

ENVIRONMENTAL IMPACT STUDY (EIA-RIMA)

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LD Celulose S/A

Dissolving Pulp Mill in Indianópolis and Araguari – MG

VOLUME V – SPECIFIC STUDIES

Risk Management Program (PGR)

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1 INTRODUCTION

LD Celulose has a policy of identifying and managing the risks of its activities, its aspects and impacts to the environment, society, health and safety of professionals and the quality of its products and services.

In line with this policy, this Risk Management Program (PGR) is the official document that defines the guidelines for the risk management system associated with the operation of the LD Celulose dissolving pulp mill to be located in the municipality of Indianópolis and Araguari - MG, with a view to accident prevention.

The Risk Management Program can be defined as a set of operational and administrative actions and procedures, whose purpose is to prevent, reduce and control the risks associated with a given activity and also to keep operations within acceptable safety standards.

It is worth mentioning that the PGR include the management of the risks associated only with the operation of the dissolving pulp mill, since the risks during the implementation phase will be restricted only to internal damages associated with work safety, remembering that the Risk Analysis Study (EAR) aimed to survey hazards related to the operation.

The coordination of the PGR is the responsibility of the Department of Occupational Health and Safety (HSMT).

This PGR was prepared based on the criteria established in Standard P4.261 / 2011 - Technological Accident Risk - Decision Method and Terms of Reference, of the Environmental Company of the State of São Paulo - CETESB and thus, includes the following items:

- Characterization of the project and surroundings;
- Hazards identification;
- Hazard identification review;
- Operational procedures;
- Modification management;
- Maintenance and guarantee of integrity;
- Human resources training;
- Investigation of incidents and accidents;
- Emergency Action Plan – PAE;
- Audit of the PGR; and
- Annexes.

2 REFERENCE DOCUMENTS

- P4.261 Standard – Risk of Accident of Technological Origin - Decision Method and Terms of Reference, of the Environmental Company of the State of São Paulo – CETESB;
- Risk Analysis Study – Dissolving pulp mill of LD Celulose S/A.

3 DEFINITIONS

Accident: any event that has caused the following consequences, individually or in combination: personal injury to persons (employees and third parties); damage to health (employees and third parties); property damage; damage (injury) to the environment; impacts on the operation of the business; impacts on the institutional image; legal impacts.

Accidental Hypothesis: Type of occurrence identified in the risk assessment and which creates accidental scenarios.

Accidental scenarios: identification of the accidental hypotheses that may occur due to the activities involved.

Alarm: signal to warning of some imminent danger.

Area Abandonment Procedure: provides steps for the safe abandonment of the locality by employees, contractors and visitors so that there is no abuse and consequent accidents, which can aggravate the emergency situation.

Brigade: collaborators that compose the Emergency Brigade, trained in theory and practice with the purpose of avoiding and controlling occurrences and / or worsening of an emergency.

Cause: fact or chain of facts, of human or material origin, that proceed and conditioning the materialization of a risk with potential for the generation of damages.

Chemical emergency: an unforeseen situation associated with any stage of the process of transporting, handling, processing or disposing of chemicals, with actual or potential characteristics of causing damage to persons, the environment or facilities.

Crisis: it is by nature a period of tension. Whether caused by accidents or by corporate problems (such as a strike, for example), the crisis has a great potential for attrition in relations with different publics and poses a real risk to the company's image and reputation.

Emergency: is a combination of facts, due to defects in equipment, failures in process control, natural phenomena (storms, lightning, floods), or human faults, which can result in fire, explosion, spills or chemical leakage, accidental air emission, accidental discharge into the water and soil, or any accident with injury, damage to property, the environment and the community.

Emergency brigade: team composed of employees from different areas, properly trained to prevent and combat emergencies.

Emergency Management Group (GGE): group formed by the Industrial Manager, its designees or substitutes with the power to forward actions of management, administrative, technical, support, assistance and emergency control, with a view to mitigating damages to persons and to the environment, facilities and / or activation of own resources, suppliers or external.

Emergency response: triggering of coordinated and integrated actions, through mobilization of human resources and materials compatible with the presented scenario, aiming to control and minimize damages to people and assets, as well as possible environmental impacts.

Environment: surroundings where the pulp mill operates, including air, water, soil, natural resources, flora, fauna, humans and their interrelationships.

Environmental accident: an unwanted and unexpected event that affects, directly or indirectly, the physical integrity and health of the exposed people, causes damages to the public and / or private property, as well as impacts to the environment.

Environmental impact: Any adverse or beneficial environmental change that results in all or part of LD Celulose's activities.

Escape route: considered safer route where people from areas already affected by the emergency or likely to be evading.

Explosion: chemical reaction, with total and instantaneous release of the energy of the oxidizing mass, causing heat and pressure surge.

Fire: chemical reaction (combustion) with uncontrolled release of energy, whose extent and magnitude - threatens lives and / or the environment and / or facilities / machines / processes.

Gravity potential: projection of the worst case scenario due to an accident or potential incident.

Hypothesis: (1) Set of ideas that presents the probable explanation for a given phenomenon. (2) Formal statement of the expected relationships between at least one independent variable and one dependent variable. (3) In research the hypotheses become questions to be answered with clarity through the work done.

Incident: Unintended and unexpected event, which under slightly different circumstances could result in accident.

Industrial Firefighter: Professional trained and qualified in the prevention and combat to emergencies.

Leakage: Leakage is understood as any abnormal situation that results in the release of product, not necessarily associated with an emergency situation.

Meeting point: place considered safe, where employees and other people who have their work places affected by an emergency must meet, waiting for abandonment order or return to work unit.

Overflow: A situation where a chemical spills from your container, vessel, piping or tank, in an uncontrolled way that creates risks to people, the environment or the facility.

Population: Set of organisms of the same species that occupy a certain area and in general is isolated in some way from other sets. Attributes of a population: birth and death rates, sex ratio, age distribution, immigration and emigration.

Radiation: (1) Any of the physical processes of emission and propagation of energy, either by of surge phenomena or by particles with kinetic energy. (2) Energy that propagates from one point to another in space or material environment.

Risk: Measure of damage to human life, resulting from the combination of the frequency of occurrence and the magnitude of the losses or damages (consequences).

Risks related to safety, health and the environment: it is the probability of damage to the health and physical integrity of workers, environment, community and property, resulting in human / material losses, penalties, interdiction and / or suspension of activities.

Security: A state in which the risks of probable damage to persons and property are limited to an acceptable limit.

Simulated Exercise: Practical training in emergency care.

Spill: Any release, whether sudden or not, of a chemical, usually in a liquid or solid state, to soil, subsoil, water, surface or atmosphere that could endanger the physical integrity of persons and / or cause environmental damage.

System: Junction of interrelated elements forming a single whole.

Toxic Substance: Biogenic poison that affects the functioning of cells, tissues, organisms and systems.

4 ORGANIZATIONAL STRUCTURE OF THE PGR

The Risk Management Program - PGR of LD Celulose will be coordinated by the Hygiene, Safety and Occupational Medicine Team (HSMT), responsible for full compliance with the established in the Program, and must report the results of its implementation and follow-up to the Industrial Management.

The functions of the General Coordinator of the PGR are:

- Coordinate the various activities foreseen in the PGR;
- Manage activities of the evaluation and review of the Risk Analysis Study - EAR;
- Compatible modifications resulting from the change management process;
- Ensure and monitor safety assessments through periodic audits, including verification of:
 - Recommended measures in the review of Risk Analysis Studies - EAR;
 - Charging of the responsible for productive areas and HSMT regarding to the updating of operating and safety procedures;
 - Inspection in compliance of standards, procedures, technical instructions and current environmental legislation;
 - Monitor the evolution of training programs and training of operators.
- Evaluate, together with the Industrial Management, the actions and procedures adopted in emergency situations;
- Promote integration among the different areas of the company, in order to provide the necessary conditions for the full implementation of the actions foreseen in the PGR.

5 PROJECT CHARACTERIZATION

5.1 Activity

The project is characterized as an industrial activity, belonging to the industrial production activities of Pulp and Paper, classified according to the CNAE-IBGE (Classification of Economic Activities - Brazilian Institute of Geography and Statistics), 17.10-9 - MANUFACTURE OF PULP AND OTHER PASTES FOR THE MANUFACTURE OF PAPER.

5.2 Location

The dissolving pulp mill will be located in the municipality of Indianópolis and Araguari (MG), along Highway BR 365, 35 km away from Uberlândia.

The following figure shows the location of the project.

