bunded and roofed. Storage areas for finished product are concreted and if necessary, can be roofed in future.

5.2.2.3 Solid Wastes

Solid waste generated at the Miro CCA facility is usually minimal. During normal operating conditions, solid waste is limited to cartridge filters that are used for dust and debris removal from recycled water and to the debris and sludges that are periodically removed from the sump, cylinder and tanks. These filters and sludges will be stored in secure containers in secure areas for toxic waste and as part of the lifecycle approach will be collected and disposed of by the the chemical supplier in terms of international best practice and global agreements in this regard.

Treated wood, such as stickers, cut-offs or broken product, is another source of solid wastes. Miro will treat these as part of a specific waste stream, these will not be disposed of into the natural environment or burnt.

5.2.2.4 Air Emissions

Potential sources of air emissions include mists from vacuum pump exhaust, chamber doors and tank vents. Some preservative chemicals may also be entrained in emissions from fixation chambers and kilns, when the chemical in the treated product is being fixed following treatment. Refer to section 3.7 of this report regarding international research in this regard. emissions to air under normal operating conditions are within internationally accepted standards.

5.2.2.5 Aquatic Toxicity

The following points should be noted when considering the aquatic toxicity of CCA.

- Ratios of copper, chromium and arsenic in soils and runoff waters from CCA facilities are not necessarily consistent with their ratios in the original CCA working solutions. Depending upon various factors, it is possible that only one element may be predominant. As a result, the toxicity of each element, in addition to the toxicity of the CCA mixture, should be reviewed.
- Valence changes of arsenic, chromium or copper may occur within the environment, and those changes may reduce or enhance the toxicities of the elements. Periodic review would be carried out to assess arsenic speciation within and around the operational tank area and adjacent ecosystems. The table below gives limitations for arsenic, chromium and copper ratios within water mediums.

Element guidelines	Recommendations for running waters	Drinking water objectives	Water quality guidelines
Arsenic	0.5 mg/L for the protection of human health	Maximum acceptable:0.025mg/L Objective:<0.005mg/L	0.05 mg/L for the protection of aquatic life
Chromium	0.05 mg/L for the protection of human health	Maximum acceptable 0.05 mg/L Objective:<0.0002mg/L	0.02 mg/L for protection of fish 0.002 mg/L for protection if the aquatic community including zooplankton and phytoplankton
Copper	0.005 mg/L for the protection of aquatic life	Maximum acceptable: 1.0 mg/L Objective	For protection of aquatic life: 0.002 mg/L Hardness 0-60 mg/L as $CaCO_3$

			0.003 mg/L Hardness 60-120 mg/L as $CaCO_3$ 0.004 mg/L Hardness 120-180 mg/L as $CaCO_3$ 0.006 mg/L Hardness >180 mg/L as $CaCO_3$

Table 7: Limitations for CCA Elements in water mediums

5.3 Occupational and health impact analysis

Over and above Miro's risk assessment Chromium, copper and arsenic are elements that occur naturally in food, water and air. The table below provides estimated daily intakes of these elements by the general population.

The Range of Possible Effects from Exposure to CCA Solutions			
		Possible health effects	
Exposure category	**Type of exposure**	**Short-term exposure**	**Long-term exposure**
General population	**Estimated daily intake from food, air, water**		
Arsenic (found in foods, especially sea foods	0.1 mg	None	None
Copper (an essential element)	3 mg	None	None
Chromium (in trace quantities in all foods)	0.2 mg	None	None
Properly protected worker	**Minimal**	**None reported**	**None reported**
Exposed worker with significant skin contact	Skin contact with work solutions or concentrates	Skin irritation Inflammation	Ulceration Potential carcinogenic action
Exposure to contaminated aerosols	Inhalation of mists, droplets or aerosols of work solutions of concentrates	Severe irritation of nose and throat Irritation of eyes	Ulceration and perforation of nasal septum upon long exposure Potential carcinogenic action
Ingestion	Ingestion of work solutions or concentrates	Nausea, abdominal pain, vomiting, shock, coma Reported amounts that have resulted in death are 0.1 to 1 g arsenic; 0.7 g chromium.	Possible liver and kidney damage, jaundice, reduced white blood cells upon long-term exposure to 0.15 to 0.6 mg arsenic per day Potential carcinogenic action

Table 8: Possible Effects from CCA Exposure

5.4 Mitigation measures

One safety objective of industrial usage of any chemical (in this case, chromium, copper and arsenic formulations) is to minimize worker exposure, ideally so that natural intake levels are not exceeded. If safeguards are not provided or implemented, a variety of human health effects may occur depending on the duration and manner of exposure, concentration of chemical forms (valence) and the varying metabolic sensitivities of individual workers.