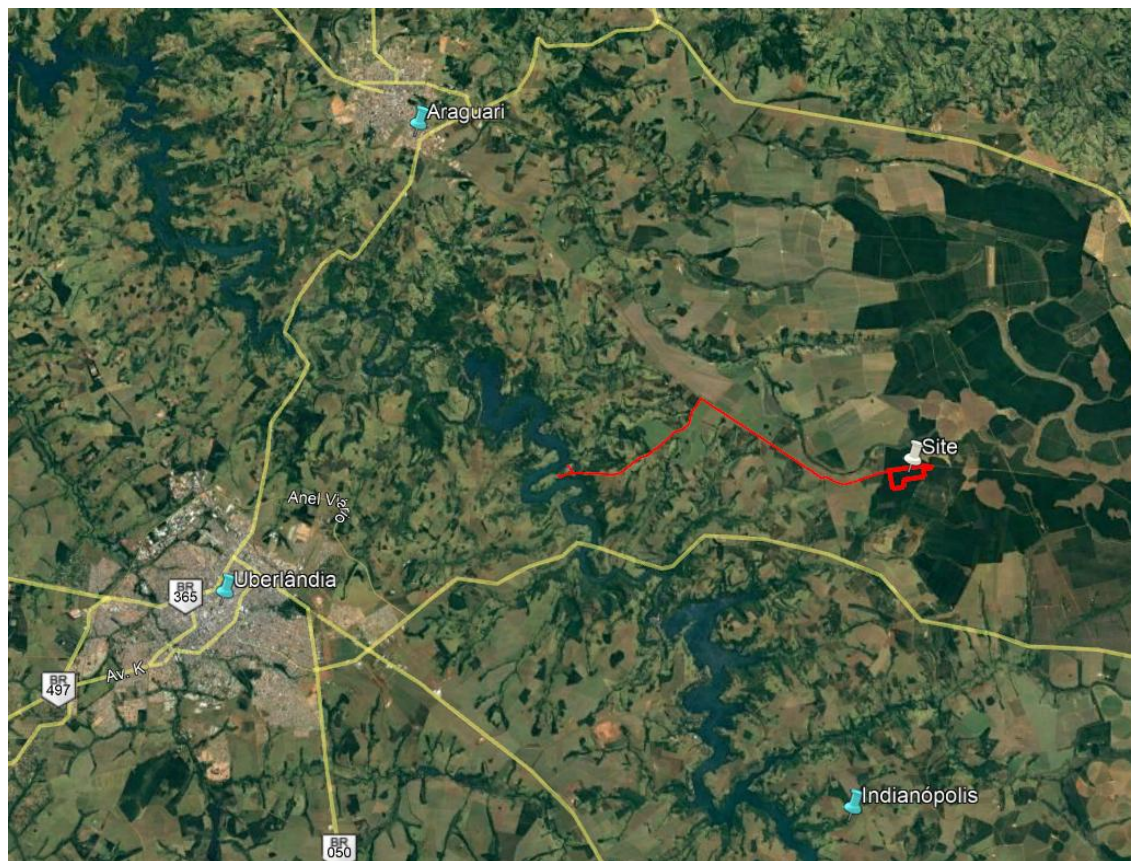


Figure 1 – Mill location. Source: Google Earth, 2018.

5.3 Layout

The Layout of the dissolving pulp mill is presented in the following figure and is also included in **ANNEX I**.

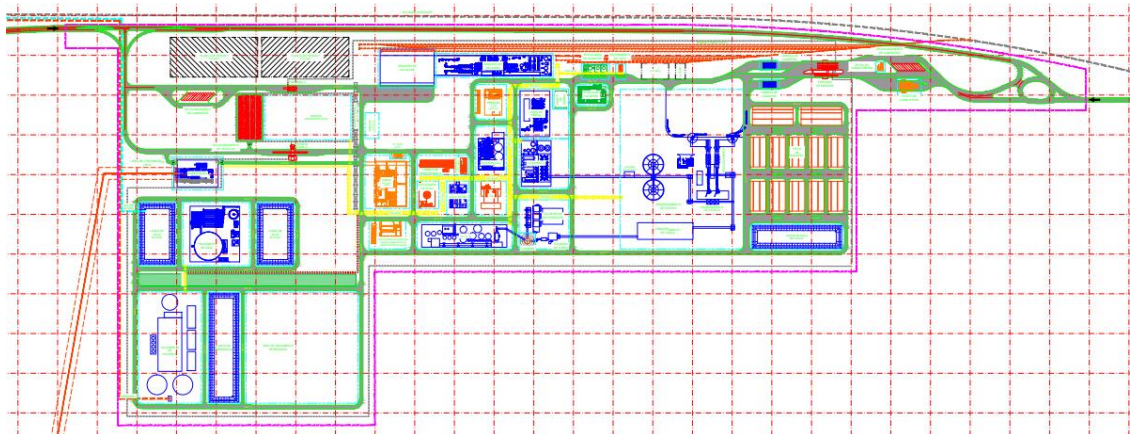


Figure 2 – Pulp mill site layout. Source: Pöyry Tecnologia, 2018.

5.4 Operation Time and Employees

The operating regime of the dissolving pulp mill will be 24 hours a day, 7 days a week and 12 months a year. The production period will be approximately 352 days, considering the annual general maintenance stoppage of the equipment.

The total workforce necessary for the dissolving pulp mill operation will be around 500 people. The working day of the employees of the industrial area will take place in 3 work shifts of 8 hours each. In the administrative area the working day will be 8 hours and will take place during business hours.

5.5 Productive Capacity

The main activity of the plant is the production of dissolving pulp of LD Celulose in the state of Minas Gerais, which forecasts a production of 540,000 tons per year of dissolving eucalyptus pulp.

5.6 Dissolving Pulp Mill Description

5.6.1 Raw Materials, Inputs and Chemicals

5.6.1.1 Wood

Considering the full capacity of pulp production (540,000 t/year) and the ratio of 6.5 m³/ton of pulp, the total demand of eucalyptus logs will be approximately 3,520,000 m³/year.

The transportation of this raw material must have origins in the municipalities around, within a radius of approximately 20 km.

The transport of wood will be carried out mostly by internal roads to Fazenda Nova Monte Carmelo , and also by federal, state or municipal highways and be carried out by transport compositions within the rules of traffic. These compositions will be known as "Bitrem" (mechanical horse pulling 2 semi-trailers) and/or "Romeo and Juliet" (platform truck pulling 1 trailer), as shown in the following figure. On the routes where it is possible the transit of compositions of greater weight and length,

mainly on the internal roads to Fazenda Nova Monte Carmelo, "Tritrem" type compositions (mechanical horse pulling 3 semi-trailers) or "Treminhão" (platform truck pulling two trailers) may be used. The wood will be transported in round logs, ranging in length from 6 meters to 7.5 meters.



Figure 3 – Transport type “Romeu e Julieta”.

5.6.1.2 Inputs and Chemicals

For the operating phase, considering production capacity of 540,000 t/year, the estimates indicate the distribution of this demand through the Table below.

Table 1 – Estimated consumption of the main chemical inputs

Inputs	Total consumption (ton/year)
Sodium Hydroxide	11,300
Sodium hypochlorite	90
Sodium Sulphate	13,000
Sulphuric acid	9,200
Sulfur dioxide	1,100
Oxygen	37,400
Ozone	2,700
Hydrogen peroxide	3,800
Magnesium sulphate	1,800
Lime	5,400
Urea	600
Aluminum sulfate	600

Source: Pöyry, 2018.

5.6.2 Production Destination

The outbound of pulp production will be 100% carried out by railway, which will be destined to the Port of Espírito Santo or Port of Santos/SP.

5.6.3 Industrial Process Description

5.6.3.1 Process Brief Description

The un-barked logs will be transported to the debarking, washing and chipping lines, which will chip the logs into chips. The chips will be stored in silos and then transported to the cooking plant.

The chips will have controlled dimensions, which will allow the penetration of the chemical products during cooking, which will facilitate the softening of the wood and the separation of the fibers, separating them from the lignin, producing the “brown pulp”.

Next, a pre-bleaching of the pulp will be carried out, through a physical-chemical process, using as main reagent the oxygen. The objective is to reduce the consumption of chemical reagents in the bleaching and to generate less organic load for the effluent.

Bleaching is a purification process that aims to remove most of the undissolved residual lignin. The goal is to obtain high degree of whiteness. For this, more selective chemical reagents and milder working conditions will be used.

The bleached pulp then will be transported to the drying and baling section, where sheet formation will occur, to ensure greater homogeneity and to avoid machine breakdowns or product irregularities. The pressing aims to remove the water by mechanical action, to consolidate position of the fibers and to give greater resistance for the wet sheet to pass through the drying. In drying, water will be removed by evaporation through the application of heat to the pulp sheet. At the exit of the dryer, the sheets will be cut, weighed and baling.

Chemical Recovery

The kraft pulp mill, in which the production of dissolving pulp is included, has a system that allows the recovery of the chemicals used to obtain the pulp.

Recovery begins with evaporation of the black liquor, raising the dry solids content from 15% to about 80%.

After evaporation, the liquor will be sent for incineration in the recovery boiler. In the boiler, the organic matter present in the liquor will be incinerated, leaving a melt, formed by the inorganic compounds that will be sent to the causticizing.

In the causticizing, the clarification of the green liquor will occur, and later the white liquor will be obtained.

5.6.3.2 Process Detailed Description

In this item é presented a detailed description of each step of the pulp production process.

5.6.3.2.1 Wood handling

The un-barked eucalyptus logs will be transported to the mill by truck, where it will be received according to the mill quality control procedure, weighed over the mill weighbridge, and sent either directly to the process or stored at the log storage area.



Figure 4 – Unloading of eucalyptus logs on the wood yard. Source: Pöyry, 2018.

The logs storage capacity in the mill will be equivalent to the average consumption of 15 days.

Wood will be loaded into an infeed conveyor feeding the debarking drums using mobile log vehicles. There will be two debarking and chipping lines. After the debarking drum the logs will enter a roller conveyor with a stone trap, bark separation section, a high pressure washing section, and then a metal detector.

The logs will be chipped, and the chips will be transported throughout a belt conveyor feeding two chip silos, each of 20,000 m³.



Figure 5 – Chip silo. Source: Pöyry, 2018.

Falling bark and residues will be collected and shredded and then fed to a covered biomass storage which will have a buffer time of 5 days.

Fines from chip screening will also conveyed to the biomass storage. From the biomass storage, the biomass will be conveyed to the biomass boiler.

Overs from chip screening will be re-chipped and recovered for exploitation of fibers for pulp production, or optionally used as biomass to be burnt in the biomass boiler. The accept chips will be fed via belt conveyor to the chip silo for cooking.

Log washing water will be recirculated, thus only a small amount of make-up water is needed. Effluent from the wood yard will be sent to the effluent treatment plant.

5.6.3.2.2 Fiber Line

Cooking Plant

The cooking purpose is to separate the fibers and other anatomical constituents of the wood chips by using a chemical reaction.



Figure 6 – Cooking plant. Source: Pöyry, 2018.

Cooking is an alkaline chemical process, it uses the power of the chemical reagents sodium hydroxide (NaOH) and sodium sulfide (Na_2S), the main constituents of the white liquor, to promote the dissolution of the components that cement the fibers to the others, under favorable and optimized conditions of pressure and temperature in the digesters.

The cooking process will be batch by the VISCBC process (Viscose Continuous Batch Cooking), where the basic concept is to have the process related conditions, such as temperatures and alkali concentrations, already prepared and adjusted in the tank using various tank to tank circulations.

The total number of digesters will be 14, in 2 parallel lines, 7 in each line.

The chips from the storage silo will be distributed into batch digesters by the conveyor system. The heating up phase actually starts by adding steam to the digester bottom. The digester will be then held for a period of time until the hydrolysis reactions have occurred.

After the hydrolysis phase is completed, the contents of the digester will be neutralized with a mixture of white liquor and filtrate from the brown stock washing tank which will also adjust the temperature.

The weak black liquor extracted from the digester during the washing will be sent to the evaporation plant to be flashed.

The pulp will be sent to one of the 2 discharge tank and then to the knots separation and brown stock screening system.

The pulp will be sent to brown stock washing and oxygen delignification.

Oxygen delignification

Oxygen delignification is one of the stages before bleaching, in which an additional delignification takes place through the reactions of the pulp with oxidizing agent in an alkaline media. The objective is to minimize the consumption of chemical reagents in the later stages of bleaching, to recover the maximum amount of alkali applied and to minimize the generation of organic load for the effluent.

Oxygen delignification will be performed in a conventional two stage reactor system followed by 3 stages of post oxygen washing (wash presses in series).

Bleaching

Bleaching is a purification process that aims to remove elements that would avoid complete bleaching of the pulp, such as resins and the undissolved residual lignin in the foregoing operations.

The objective is to obtain TCF pulp (total chlorine-free) with a high degree of whiteness and stable, without physico-mechanical characteristics losses. This required high brightness in the process is achieved through the use of appropriate multi-stage chemical reagents, each with specific operating conditions.

The bleach plant is based on a 3-stage Totally Chlorine-Free (TCF) sequence A Z P with the following meaning:

- A = Acid stage
- Z = Ozone stage
- P = Peroxide stage

The bleached pulp will be sent to the storage towers, where it will be stored at medium consistency and fed to the drying machine.

5.6.3.2.3 Pulp Machine Dryer, Cutter and Baling

From the bleached pulp storage tower, the pulp will be mixed with broke from re-pulped pulp bales, purified and have its consistency accurately regulated.

Before being sent to the drying machine, the pulp will be pumped to a filtration and cleaning system, whose function is to remove small impurity particles, both light and heavier impurities. The cleanliness requirements for dissolving pulp are significantly higher than paper grade pulp.

Then will be submitted to a drying machine in which the fiber suspension with water will be sent to the dewatering process, forming the sheet.

The pulp dryer is the type of floating sheet that will dry the sheet while holding onto a steam-heated hot air mattress.

Then, the sheet will be sent to a cooler, at which outlet the sheet will be drawn through a press and directed to the cutter, where it will be cut and stacked through the conveyor. Stack size of the sheet will be monitored by the total weight of the conveyor or the sheet count.

The cut sheets in the programmed size will be stacked, enclosed in bales, wrapped and identified. The bales will be also stacked and unitized, moving to the warehouse.



Figure 7 – Drying Machine. Source: Pöyry, 2018.

5.6.3.2.4 Evaporation Plant

The purpose of the evaporation is to concentrate the black liquor from the cooking from the initial concentration of 14.0 – 16.0% to the final concentration of 80% solids.

The evaporation plant will be a multi-effects plant using low pressure steam. The final concentration of the liquor will be achieved in a six effect evaporation plant. The concentrated liquor produced will be stored for later burning in the recovery boiler.

The condensates of evaporation plant will be segregated in different quality grades. Segregation is therefore important to ensure sufficient quality in the condensates that will be used in other areas of the plant.

The condensate treatment plant and methanol rectification will be integrated into the evaporation plant.

The contaminated condensate collected from the process will be treated and used later in the process.

The stripper column gases from the condensate treatment will be sent to the rectifier column for extraction of methanol. The produced methanol will be used as auxiliary fuel in the recovery boiler. If it is impossible at the recovery boiler, the methanol can be incinerated in the biomass boiler, or in the lime kiln, or even in the flare.



Figure 8 – Evaporation plant. Source: Pöyry, 2018.

5.6.3.2.5 Recovery Boiler

The purpose of the recovery boiler is to:

- Recover the chemicals used in cooking;
- Reduce sodium sulfate added to sulfide;
- Generate steam using the energy resulting from the burning of the organic matter extracted from the wood.

Concentrated black liquor from the evaporators will be burnt in the recovery boiler, generating flue gases at the top and smelt of chemicals at the bottom. The smelt, containing mainly sodium sulphide (Na_2S) and sodium carbonate (Na_2CO_3), will be removed from the bottom and dissolved in the dissolving tank to generate green liquor.

The boiler will be high efficiency and low odor type with multilevel type air system for 80% (no ash) burning of liquor.

The steam generated in high pressure will be sent to the turbogenerators for electricity generation.

The combustion air will be introduced into the furnace in at least three levels with forced draft fans to allow optimum combustion control, NO_x and TRS emission reduction and smelt reduction.

Flue gases from combustion shall pass through an electrostatic precipitator, the expected efficiency of which shall be greater than 99.7%. The ash (from precipitator) treatment system will be integrated into the recovery boiler or the evaporation plant.

The concentrated and diluted non-condensable gases and methanol will be incinerated in the recovery boiler.

Fuel oil will be used as fuel for starting and stabilizing the production process.

5.6.3.2.6 Causticizing and Lime Kiln

Causticizing

In causticizing, the green liquor from the dissolving tank will be transformed into white liquor, which will later be used in the chip cooking.

This transformation consists in the reaction of the sodium carbonate of the green liquor with the lime (calcium oxide), obtaining sodium hydroxide and calcium carbonate, which will be separated by filtration.

Before contact with lime (calcium oxide and inerts), the green liquor will be filtered for the removal of impurities (dregs). The dregs will be washed and filtered in a filter or centrifuge, specific equipment for this application.

Secondary condensate from evaporation plant or warm water will be used for washing the dregs. The filtrate from the lime mud filter will be pumped into the weak liquor tank.

The lime residues (grits) will also be washed and, like the dregs, will be sent to the solid waste center for the generation of soil correctives.

After the reaction of the green liquor with lime, the white liquor will be obtained by filtration of the mixture sodium hydroxide (white liquor) and calcium carbonate (lime mud) through a pressurized disk filter.

The white liquor will be sent for cooking and the lime mud will be washed and dewatered in a vacuum disc filter before being sent to the lime kiln.

It is expected to collect and recover all effluent from this area as well as the closing of the cooling water circuit.

Lime Kiln

Calcination has the purpose of transforming the calcium carbonate, obtained in causticizing, into calcium oxide ($\text{CaO} + \text{inerts}$) to be used in the reaction with the green liquor.

Calcination will be carried out in a rotary kiln, internally coated with refractory and insulating bricks and heated by the combustion of fuel oil or in the future other alternative fuel (natural gas, biomass gas, etc.).