Several mitigation measures can be adopted to minimize or eliminate the risk of health related diseases when exposed to CCA. These are discussed below under section 6.1.

5.5 Environmental Monitoring

5.5.1 Environmental Monitoring of ground water

When proper precautions are not taken, ground waters in the immediate vicinity of CCA facilities may be contaminated to levels that render the ground water unsafe for human use. Data on ground and surface water should be regularly taken and analysed for regulatory purposes. The frequency of this testing should be at least once a year during the high rainfall season where run-off is more likely. The results may indicate whether storm water runoff from the Miro CCA facility contain at least one of copper, chromium or arsenic at levels in excess of existing water quality limits. Such analyses may also indicate that ratios of copper/chromium/arsenic are not consistent with runoff waters. The inconsistency may be due to differences in the ability of the components to bind to the soils in the operational tank area or due to different sources within the tank area. Additional monitoring studies are recommended to properly assess the degree of such releases.

5.5.2 Environmental Monitoring of soils

Where proper operating procedures and precautions are not followed there is potential for spillage, drip-off and run-off waters to contaminate soils downslope from the plant. This in term has the potential to have secondary impact of contaminating ground and surface waters. Data on soil downslope from the plant should be taken and analysed on a regular basis and analysed for regulatory purposes. The frequency of this testing should be at least once a year during the dry season where contaminate levels are expected to be higher.

5.5.3 Environmental Monitoring of air quality

Based on research reflected under section 3.7 above, the effect of a normal CCA facility on air quality of the surrounding environment is expected to be non-detectable, therefore air quality monitoring will not add value in terms of environmental or personal protection. Of more value and importance is to protect and monitor employee health of employees in the pole treatment plant that may be subjected to any potential air quality toxins in higher risk operations. See further recommendations under section 6.5.5 below.

5.5.4 Proposed market for the treated poles

Most experts agree that demand for timber will continue to rise with increased national and global demand for wood products, particularly from the expanding and increasingly affluent emerging markets.

The primary target market for the treated wood poles would be the Electricity Distribution and Supply Authority (EDSA) market, all of which falls under the Ministry of Energy. Demands for utility poles are on the increase in Sierra Leone and they are coming from the Energy Sector Utility Reform Project and the Sierra Leone Electrification Project as well as from the private sector in Sierra Leone.

Against this increasing demand, the country is losing vast areas of timber land every year. To curtail this continued deforestation and illegal logging, which is increasingly viewed as unacceptable, demand for sustainable timber grown in plantations will continue. Today, there is simply not enough area of forest plantations to meet the ever-increasing demand nationally and internationally.

The oldest areas of Miro Forestry's plantations, planted by the company, are now reaching maturity for final clear fell harvest. In addition, the company operates mature plantations, managing these sustainably, replanting after harvest. From these plantations, Miro is producing sawn timber, poles and wood biomass products in the company's own processing factories. Over the next five years, the volume of timber annually reaching maturity on the company's plantations will increase, thus allowing for increased solid wood product production. As a result, the company's revenue will continue to grow in parallel to such wood-flows.

5.5.5 Details of the importation procedures of CCA including manufacturers, mode of transportation and storage procedures.

The impregnation of CCA into wood is carried out in pressure-treating plants. In 1993, 59 Canadian plants used 5920 t of CCA to treat 1.56 million m^3 (55 million ft^3) of wood products. Of these plants, 45 used CCA as the sole preservative and 14 had facilities applying one or several of the other preservatives as well.

There are three suppliers of CCA (Timber Specialists, Hickson Building Products, Chemical Specialists Inc.), who all offer a high level of support services, including facility design and routine safety and consulting expertise on operations, maintenance emergency response procedures. This approach provides a relatively high level of control over preservative use at most facilities. Miro intends to contract Dolphin Bay Chemicals for the supply of chemicals and lifecycle management of toxic waste.

CCA is normally purchased as a premixed concentrate (50% or 60%) shipped by bulk truck and rail tanker. The concentrate is stored in tanks and diluted with water to a 1.5% to 5.0% strength working solution. This dilution is accomplished by pumping transfers and recirculation between bulk tanks. The working solution is then applied to the wood in a pressure chamber, which may be up to 45 m long and 2 m in diameter. Refer to Miro's Technical Details and Risk Assessment report for details of machinery it plans to use.

The full-cell treatment process, used to apply the preservatives in CCA treatment plants, consists of the following steps:

- application of an initial vacuum to remove air from the wood cells;
- flooding with CCA working solution and pressurization (up to 1040 kPa) until the target CCA retention level is achieved;
- draining of the excess CCA working solution (to the working tank for reuse with subsequent charges)
- application of a final vacuum

- drip-off and fixation process

The specific treatment times and pressures are dictated by the species of wood, the type of wood product (e.g. plywood, boards or poles) and the moisture content of the wood. A predetermined range of process parameters is defined by the applicable treatment standards and quality control tests are carried out to ensure that a minimum treated product quality is achieved. Once the treated wood is withdrawn from the treating cylinder, it is subjected to a fixation process and then stored until shipment to customers.

6 CHAPTER

CHEMICAL AND WASTE MANAGEMENT PLAN

6.1 Introduction

Miro plantations are Forest Stewardship Council (FSC)© Forest Stewardship certified, while existing processing plants are FSC© Chain of Custody certified meaning Miro voluntarily complies with international gold standards of responsible forest management and timber processing and traceability.

The demand for treated poles is on the increase, both from the public and private sectors in Sierra Leone. Thus, the treatment of utility poles is becoming of great concern to Miro and one of the options available to them is to bring into the manufacturing process a CCA treatment facility. The operation of such a facility requires a chemical and waste management plan. This chapter therefore presents a chemical and waste management plan.

6.2 Personnel Protection

6.2.1 First Aid for CCA Exposure

Exposure	First Action	Second Action
Eye Contact	Immediately flush eyes with water (flowing or not), occasionally lifting the upper and lower lids Flush eyes for at least 15 minutes	Use boric acid solution and cortisone ophthalmic drops Get medical attention
Skin Contact	Flush contaminated area immediately with water (flowing or not) Subsequently remove contaminated clothing Continue to flush contaminated skin for at least 15 minutes	Get prompt medical attention if the skin becomes inflamed (redness, itching or pain)
Inhalation	Immediately remove the exposed person to fresh air	Apply artificial respiration if breathing has stopped. Keep the affected person warm and quiet Get immediate medical attention
Ingestion	Promptly have the exposed person drink a large quantity of milk, egg whites, gelatin solution or water if the aforementioned are unavailable Never give liquids to an unconscious person	Call an industrial physician or poison control centre immediately for subsequent advice. (Stomach pumping by medical personnel is desirable) Do not induce vomiting
Chronic symptoms requiring medical referral	Ulceration of the skin or mucous membrane (breaks in the skin, disintegration of tissue, pus formation). Abdominal pains and other persistent symptoms of illness.	

Table 9: First and secondary treatment actions for different types of exposure to CCA

6.2.2 Regulatory Controls

Specific limits for worker protection are generally proffered for CCA treatment plants. Most of the criteria are based on the threshold limit values (TLVs) and biological exposure indices. The limits of exposure in the workplace for copper, chromium and arsenic are summarized in the table below.