As auxiliary fuel, the lime kiln may burn methanol.

The lime kiln will be equipped with an external drier for lime mud and with chilled lime coolers for the burnt lime.

Through electrostatic precipitator the dust will be removed from the flue gases and may return to the lime kiln or be discarded (lime mud purge).

The flue gases will be sent to the chimney, from where they are released into the atmosphere.

5.6.3.2.7 Handling, Preparation and Storage of Chemicals

The description of this area corresponds to different systems in order to meet the requirements of supplying chemical to the mill. All chemical storage tanks shall contain containment basins with a volume at least equivalent to the maximum storage volume.

The chemicals area will include, mainly:

- Sodium hydroxide handling
- Hydrogen peroxide handling
- Sulphuric Acid handling
- Magnesium Sulphate handling
- Oxygen production plant
- Ozone production plant
- Sulphur dioxide preparation plant

Storage Volumes

The chemical storage tanks volumes are shown in the Table below.

Table 2 – Chemical storage tanks

Chemical	Volume (m³)
Caustic soda, 50%	960
Sulphuric Acid, 98%	270
Hydrogen peroxide, 50%	400
Sodium sulfate	360
Magnesium Sulphate	100

Source: PÖYRY, 2018.

Chemicals Transportation System

The main chemicals transportation, in liquid form, will be carried out in a bulk through tank trucks.

The transport companies should have a specific training for drivers and operators regarding traffic management, education and safety, in order to reduce the risk of accidents.

Control and Operational Safety System of the Chemical Plant

The Chemical Plant shall be provided with the following equipment and structures for storage, containment, control and safety:

- Chemical unloading platforms, fitted with restraints through spines or walls;

- Storage of liquid products in metal tanks, made of carbon steel, stainless steel or fiberglass (the material will depend on the type of chemical being stocked);
- Concrete containment dikes for chemical storage tanks;
- Containment channels in production areas and in the storage of chemicals;
- Process monitoring instruments (level, pressure, temperature, among others) operated remotely, in order to minimize the need for operators in the area of production or storage of chemicals. Remote operation can be performed by dedicated remote control systems;
- Atmospheric discharges protection systems (also known as SPDA), provided with grounding and/or lightning strikes;
- A highlight of the chemicals in the LD Celulose pulp mill is that the transfer system from the Chemical Plant to the points of use will be carried out by aerial pipelines (also known as pipe rack), which avoids the handling operators and greatly minimizes the risk of accidents.

Chemical Plant Processes Description

Caustic Soda Handling

Caustic soda will be delivered as a 50% solution and unloaded from trucks by the unloading pump to the caustic soda tank. From there the 50% solution will be diluted to 15 % using soft water.

Most of this solution will be transferred for use in the liquor systems, delignification and pulp bleaching. Other areas of the mill will also utilize sodium hydroxide, such as: water treatment plant, boiler water treatment and effluent treatment.

Hydrogen Peroxide Handling

Hydrogen peroxide will be delivered to the mill as a 50% solution and will be unloaded to the 50% peroxide storage tank before being pumped to a smaller peroxide tank located in the bleach plant.

Sulphuric Acid Handling

Sulphuric acid at 98% concentration will be delivered to the mill by truck and will be unloaded to the mill sulphuric acid storage tank. From there the acid will be distributed to the various consumers, mainly the bleach plant, water and effluent treatment and to the boiler feed water treatment plant.

Magnesium Sulphate Handling

Magnesium sulphate will be received as bulk powder into a storage silo. It will be mixed with soft water to make about 20 % solution, which will be pumped to bleach plant P-stage.

Oxygen Preparation Plant

The oxygen production will be performed through a dedicated plant to meet the needs of delignification, bleaching and white liquor oxidation.

The oxygen generation can be done by purifying the atmospheric air by the adsorption process (VSA - Vacuum Swing Adsorber) through molecular sieves.

At the beginning of the process, the atmospheric air will pass through a filtration system, where solid particles will be removed.

Thereafter the air will be sucked in order to be subjected to a vacuum regime, sufficient only to allow the flow of air into the purification system.

The air purification system consists mainly of adsorbent vessels, which operate in cycles. Through passage through a molecular sieve bed, the moisture, CO₂ and air nitrogen will be removed from the main stream.

Purified air, rich in oxygen, will exit the purification system and then proceed to the oxygen compressor, which will compress it to the conditions necessary for its use. The waste gas will be vented to the atmosphere through the silencer.

Ozone Preparation Plant

The feed gas for the ozone plant comes from the VSA oxygen plant or from the liquid oxygen back-up storage system.

Ozone will be produced in an electrical discharge by the high electric field in the annular spaces. Some of the energy will be transformed into heat and is removed by cooling water passing through the vessel. Ozone will be compressed and delivered to the bleach plant.

The system will also include an off-gas catalytic destruction system which will remove non-dissolved ozone gas and will convert any remaining ozone to oxygen, so that concentration will be not higher than 0.1 ppm.

Since approximately only 10 to 12 % of the oxygen passing through the ozone generator will be converted to ozone, the off-gas from the ozone bleach stage will be recycled after the ozone destruction unit so that the unused oxygen can be used in the oxygen delignification and white liquor oxidation departments.

Sulphur Dioxide Plant

The sulphur dioxide plant will use purchased liquid SO₂ in 1 ton cylinders to produce dilute gaseous sulphur dioxide.

The liquid SO₂ will be released as a SO₂ gas stream via a hot water vaporiser into a packed bed SO₂ absorption tower where it is contacted with chilled water, which will be produced in the ozone plant.

The resulting 7 g/l SO₂ solution will be then pumped by the SO₂ solution transfer pump to storage.

5.6.3.2.8 Utilities

Industrial Water Supply and Treatment

There will be a Water Treatment Plant (ETA) in order to meet the consumption needs of LD Celulose dissolving pulp mill.

The raw water will be taken from the Araguari River, through a surface system, consisting of a channel and screening.

It is worth mentioning that the water intake will be of the type water, that is, a dam system will not be built.

Pumps will be installed for raw water intake, totalizing a flow of 3,000 m³/h to supply the dissolving pulp mill.

A raw water pipeline, diameter 800 mm will be installed, which will feed a raw water reservoir, excavated type, with reserve capacity of 48,000 m³.

The raw water, arriving in ETA, will suffer the addition of aluminum sulfate, sodium hydroxide and sodium hypochlorite, the latter used to promote the removal of iron, besides oxidizing the organic matter present. After the coagulation process, polyelectrolyte will be added to promote flocculation.

Then, by gravity, the flocculated water will proceed to the solids removal unit through a dissolved air flotation or a similar system. The formed sludge will be discharged periodically and automatically into the central discharge channel. The collected sludge will be dewatered and drained and then sent to final disposal.

By gravity, the clarified water will be conducted through channels to the gravity filters. After filtration, the treated water will be stored in the treated water reservoir which will supply the various points of consumption of the plant, including water for firefighting and drinking water.

The total capacity of treated water will be 2,600 m³/h.

Demineralized Water and Soft Water

Demineralized water will be required for the water supply system in the boiler for steam production. Soft water will be required for bleaching and drying of pulp due to the stringent quality requirements of the dissolving pulp.

The concept for obtaining this water is based on the ion exchange technology, through the use of cationic and anionic resins.

Fire Fighting Water System

Fire water will be supplied from the 3,000 m³ firewater tank, which will be supplied with treated water.

There will be two firewater pumps, 570 m³/h, one electric and one diesel. The fire water system will be maintained under a pressure of 12 bar (g) with a jockey pump of 60 m³/h 13 bar (g). The system will power hydrants and sprinklers in the mill.

Cooling towers

The cooling water system will be closed-loop, and countercurrent type towers with exhaust fan at the top are being considered to serve several mill consumers.

The large consumers like turbine condenser, evaporator surface condenser and ozone generator will have dedicated cooling water pumps.

The water lost by evaporation and blow down will have its make up with treated fresh water.

Compressed Air

Both the service air and the instrument air will be treated in a dryer to remove moisture, however there will be 2 independent air nets, one for service air and one for air of instruments.

Both systems will be treated in two dryers to remove moisture. The system consists of three oil-free centrifugal compressors, one for instrument air, one for process air and one as a stand by. The operating pressure shall be 7 bar (g).

5.6.3.2.9 Biomass Boiler

The biomass boiler will supplement the steam generated in the recovery boiler for power generation, through the use of waste wood handling.

Wood handling and brown pulp waste will be mixed and stored in covered biomass pile from where they will be sent to the boiler silos.

The steam produced by the biomass boiler will be mixed with steam from the recovery boiler and sent to the turbogenerators.

An electrostatic precipitator will be installed to control atmospheric emissions.

The biomass boiler will be able to burn methanol as an auxiliary fuel, thus acting as a stand by burning system for recovery boiler. Biomass boiler may also burn the concentrated and diluted non-condensable gases when it can not be incinerated in the recovery boiler.

The ash from the bottom and precipitator will be collected in dedicated silos for later final disposal.