Route of entry	Basis for recommendation	Recommendations/Comments
Skin and eye contact	CCA is corrosive. Chromuim can be absorbed through the skin Arsenic is a potential dermal carcinogen.	Protective measures should be used by workers in contact with CCA concentrate. Avoid direct contact of skin and eyes with all CCA solutions. Sensitive individuals should take special care to avoid exposure **Comment:** Current material safety data sheets should be trained to; and readily available to; workers
Inhalation	The threshold limit value-time weighted averages for the different CCA elements are: **Arsenic** and soluble compounds: 0.01 mg As/m³ air Copper (dusts and mists): 1.0 mg Cu/m³ air Chromium (+6) compounds (water soluble) 0.05 mg Cr/m³ air Arsine: 0.2 mg/m³ of air (0.05 ppm)	Full face protection and good ventilation should be used during chemical unloading and mixing operations. Provide respiratory protection, eye protection and good ventilation: - When welding contaminated equipment - During any activity that might generate arsenic vapours (e.g. from exposure of CCA to reducing agents - When CCA dust, mist or spray is present Self-contained breathing apparatus should be used for firefighting activities where CCA is present **Comments:** - Permissible concentrations of arsenic and chromium refer to vapours: both could occur in air as aerosols; - Arsenic vapours can be formed from exposure of arsenic salts or CCA to reducing agents; - Current material safety data sheets describing safety precautions should always be readily available to workers
Ingestion	Arsenic lethal dose range from 0.1 to 1.0 g for adults. The lowest reported lethal dose of 0.1 g is equivalent to 1 g of 50% CCA solution.	Prevent the ingestion of any quantity of CCA solutions.

Table 10: The limits of exposure in the workplace for copper, chromium and arsenic

6.2.2.1 Skin and Eye Contact

The threshold limit values (TLVs) and specific precautions with regards skin and eye contact have been discussed above. In addition to the regulatory control for skin and eye contact, Miro does understand that there are threshold limit values levels for individual components of CCA:

- Copper salts act as irritants that may produce itchy eczema on skin and conjunctivitis or ulceration of the eye;
- Hexavalent chromium may cause contact dermatitis and skin ulcers, and may be absorbed through skin to cause kidney damage.

6.2.2.2 Inhalation

The recommended limits for copper, chromium and arsenic are based only upon “inhalation” threshold limit values. These limits may not adequately take into account routes of exposure other than inhalation, and in such cases biological exposure indices may be useful as a guide to safe exposure. Table 9 above gives the threshold limit values for copper, chromium and arsenic but with the following provisos:

- The limits are intended for use in the practice of industrial hygiene as guidelines for good practices or recommendations in the control of potential health hazards and for no other use (i.e. proof or disproof of the cause of an existing disease or physical condition)
- The limits are not fine lines between safe and dangerous concentration
- In spite of the fact that serious injury is not believed likely as a result of exposure to the threshold limit concentrations, the best practice is to maintain concentrations of all atmospheric contaminants as low as is practical.
- When two or more hazardous substances, which act upon the same organ system, are present, their combined effect, rather than that of either individually, should be given primary consideration.

6.2.2.3 Ingestion

Oral intake of CCA must be avoided. Ingestion of CCA-containing liquids is unlikely if workers follow the precautions in table 10 below. Reported fatal single dose levels for components of CCA, include:

- 0.7 g chromium as chromium (+6) assuming a 70 kg body weight; and
- 14 g copper as copper (+2)

Reported doses for “arsenic” and “arsenic” (+3) range from 20 to 300 mg. Registry of Toxic Effects suggests arsenic (+5) is more acutely toxic to rats than arsenic (+3); however, it is known that laboratory animals react to arsenic differently than humans.

Activity	Recommendations
Objective:	To ensure safe workplace practices for each activity during the treatment process
Unloading bulk CCA concentrate	• Wear protective apparel, including chemical goggles or face shields, impermeable gauntlets, coveralls / impermeable aprons and impermeable shoes or boots; • Prohibit foot or vehicle traffic between the point of delivery and the transport vehicle; • Place “DANGER – CCA UNLOADING” signs at each end of the transport during unloading operations;

	• Ensure that at least two individuals trained in handling CCA are present at all times during unloading operations (i.e. at least one person other than the truck driver; this person may include forepersons, supervisors and management employees); • Ensure that all connections are secure and leak tight; • Provide an emergency eyewash and shower in the immediate unloading area.
Preparing CCA work solutions	• Wear full face protection, impermeable gauntlets, coveralls / impermeable aprons and impermeable shoes or boots for all operations involving direct exposure to CCA concentrates • Thoroughly clean and hose down the work area following solution preparation • Dispose of debris and empty containers according to recommended disposal practices for wastes contaminated with CCA • Thoroughly clean protective equipment after use. Reuse all rinse waters for work solution preparation) • Provide an emergency eyewash and shower in the immediate area
Sampling procedure	• Wear eye protection and impermeable gloves when sampling CCA solutions (including full face protection with CCA concentrates). • Wear impermeable gloves when taking borings from freshly treated wood. • Wash gauntlets and goggles immediately after completing sampling • Wash the outside of sample containers immediately after sampling solutions. • Wash hands thoroughly after all sampling operations
Cleaning cylinders, fixation chambers or storage tanks	• Follow all standard precautions for tank or vessel entry • Flush tank or vessel as required to establish safe entry conditions, or use an approved self-contained breathing apparatus prior to entry • Wear approved respirators (or breathing apparatus), impermeable gauntlets and coveralls / aprons (rubber or polyethylene coated) and rubber boots during all tank or vessel entry. Select respirators with combination of acid gas/high efficiency filter cartridges • Always have a standby attendant present • Collect and store contaminated waste material in sealed and labelled drums • Wash all protective equipment immediately after use (reuse all rinse waters for preparing treating solutions) • Shower after completion of clean-up tasks.
Removing treated charges from cylinder	• Wear gauntlets during door openings and when moving loads of freshly treated wood. • Avoid breathing preservative mists. Wear an approved respirator if airborne concentrations are unknown or at or above TVLs
Handling treated lumber	• Wear impermeable gloves • Wear impermeable gloves, aprons and boots if there is potential for getting wet by CCA solution
Handling and maintaining contaminated equipment	• Thoroughly flush equipment with water prior to handling. (Reuse rinse waters for preparing work solutions.) • Wear an impermeable apron and boots if there is potential for getting wet by CCA solution
Welding	Welding can produce toxic fumes.

	In addition to the precautions for handling and maintaining contaminated equipment: • Obtain the specific approval of the supervisor before welding • Block or disconnect lines from tanks before initiating welding operations • Completely drain and thoroughly rinse tanks or lines prior to welding operations • Ensure that equipment is completely dry from cleaning solvent residues • Wear a respirator or provide effective, local exhaust ventilation during welding to prevent potential exposure to toxic fumes • Assume good general ventilation of the work area. • Comply with all additional workplace safety rules • An initial workplace monitoring program is recommended. General background information will have determined he need for respirator use • Heavy-duty, lined polyvinyl chloride nitrite/PVC, neoprene, polyethylene is recommended for impermeable apron and boots.

Table 11: Safety Precautions for Personnel Working with CCA Solutions

6.3 Design Recommendations

Table 11 below presents good design features specifically applicable to CCA wood preservation facilities.

Storage format	Design feature	Recommendations
Bulk CCA liquids Concentrates Working solutions Contaminated surface runoff Drip return	Backflow prevention	Install backflow preventers on all waterlines at plant entry Use top entry of waterlines to tanks (as secondary backflow prevention). Waterlines must comply with all applicable local codes
	Emergency response	Provide accessible storage for all spill response equipment, absorbents (lime for concentrate, sawdust for wood solutions, drip return, runoff and personnel protection equipment)

Table 12: Recommended Design Features for Chemical Storage Areas

Chemical from	Design feature	Recommendations
CCA bulk concentrate	Location/shelter	Locate in a contained, enclosed area.
	Spill prevention	Interlock high-level alarms to tank feed pumps

Table 13: Recommended Design Features for Chemical Mixing Systems

Design feature	Recommendations
Objective	To minimize soil and surface water contamination, from CCA drip off and reduce losses of preservative chemicals from treated wood by: • providing proper conditions for preservative fixation in freshly treated wood; • controlling the generation of disposal of contaminated runoff waters.

Drip protection	• Provide for sufficient contained and roofed storage or transfer area for freshly treated wood prior to application of the fixation process. Completely enclosed drip areas are preferred. • Provide completely contained and roofed drip area for material undergoing fixation at ambient conditions.
Fixation	• Where freshly treated wood is stored prior to removal to an accelerated fixation unit or a protected, contained storage area for fixation under ambient conditions, a paved (impermeable), contained and roofed area should be provided for such storage • The stored area for fixation under ambient conditions should be paved (impermeable), contained and roofed, with provisions for recovery of drips and any infiltrating precipitation

Table 14: Recommended Design Features for Freshly Treated Wood Drip Areas

6.4 Operational Recommendations

Table 14 below present recommendations for operation of the wood preservation plant and the objectives are to protect both workers and the environment from harmful exposure to CCA solutions.