Fuel oil will be used as fuel for starting, stabilizing the production process and eventually for oxidation of non-condensable gases when diverted to the biomass boiler.

5.6.3.2.10 Electric Power Cogeneration (Turbogenerators)

In general terms, it can be said that the cogeneration system starts in the production of high pressure steam that will be carried out by the Recovery Boiler and the Biomass Boiler.

The high pressure steam will expand in the turbine vanes and will be extracted at different pressure levels for use in the pulp process.

The turbogenerators will have the purpose of transforming the thermal energy of the high pressure steam into mechanical energy to drive the electric power generators.

The steam feed to the turbogenerators will be based on balance, plus contingency. The contingency is considered to absorb any variations in the production of steam in the recovery boiler due to variations in the production of the solids contained in the liquor or even in the calorific value.

A new cogeneration unit with a nominal capacity of 132 MW will be installed and 63.5 MW will be consumed in the pulp mill. There will therefore be a surplus, which will be arranged for sale.

5.6.3.2.11 Fire Fighting System

The dissolving pulp mill will be equipped with dedicated fire prevention and control systems.

The internal network of hydrants of the areas will be distributed in ring form that will be fed by the main network of hydrants.

Hydraulic and lubrication units, depending on the volume, can be protected by an automatic sprinkler system controlled by an independent valve and alarm. In addition, each hydraulic and lubrication unit shall be installed within a containment dam with sufficient volume to maintain the full volume of oil in the unit.

Portable fire extinguishers shall be installed at the required locations as required by the Fire Department.

Fire department regulations also require the installation of signage boards in the area reserved for fire extinguishers.

For the firefighting system of the fuel oil storage area, fire hydrants will be installed at suitable locations to provide cooling of the tanks, as well as foam lines to combat occasional tank spills.

All hydrants around the tanks will be provided with foam supply accessories and adjustable nozzles for water mist generation.

Potential oil leakage points, such as flanges, threaded connections, etc., depending on the pressure, may be shielded to prevent fire occurrence in the form of spray.

5.7 Administrative and Operational Support Facilities

Concierges

The mill will count with two 2 concierges, one for access control of people and another for access control of raw material and product outlet.

Administrative building

The administrative building will consist of rooms, toilets, restaurant and medical clinic.

Parking for Vehicles and Trucks

The mill will have parking for touring vehicles for employees and visitors. In addition, there will be truck parking.

Weight Balance

Road balances will be installed to control entry and exit of inputs to the mill.

Warehouse

Next to the administrative building there will be a warehouse for storage of materials in general.

Workshop

The workshop will be used for maintenance of equipment, vehicles and fork-lift of the mill and will be composed of reinforced concrete floor.

The wastewater generated in the workshop will be collected and directed to a water / oil separator tank. The oil collected will be destined for refining, by specialized and licensed company.

Railway Composition Maneuvering Yard

A maneuvering yard will be implanted to receive the railway composition, for the production of dissolving pulp.

The maneuvering yard will be erected inside the site of the LD Celulose and will have an approximate length of 1,500 meters, being connected to the FCA railroad.

5.8 Enviromenmental Control

5.8.1 Liquid Effluent

5.8.1.1 Generation Sources

Basically, the liquid effluents generation sources, that will correspond to the activities of the pulp mill process and other support activities, are listed below:

- Effluents from wood handling area;
- Effluents from cooking area and brown pulp washing area;
- Filtered alkaline and filtered acid form bleaching;
- Effluents from drying machine;
- Effluent from evaporation and recovery;
- Effluents from recausticizing area and lime kiln;
- Contaminated condensate;
- Sanitary sewer;
- Contaminated rainwater; and,
- Others (spills, leaks, areas cleaning etc.).

5.8.1.2 Spill Control System

The spills collecting and handling system has been designed in such a way that accidental discharges can be collected as close to the source as possible, and recycled directly to its own process stage.

The main approaches are:

- Containment with small walls around tanks and equipment where there are black or white liquors and chemicals. An accidental spill/leak will be collected and returned directly to the process;
- Tanks and equipment systems that will enable to drive properly the remains of liquors when needed emptying for maintenance. Process liquors will be taken to a spill tank and return directly to the process rather than being discharged into the effluent collecting system;

- In areas with potential for leakage there will be interconnection of the floor channels from the floor with pumping wells, where the liquids will return to the process;
- Emergency pond in effluent treatment, to where there can be directed also the main effluents in the case of spills that were not contained with the previously provided ways;
- Appropriate instrumentation for on-line effluent monitoring, and a good supervisor system to support operators to detect accidental discharge and to take the appropriate corrective measures; and,
- Operators training, process managers and informational systems, where environmental issues and accidental discharges require continuous attention.

5.8.1.2.1 Effluent Treatment Plant (ETE)

The LD Celulose effluent treatment plant will have a capacity of 2,200 m³/h and basically consist of two steps: removal of solids and removal of organic load. The main units of this system are listed and described below.

The main steps of the effluent treatment process are:

- Screening;
- Primary clarifier;
- Emergency lagoon;
- Neutralization;
- Cooling;
- Activated sludge - aeration tank;
- Secondary clarifier; and
- Emissary.

Screening

Untreated effluent will be gravity driven to a screening system to remove coarse materials. This system will be provided with 2 sets consisting of a mechanized screen and a manual screen, which will be used in the maintenance of the mechanized screen.

Primary Clarifier

After passing through the screening and flow measurement system, the untreated effluent will be sent to two primary clarifiers to reduce the amount of suspended solids. These clarifiers will be equipped with a scraper to remove sedimented solids and scum accumulated on the surface thereof. The sedimented solids and scum will be withdrawn by pumps to be sent to the primary sludge dewatering system. The clarified effluent will be sent to the neutralization system.

Primary Sludge Dewatering System

The primary sludge dewatering system will be comprised of a mechanical drum or gravity table type thickener and a screw type dewatering press.

Emergency lagoon

In addition to the expected collection and spill leakage and spill systems in each department of the mill, there will be an emergency lagoon at the effluent treatment plant. The objective of this lagoon will be to receive all effluents with characteristics outside the specification. Once diverted to the emergency lagoon, the contents of the lagoon will be dosed to the inlet of the neutralization tank, so that no disturbance is created in the biological treatment.

The operation of this will be controlled by online monitoring of pH, temperature and conductivity. When levels outside the acceptable range occur, the valves will be closed and the effluent will be diverted to the emergency lagoon.

The lagoon will be constructed as an excavated pond with the bottom adequately waterproofed and inclined to the drainage pumps.

Rainwater

The rainwater that fall into the process areas, because they have a greater contamination potential, will be sent along with the effluents to the effluent treatment plant (ETE) of LD Celulose. The rainwater that that fall into the areas of roofs, streets, etc. as well as the log storage yard, because they have a lower potential for contamination, will be sent to rainwater lagoons, which will be provided with pH and conductivity measurement to avoid hydraulic overload in the ETE due to high rainfall. In these lagoons, if the pH and / or conductivity parameters are outside acceptable standards, these waters will be sent to the ETE. Otherwise, they will be sent for disposal to the Araguari river, which will be carried out through the emissary of treated effluents. It is important to note that these rainwater will be added to treated effluents after the effluent sampling and sampling point.

Effluent Neutralization

The effluent from the primary clarifiers will be sent to a neutralization tank equipped with mechanical mixers. The purpose of this step will be to neutralize the effluent through the addition of caustic soda or sulfuric acid, aiming to maintain a pH between 6 and 8, making it suitable for biological treatment.

Effluent Cooling

The neutralized effluent still has a temperature considered high for biological treatment, then should be cooled to a temperature that does not adversely affect the performance of the biological treatment.

The effluents cooling will be carried out through a cooling tower, being sized to an approximate temperature of 70 °C, and an exit temperature of around 35 °C.

Activated Sludge

The biological treatment system adopted in the LD Celulose will be of the aerobic type by activated sludge. The biological process requires, for optimum performance, sufficient concentrations of nitrogen and phosphorus in the effluent. Urea and

phosphoric acid are being considered as sources of nitrogen and phosphorus and will be added, if necessary, before the effluent enters the aeration tank.

After the dosage of nutrients, the effluents will be sent to the selector tank, where they will be submitted to the degradation of the organic matter present in the soluble and colloidal form through the activity of the aerobic microorganisms. The air injection into the system will be performed by fine bubble diffusers that will be installed in the bottom of the aeration tank. These diffusers will provide oxygen necessary for the development of the bacteria and promote mixing of the liquid mass contained in the aeration tank, keeping the mixture in suspension.

In the activated sludge process, there will be the formation of the biological mass (sludge) that must be physically separated from the liquid mass (clarified effluent), which will occur through four secondary clarifiers. The treated and clarified effluent will be released through emissary and diffusers in the river.

Secondary (biological) sludge will be constantly removed from the bottom of the clarifiers through scrapers and directed by gravity into a sludge pit, from where it will be pumped to aeration tank, and recirculated. The excess biological sludge will be sent to the secondary sludge dewatering system.