Operation	Recommendation
Storage of CCA solution (concentrates)	• Prevent contact of CCA concentrate with reducing agents (including aluminium, brass and zinc) or with organic combustibles (e.g. gasoline, kerosene, oil).

Table 15: Recommended Operating Practices for Chemical Handling and Storage

Objective	To ensure that ground contamination due to preservative drippage or leaching is minimized
Treatment process	• Apply an effective final vacuum after completion of the process cycle
Fixation	• Fixation is a temperature and humidity-sensitive process that may take from several hours at 60 to 70ºC to a few days under Sierra Leone weather conditions. • Under ambient conditions (21ºC) it may take up to 100 days (typically 4 to 5 days) to fix completely. Accelerated fixation at elevated temperatures (e.g. 70ºC) requires the presence of high humidity conditions to ensure optimum fixation results. • Accelerated fixation is preferred to fixation under ambient conditions. It can be achieved by application of elevated temperatures, while maintaining high humidity conditions. Conditions promoting drying do not result in optimum fixation levels. • Where interim storage is necessary, freshly treated wood should be held in a protected, contained area. • The treated wood should be released from the protected fixation area only after CCA has been verified by an acceptable test method (e.g. CAN/CSA 080 and AWPA-A3/11).

Table 16: Recommended Operating Practices for Freshly Treated Wood

6.5 Process Emissions and Disposals of Wastes

Potential process emission sources from CCA wood preservation facilities are presented below.

6.5.1 Control, Treatment and Disposal

Liquid CCA Concentrate (Bulk)	Potential Chemical Releases
Chemical delivery – Bulk Tankers	DRIPS, SPILLS to the ground
Chemical Storage – Tankage	AEROSOLS to air (vents)
Chemical dilution (closed system)	• AEROSOLS to air (vents) • DRIPS, SPLATTERS to surfaces (access points)
Solution Storage (Tankage)	• AEROSOLS to air (vents) • Sludges to landfill, to ground, to air (if burned) (Sludge burning should not occur)
Pressure Treatment (Retort cylinder)	• Aerosols to air, (door opening, vacuum exhaust) • Sludges to landfill, PAD OVERFLOW to ground.
Freshly treated wood storage	• DRIPS, RAINWASH to ground • DUST to AIR
Klin Drying/Fixation Chamber	• AEROSOLS, DUST CONDENSATES to AIR, • DUST, Drainage to ground.
Dry-Treated Wood Storage (Ground)	• DRIPS, RAINWASH to ground • DUST to AIR

Table 17: Recommended Operating Practices for Freshly Treated Wood: Potential Chemical Releases from CCA Pressure Treating Plants

6.5.2 Liquids Containing CCA

Liquid Process Wastes
Liquid process wastes (i.e. >1% total oxides) are not normally discharged from CCA plants. In Miro's process design liquid solutions (such as drips and wash waters) containing CCA are routinely collected and reused as makeup in preparing new treatment solutions. If unusual circumstances (such as prolonged plant shut down) prevent on-site reuse, suppliers of the CCA will collect (for reuse) and disposal would only be considered as a last alternative.

If disposal is unavoidable, specific approval will be obtained from the EPA-SL. If no suitable means of disposal are readily available, then the solutions should be sealed in leak proof metal containers, labelled and stored in a secure area.

Contaminated Storm Runoff
Contaminated storm runoff should be minimized. Various approaches will be used including work procedures and work instructions of proper final vacuum to remove any excess CCA solution from treated wood; use of roofed areas for treated product storage; assurance of proper fixation methods and minimization of surface deposits (keeping solutions clean) prior to storage in the open environment; and containment and reuse of storm runoff waters. In Sierra Leone roofing will be used to protect any areas and products that have a potential to leach chemicals into storm water run-off. If the release of CCA-contaminated runoff is required, guidance (and possibly specific approval) will be obtained from the EPA. Control specifications may depend on factors such as the volume and frequency of the discharge and the sensitivity of the receiving

environment. The discharge of CCA-contaminated runoff into waters inhabited by fish is subject to the provisions of the Fisheries Regulations.

6.5.3 Solids with High CCA Concentrations

These solids include sludges from sumps and cylinders and the disposal cartridge filters used to filter recycled waters. Solids with high concentrations of CCA should be drained and stored in leak proof sealed containers while awaiting disposal. Contaminated solids will be stored in a specifically designated area, which is bunded and lined with impermeable material. The area will be roofed to protect the wastes from precipitation. Any seepage or leachate generated at site will be contained within the bunded areas.

The preferred means of disposal for CCA-contaminated sludges and cartridge filters is solidification and burial in an approved secure (hydro geologically isolated) chemical landfill. It is the responsibility of Miro Forestry Ltd to obtain and comply with the approvals requested by the EPA authorities. Miro will ensure supply contracts of CCA include lifecycle elements where the supply will collect and dispose of these waste in compliance with legislation and international agreements in this regard.

Incineration of CCA-contaminated materials at below 800^{o} Celsius is not recommended because of formation of toxic combustion by-products.

6.5.4 Miscellaneous Solid Wastes

Miscellaneous solid wastes (e.g. stickers or cuttings from CCA treated lumber) from the Miro CCA wood preservative plant may be disposed of at designated sanitary landfills as approved by the District Council in Tonkolili in agreement with the EPA-SL Tonkolili Branch. CCA concentrates drums should be triple rinsed with water prior to disposal, and the rinse water should be used for preparation of working solutions. These CCA containers would normally be returned to the supply as part of contractual lifecycle agreements.

6.5.5 Air Emissions

Air emissions at CCA facilities are normally localized and below international air quality standard limits; effects, if any would be restricted to workers at the facility. Air emissions from CCA facilities include:

- Exhaust from kilns
- Exhaust from tank vents
- Mists from vacuum pump discharge
- Mists from opening of retort cylinder doors

Employee health monitoring for employees working with these areas should be subject to annual medical examination that would test for any implications on these employee's health.

Waste category	Examples	Recommendations
Liquid CCA solution	• CCA concentrates • CC work solutions • Drips from freshly treated lumber • Wash waters	• Reuse as makeup for work solutions (standard practice at CCA plants) • Return to supplier

Contaminated solid wastes	• Debris and bottom sludge from storage tanks and sumps • Debris and sludges from recycle filters • Any wood waste or wood debris that has contacted CCA concentrate	• Drain, drum and dispose of in a secure chemical landfill with prior approval of the regulatory agency • Do not burn CCA-contaminated wastes (toxic gases may be formed).
Miscellaneous solid wastes	• Empty concentrate drums. • Scraps, cuttings and shavings from CCA-treated lumber • Solid fire residues	• Rinse drums thoroughly and dispose of in designated sanitary landfills subject to approval by the regulatory agency • Dispose of other waste in sanitary landfills subject to approval by the regulatory agency, EPA-SL • Return to supplier as part of lifecycle agreements
Contaminated storm runoff	• Any storm runoff or contaminated liquid discharge that contains arsenic at concentrations exceeding 0.5 mg/L, or whose discharge results in concentrations of arsenic in the receiving environment exceeding 0.025 mg/L, or whose discharge results in concentrations of copper in the receiving environment exceeding 0.005 mg/L • Note: These limits are subject to change	• Prevent or minimize contamination of storm runoff • Contain and reuse contaminated runoff as makeup for work solutions (to the greatest possible extent). • Monitor surface and ground water (in consultation with the EPA Regional Office) to assess containment concentrations.
Firefighting water runoff	• As above (contaminated storm runoff	• Contain and reuse contaminated runoff as makeup for work solutions (to the greatest possible extent). • Where practical and necessary this run-off may be contained in earth wall dykes for later treatment with lime. • If reuse is not practical, consult with the Regional EPA Office to determine acceptable disposal.

Table 18: Recommended Disposal Practices for Wastes Contaminated with CCA

6.6 Emission and Site Monitoring

Site monitoring and assessment are recommended at CCA facilities to verify that wood preservative chemicals are properly managed at the site and to ensure environmental and worker health protection.

Environmental monitoring, including water and soil monitoring requirements would be worked out with the EPA-SL. However, worker health monitoring programs may be developed in consultation with the Ministry of Labour and Industrial Relations.

A program needs to ensure that adequate monitoring sites and frequencies are selected and that the preservative constituents, detection levels and quality control are defined.

6.7 Transportation of CCA Solutions and Wastes

CCA solutions and wastes are considered as dangerous goods. The regulation for movement of dangerous goods is the responsibility of the EPA-SL and the Local Councils, and in this case the Tonkolili District Council.