Secondary Sludge Dewatering System

The secondary sludge dewatering system will consist of mechanical type thickeners and centrifuges.

5.8.1.3 Final Disposal

The treated effluent will be discharged into the Araguari river through an underwater emissary.

The emissary is intended for the treated effluents discharge in the river, under controlled and safe way through the underwater discharge in conditions that prevent the formation of foams and promote dispersion in the most efficient way in the receiving body.

The complete system consists of: (a) one treated effluent well; (b) emissary of treated effluents to the river bank, at of the discharging point; (c) control valves; (d) emissary piping in the riverbed; (e) vertical risers with nozzles for underwater discharging and dispersal in river waters.

The underwater pipelines will consist of 3 parallel lines (2 in operation and 1 spare) of HDPE (high density polyethylene), in the bed of the river. At certain locations favoring the best dispersion in river waters and the homogenization of the mixture, there will be steel risers, which will conduct the treated effluent from the buried pipelines approximately 50 cm above the river bed.

At the end of each riser there will be a 90 ° turn to the horizontal. At the end of this curve, a special check valve will be installed, allowing the discharge of effluent jets optimally, as well as prevent the entry of sand and foreign bodies into the system.

5.8.2 Air Emissions

5.8.2.1 Emission Source and Main Control Parameters

The main sources of atmospheric emissions from the mill will be generated from the following equipment:

- Recovery boiler;
- Lime kiln; and,
- Biomass boiler.

The main control parameters related to the significant atmospheric emissions of a pulp mill correspond to:

- Particulate matter;
- TRS (Total Reduced Sulfur);
- SO_x (sulfur oxides);
- NO_x (nitrogen oxides); and
- CO (carbon monoxide).

5.8.2.2 Technologies for Minimization, Control and Monitoring of Atmospheric Emissions

The minimization, control and monitoring of atmospheric emissions will be based on the technologies already consecrated and used with great success, which are listed below:

- Use of low odor recovery boiler;
- High dry solids content of up to 80% in the burned liquor in the recovery boiler, which minimizes SO_x emissions;
- Use of high efficiency electrostatic precipitators for the recovery boiler, biomass boiler and lime kiln;
- Collection of concentrated non-condensable gases from the digester and evaporation, and its incineration in the recovery boiler. If these gases can not be burned in the recovery boiler, they will be burned in the biomass boiler and, if it is not possible, the gases will be incinerated in flare;
- Extensive collection of diluted non-condensable gases from the digester, brown pulp line, evaporation and causticizing, with treatment in the recovery boiler;
- Treatment of the dissolution tank gases in the recovery boiler itself;
- Efficient cleaning of bleach plant relief gases; and
- Gas monitoring systems and real-time control system, identification and rapid correction of operational disturbances.

Recovery Boiler

The recovery boiler will be equipped with a high efficiency electrostatic precipitator to remove particulate matter, which will be collected and transported to the mixing tank.

The electrostatic precipitator will promote the removal of solid, or liquid, microparticles charged by a gaseous stream through the use of static electricity. The electrostatic pickup process is highly efficient, allowing the removal of extremely fine particles.

The precipitator to be used will have separate chambers, operating together, in parallel. In this way it is possible the occasional removal of one of the operating chambers, so as to facilitate its maintenance and not significantly affect the overall efficiency of the control facility, since the system is already designed for such eventualities.

Lime Kiln

For air pollution control, the lime kiln will be equipped with a high efficiency electrostatic precipitator to remove particulate matter from the flue gases. This material will return to the lime kiln. The description of the precipitator control is similar to the description of the recovery boiler.

Biomass Boiler

Due to the legal requirements regarding the emission of particulate matter in the flue gases, the best alternative for the cleaning of gases generated in the combustion by the biomass boiler will be high efficiency electrostatic precipitators for the removal of particulate matter.

Non-Condensable Gas Collection and Incineration System

The non-condensable gases of high concentration generated in the evaporation plant will be incinerated in the recovery boiler. If these gases can not be burned in the recovery boiler, they will be burned in the biomass boiler and, if it is not possible, the gases will be incinerated in flare.

The low-concentration non-condensable gases collected at various sources in the process areas of the fiber line and the evaporation plant will be conditioned before being introduced as secondary air into the recovery boiler or the biomass boiler.

The diluted gases from the recovery tank of the recovery boiler will be cooled in a washer, reheated and introduced as secondary air into the recovery boiler.

The flue gases from the lime extinguisher, causticizers, storage tanks and causticizing equipment will be collected, cooled in a heat exchanger to remove moisture and sent through a fan as combustion air.

5.8.3 Solid Wastes

5.8.3.1 Generation Sources

In the dissolving pulp mill, during the operation phase, industrial and non-industrial solid waste will be generated.

Industrial Solid Waste

The industrial solid waste generated by the pulp production process will come from the areas of wood handling, causticizing, boiler and water and effluent treatment plants.

In this category, the following main residues are included:

- Waste from wood preparation;
- Biomass boiler ash;
- Dregs, grits and lime mud;
- Sludge from the water treatment plant; and
- Prim Primary and secondary sludge from the effluent treatment plant.

Non-industrial Solid Wastes

Non-industrial solid waste corresponds to all materials discarded by the administrative and operational support activity that covers the activities of offices, restaurants and maintenance workshops.

The following main residues are included in this category:

- Paper / Cardboard;
- Plastics;
- Metallic scrap;
- Waste from maintenance workshops;
- Restaurant waste;
- Waste from health services; and
- Fluorescent lamps, batteries and batteries.

5.8.3.2 Solid Waste Management

The solid waste management generated during the dissolving pulp mill operation will contemplate the best practices, as described in Federal Law 12,305 / 2010, among which the following stand out:

- Minimization of waste generation through the use of the 3R's principle (Reduce, Reuse, Recycle);
- Solid Waste Segregation, according to the color standard established by CONAMA Resolution No. 275/2001;
- Collection, packaging, storage and transport of solid waste, in accordance with current legislation;
- Environmentally appropriate final destination (reuse, recycling, composting, energy use, etc.) and / or environmentally appropriate disposal (industrial landfill) of the solid waste generated in the project.

Waste Classification

Standard ABNT NBR 10.004 classifies solid waste as regards its hazardousness, that is, its potential risks to the environment and public health. These wastes are classified in: Class I - hazardous waste, Class IIA - non-hazardous and non-inert waste, and Class IIB - non-hazardous and inert waste. The waste from the pulp mill is classified as follows:

- Waste Class I - Hazardous Waste: workshop waste (lubricating oils), waste contaminated with paint, waste contaminated with chemicals and also contaminated packaging, health care waste, fluorescent lamp, batteries and batteries;
- Waste Class II - Non-Hazardous Waste: ETE and ETA sludge, biomass boiler ash, dregs/grits, lime sludge, wood (organic) handling waste, paper / cardboard, plastic, scrap metal, glass, organic waste (meal rest), waste tires / rubber.

Segregation and Conditioning of Solid Waste

The mill must have a system of selective collection that aims to separate previously in the source the materials with similar characteristics.

The temporary storage of solid waste will be carried out in suitable collectors in such a way as to eliminate risks to human health and the environment. This storage will be in accordance with the Standards ABNT NBR 11,174 - Storage of IIA - non inert and IIB - inert waste and ABNT NBR 12.235 - Storage of Hazardous Solid Waste, and CONAMA Resolution 358/2005, as well as ANVISA RDC No. 306/2004.

Treatment and Final Disposal

Os resíduos sólidos serão destinados para tratamento e/ou disposição final, conforme descrito na Tabela a seguir.

Table 3 – Forms of treatment and / or disposal of solid waste in generating areas

Solid waste	Treatment	Destination or Final Disposition
Wood waste + sand	Composting / incineration on biomass boiler	Forest application / Industrial landfill (by third parties)
<i>Dregs/ grits</i>	Corrective soil acidity	Forest application / Industrial landfill (by third parties)
Lime mud	Corrective soil acidity	Forest application / Industrial landfill (by third parties)
Precipitator lime	Corrective soil acidity	Forest application / Industrial landfill (by third parties)
Ash + sand	Corrective soil acidity / composting	Forest application / Industrial landfill (by third parties)
Primary Sludge	Composting / incineration on biomass boiler	Forest application / Industrial landfill (by third parties)

Solid waste	Treatment	Destination or Final Disposition
Secondary Sludge	Composting / incineration on biomass boiler	Forest application / Industrial landfill (by third parties)
Sludge from ETA	Composting / incineration on biomass boiler	Forest application / Industrial landfill (by third parties)
Metal scrap	-	Recycling
Paper / Cardboard	-	Recycling
Plastic	-	Recycling
Glass	-	Recycling
Organic	Composting	Forest application / Industrial landfill (by third parties)
General non-recyclable waste	-	Landfill of third party or municipal duly licensed
Health Service	-	Incineration
Hazardous waste	-	Incineration / coprocessing
Lubricant	-	Refining

Composting

Residues generated in pulp production processes such as eucalyptus bark, woodyard waste, primary and secondary sludge from the treatment of liquid effluents, as well as biomass boiler ashes, can be previously submitted to the composting process by accelerated fermentation.