6.8 Spill and Fire Contingency Planning

Preparedness for emergencies is essential in any wood preservation plant. Hence, Miro should prepare and have readily available detailed contingency plans to ensure that response to spills and fires is quick, safe and effective. Miro has management systems in place for their plantations and other processing plants and this treatment plant would form an additional part of this management system.

6.8.1 Spill Contingency Planning

Contaminated sawdust or soils, etc., should be neutralized with lime before the clean-up efforts begin (use a ratio of 91 kg lime per 227 L CCA 50% concentration – 200 lb./50 gal.

6.8.2 Fire Contingency Planning

Components of CCA and CCA solutions are not flammable. However, precautions should be taken in the event that a fire occurs in the vicinity of CCA solutions. One of the components, chromic acid, is a strong oxidizer and may increase the fire threat upon dispersal on wood floors, pallets, cotton packaging or cartons. Arsenic acid may be converted to more toxic reduced forms of arsenic upon exposure to high temperatures. It is, therefore, important that CCA wood preservation facilities devise and adequate contingency plan for fire protection.

The following action steps should be included in the plan:

- Use of water blanket area;
- Use of water spray to suppress toxic dust and gases and to keep temperatures of other oxidizable material below that for ignition;
- Use of any fire protection agents except soda-acid;
- Ashes from CCA-treated wood should be considered a hazardous waste and disposed of as such.

As part of Miro’s Management Systems they have emergency plans for now potential emergencies and this would be expanded to include potential emergencies related to the pole treatment plant.

Annex 1: REFERENCES

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9. SAWPA, CCA Treated Timber, South Africa

Annex 2: Results of Water Quality Analysis of Borehole Water

No.	Parameter	Measured Value	Maximum Limit Value
	Water Temperature (^{0}C)	27	No Value
	PH	6.50	6.5 – 8.5
	Turbidity (NTU)	0.80	< 5.0
	Conductivity (µS/cm)	157.1	< 450 (µS/cm)
	TDS (mg/l)	94.26	< 1000
	Residual Chlorine (mg/l)	0.04	0.3 – 0.5
	Aluminum (mg/l)	0.0	0.20
	Ammonia (mg/l)	0.0	No value
	Calcium Hardness (mg/l)	42	< 200
	Copper (mg/l)	0.09	< 2.0
	Fluoride (mg/l)	0.42	< 1.5
	Iron (mg/l)	0.12	< 1.0
	Magnesium (mg/l)	32	< 200
	Nitrate (mg/l)	13.1	< 3.0
	Nitrite (mg/l)	0.02	< 50
	Potassium (mg/l)	0.90	< 6.0
	Sulphate (mg/l)	10.0	< 500
	Sulphide (mg/l)	0.0	< 0.5
	Chloride (mg/l)	3.8	< 250
	Zinc (mg/l)	0.2	< 15.0
	E. Coli	0.0	0.0
	Faecal coliforms	0.0	0.0
	Non-faecal coliforms	0.0	< 10.0µ
	Arsenic	0.0	0.01
	Chromium	0.01	<0.05

Annex 3: Certificate of Analysis for CCA in Soil and Borehole

SLARI
Sierra Leone Agricultural Research Institute
ANALYTICAL SERVICES LABORATORY
NJALA AGRICULTURAL RESEARCH CENTRE (NARC)
Njala, PMB 540, Freetown, Sierra Leone. Contact: Mohamed Saimah Kamara
Email: emeskay05@gmail.com Cell: (+232) 88 284 992

RESULTS

Date: 27th August, 2020

To: Imoasina Jalloh
Miro Forestry
Mile 91

Sample Label	Arsenic (mg/kg soil)	Copper (mg/kg soil)	Chromium (mg/kg soil)
1a Top Soil Sample 1	0.00	0.30	0.30
1b 0.5-Meter Soil Sample 1	0.00	0.10	0.10
1c 1.0-Meter Soil Sample 1	0.10	0.10	0.00
2a Top Soil Sample 2	0.00	0.40	0.20
2b 0.5-meter Soil Sample 2	0.00	0.20	0.20
2c 1.0-Meter Soil Sample 2	0.10	0.20	0.00
WHO Permissible Limits	1.50	3.50	1.30

Sign: .....
Laboratory Manager