This process, in which the microorganisms transform the initially Carbon / Nitrogen ratio of 120/1 to below 26/1, will result in excellent quality material for agricultural purposes.

The process will start with the proper mixing of the residues in a row, where the microorganisms responsible for the fermentation will be inoculated. These patios will be constructed with compacted clay forming an inclined plane towards the system of collecting percolates with slope, that allows the rapid drainage of rainwater, aiming to minimize the drag of solid material.

The composting lines shall be assembled from the material unloaded by the trucks in parallel lines until they occupy the entire length of the respective yard. After all the loads have been deposited, the material will be reassembled with the aid of a loader or hydraulic excavator, forming a trapezoidal shaped belt. These lines will be made alternately with spacing between them to allow the transit of trucks, the revolving with mechanical equipment.

The percolated liquids will be collected by a drainage net, will go to a leach tank and will then be sent to the mill ETE.

The product obtained has uniform granulometry, which will facilitate the application to the soil, proven agronomic characteristics and possibility of registration with the Ministry of Agriculture.

Soil Acidity Corrective Production

Inorganic waste from causticizing (dregs/grits, lime mud and precipitator lime) and biomass boiler (ash) will be used for the production of soil acidity corrective.

Depending on its composition, lime sludge and ash may be used individually as a soil acidity corrector.

Lime mud and dregs with grits are basically carbonated alkaline by-products, which have a high concentration of nutrients such as calcium and magnesium and have high neutralization capacity.

The ash, in spite of the low neutralization capacity, presents concentration of macronutrients such as phosphorus, potassium, calcium and magnesium that enrich the corrective acidity of the soil. These nutrients are important for plant development.

6 HAZARDS IDENTIFICATION

In order to identify the hazards, the Preliminary Hazard Analysis (APP) technique was used in order to identify the hazards, their causes, the effects (consequences), if external damage is caused and what protections exist, with possible observations and recommendations relevant.

The APP sheets were filled out by PÖYRY Tecnologia's technicians, with a grant from LD Celulose, based on the characterization of the project, identifying the main hazards, their causes and their associated effects.

ANNEX II presents the APP sheet containing the hazards identified in the operational activities of the dissolving pulp mill.

7**REVIEW OF HAZARDS IDENTIFICATION**

The data and information that guide the Risk Management Program (PGR) are based on the characterization of the project and the environment, as well as on the identification of hazards, which, over time, should be reviewed and updated, since activities, materials and equipment, or even the neighborhood and other aspects of the factory environment undergo changes and exhibit dynamic behavior.

Therefore, periodically, or whenever necessary, not to exceed five (5) years, the hazard identification should be reviewed in order to provide the necessary subsidies for the updating and improvement of the Risk Management Program (PGR), contributing for the prevention of emergency situations and improvement of the actions foreseen in the Emergency Action Plan (PAE).

When accidents at the mill occur, as well as the detection of dangerous situations which may contribute to the generation of accidents, hazard identification should be reviewed.

Any employee who has a direct relationship with the operational area, maintenance and / or emergency response may suggest to the PGR Coordination that a specific study be carried out to evaluate or revise the risks.

The PGR Coordination should evaluate the requests and promote the execution of the specific study, for later evaluation and implementation of the suggested mitigating measures, if pertinent from the point of view of reduction and management of the risks in question.

8 OPERATIONAL PROCEDURES

LD Celulose takes special care in the preparation, disclosure and updating of its operational procedures, especially those related to operations that may cause accidents and environmental impacts, ensuring that activities are planned and executed in accordance with pre-established instructions, and that detail each step to be followed in the different operations, considering the required security requirements.

All teams that will compound the mill staff will follow the guidelines and procedures established in the operating procedures. It is very important that these activities and tasks are delegated to qualified people to perform them, thus reducing the possibility of an operational error.

All procedures should be available to the Mill Manager as well as to the operational teams in the form of digital documentation in the local network system.

It will be the responsibility of the Mill Manager to update the operational procedures related to the activities carried out at the mill.

The minimum frequency to verify the need to update and review each of the operational procedures is two years, or in case of any changes in the facilities or in the operational activities of the dissolving pulp mill.

The company will have security procedures to carry out any operation that may subject any employee of the company to a situation in which its integrity is compromised. The HSMT Team will be responsible for carrying out these operations, and the latter shall strictly follow the content recommended in the Company's Safety Procedures when there is a need to carry out any operation that is identified by them.

The main operating procedures applicable to the operations of the dissolving pulp mill are listed in **ANNEX III**.

9 MODIFICATIONS MANAGEMENT

In the dissolving pulp mill, all modifications to the physical facilities, processes, procedures, acquisition of hazardous inputs and implementation of new activities that have the potential to impact the environment, occupational health and safety will be duly managed by Mill Management.

This management aims to minimize possible environmental impacts, ensure the physical integrity and health of workers and the integrity of industrial facilities.

Thus, the management of these modifications aims to establish the systematic to follow up, establish deadlines, analyze the security and environmental aspects about the change and define those responsible for communications to those involved and impacted.

The scope applies to all changes to be made at the mill that have the potential to generate or modify environmental aspects, occupational health and safety aspects, such as:

- Implementation of new activities;
- Modification of the physical facilities of the various process areas (wood yard, fiber line, drying, chemical recovery circuit, utilities), firefighting system, storage of chemical inputs;
- Changes in the operations of the process areas;
- Change due to changes in legislation.

At the time of the need for modification, the department responsible for the area, equipment or process shall communicate and request a hazard and risk assessment to the HSMT and Environment Teams.

The Environment Team will also be responsible for verifying compliance with the requirements of the Environmental Management System as well as the environmental legislation applicable to the modification.

Mill Management will be responsible for verifying and managing the necessary modifications to the operating procedures.

In case of modification in physical facilities, the department responsible for the area will request the appropriate adjustments in drawings, plans, flowcharts to the Engineering Team.

The department by the area in which the modification will occur will be responsible for defining the term of the change, whether provisional or definitive.

The monitoring and recording of the modifications will be managed by the Mill Management and the Engineering Team.

ANNEX IV presents the operational procedure " Modifications Management", which establishes criteria for conducting a process of analysis of the safety, health and environmental aspects of LD Celulose.

10 MAINTENANCE AND GUARANTEE OF INTEGRITY

LD Celulose adopts as a philosophy to maintain in optimum conditions of operation all the critical equipment and systems of the dissolving pulp mill, in order to avoid that any failures can compromise the operational continuity, the safety of the facilities, people and the environment.

All systems and components in which failures may contribute or cause unacceptable environmental or operating conditions will be considered critical.

The dissolving pulp mill will have digesters, bleaching towers, evaporation plants, recovery and biomass boilers as critical systems, including electrostatic precipitators, sulfur dioxide plant, ozone plant, concentrated non-condensable gases and firefighting system.

Maintenance of the critical systems of the dissolving pulp mill is the responsibility of the Maintenance Team, who will follow the maintenance program and procedures, which shall include the identification and categorization, inspections and tests, as well as the respective documentation of the inspection results and services performed.

The specific maintenance and inspection procedures will bring together in a condensed and simple manner the main technical and administrative concepts and guidelines related to the specific activities, as well as include forms, checklists and LD Celulose standards.

Scheduled periodic maintenance, also called preventive maintenance, will be carried out during the so-called "general stops", which will occur every 12 to 15 months of operation.

11 HUMAN RESOURCES TRAINING

LD Celulose adopts as a policy to promote the training and development of all its employees, favoring organizational learning and self-development, aiming to contribute to the strategic needs of the company.

In line with this policy, a training procedure (**ANNEX V**) was developed for the operations of the dissolving pulp mill.

The purpose of this procedure is to ensure that employees (including emergency brigade members) who carry out the operations involved in the mill are fully qualified to perform their duties and are continuously up-to-date for the development of their activities.

Proper training is a basic requirement for efficient and safe operations. In this way, all employees of the company should know in detail their tasks, demonstrating the competence required in the performance of their duties.

All training will be recorded, through the presence list, indicating the date of the training; professionals (name, position and area of activity); local; and responsible for the training.

Training will be given to all emergency brigade staff and members, including those newly admitted and transferred, as well as to recycling, with a view to updating and improving knowledge.

Annually, Mill Management, along with Human Resources Teams, and HSMT will conduct a survey of training needs and prepare a training plan.

All training will be analyzed and recorded by the manager of each professional, or by the Human Resources Team, and may be performed by LD Celulose professionals, external consultants or externally.

12 INVESTIGATION OF ACCIDENT AND INCIDENTS

LD Celulose has a policy of investigating incidents and accidents, in order to minimize and prevent the occurrence and incidence of these, thus protecting its human capital and the environment, as well as preserving its facilities.

Based on this policy, all employees of the dissolving pulp mill will follow the procedures established by LD Celulose to investigate incidents and accidents.

The purpose of incident and accident investigation is to obtain as many elements as possible to identify the root causes of such occurrences in order to prevent other similar events.

Incidents or accidents of the activities carried out in LD Celulose, which result or may result in operational discontinuities, damage to the physical integrity of persons, damages to property or environmental impacts will be mandatorily investigated and evaluated in detail.

The investigation will include:

- Technical evaluation of the site;
- Survey of equipment information;
- Consideration of relevant facts;
- Analysis of the information collected;
- Definition of causes that contributed to the occurrence;
- Elaboration of actions to effectively block recurrent causes and abnormalities found.

In the event of an incident or accident, the HSMT Team will immediately report its occurrence, as well as the actions taken, making the records.

As soon as possible, all accidents and incidents with a high potential for seriousness will be analyzed, investigated and their causes duly investigated by Mill Management, with the support of HSMT professionals, members of the Internal Accident Investigation Commission (CIPA) and others involved, called as necessary.

For the investigation of incidents and accidents, the methodology of causes tree is applied, considering the identification of the immediate and basic causes and elaboration of action plan to avoid recurrence. All this research methodology is described in detail in the procedure "Investigation of accidents and incidents" (ANNEX VI). In specific cases, the investigation may count on the advice of external technicians, specially hired for this activity.

After completion of the service, a multidisciplinary team with representatives of the mill will meet to present the results obtained in the collection of information in the field, where they will be debated the failures that contributed to the occurrence of the accident.

13 EMERGENCY ACTION PLAN (PAE)

The Emergency Action Plan (PAE) aims to provide the necessary conditions for triggering fast and efficient actions in cases of emergency, in order to minimize possible damages to people, property and the environment.

The PAE, although elaborated in a specific document, is an integral part of this PGR, which is why it will be permanently updated and periodically reviewed, with the disclosure of any changes or updates to all employees.

Thus, the PAE is presented in **ANNEX VII**.

The Emergency Action Plan (PAE) details: accidental scenarios; organizational structure; flow chart driving; communication in emergencies; emergency action procedures; form of dissemination and training of the PAE; and maintenance of PAE.

The responsibility for coordinating the PAE is the HSMT team of the dissolving pulp mill.

The PAE will be reviewed in a maximum period every 02 (two) years, or when there are changes in the facilities, processes or procedures that impact the actions in case of emergency. In the revisions to the plan, the results and recommendations of risk analysis and review studies shall be considered, especially with regard to accidental scenarios, accident analysis recommendations, as well as any suggestions from audits, after any training / simulation or eventual emergency situation served by the PAE.

It is the responsibility of the PGR Coordination to monitor the updating and revision of the PAE, as well as to promote its integration with other institutions, as well as its dissemination and conduct of simulated exercises and exercises.

14 AUDIT OF PGR

The guidelines for the execution of audits of the PGR in the dissolving pulp mill are established in the procedure "Internal Audit of Management Systems" of LD Celulose, which is found in **ANNEX VIII**, which defines the guidelines, responsibilities and criteria for planning, realization and monitoring of the results of the internal audits, aiming at the adaptation to the normative standards and the fulfillment of the requirements established in:

- Environmental management system
- Occupational Health and Safety Management System
- CETESB Standard P4.261 - Guidance Manual for the preparation of a Risk Analysis Study

The procedures foreseen in the Risk Management Program (PGR) will be verified as to their conformity and effectiveness, through the systematic internal audits of the standards adopted by LD Celulose and Standard CETESB P4.261.

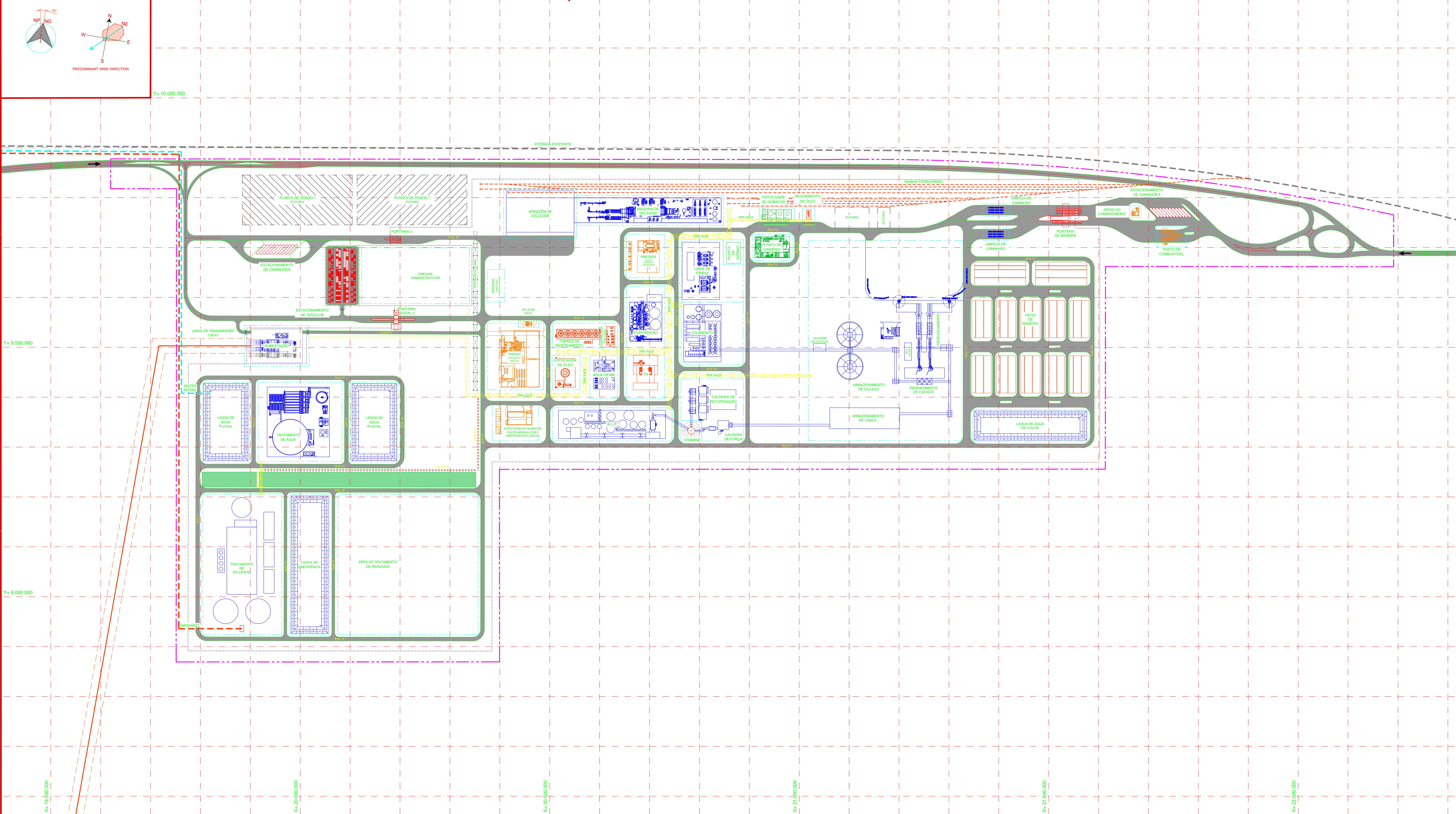
The responsibility for planning the audits of the PGR shall be the consultants of the management system, and the execution shall be carried out by trained and qualified internal auditors of LD Celulose. When necessary, LD Celulose may use external resources to perform these audits, provided they have the competence for the scope to be audited in each system. The execution of audits by external consultants must follow the same flow and standards determined by LD Celulose.

It will be the responsibility of the Coordinator of the PGR to facilitate its implementation in the facilities of the same, as well as to adopt all the necessary actions for the implementation of the corrective measures.

The management of the audits (scheduling, dates of performance, teams of auditors and processes to be audited) will be defined by the management system team.

The audits will be performed based on the criticality of the activities and results of previous audits, each element being audited at most each year, the results of which will be recorded and brought to the attention of those responsible so that, in a timely manner, implement the necessary corrective actions to adapt the eventual non-conformities indicated.

ANNEX I
GENERAL LAY OUT



REVISION TABLE

REV	DATE	PROJ	VERIF	APPROV	AUTHOR	CODE	DESCRIPTION
0							

NOTAS:

LEGENDA:

ÁREAS DE PROCESSO

UTILIDADES E BALANÇO DA PLANTA

QUÍMICOS

PREDIOS NÃO PROCESSOS

FUTURO

LIMITE DO SITE

ITEM PENDENTE:

REFERENCE DOCUMENTS

TITLE	NUMBER

DISTRIBUTION

TO	REVISION	a	b	c	d	e	f
AMADEUS	E						
POYRY	E						

PRELIMINARY

PROJETO AMADEUS

Fábrica de celulose sustentável

Minas Gerais - Brasil

TITLE

LAYOUT GERAL DA FÁBRICA

SCALE

1:2000

UNIT

mm

PROJECTION

PROJ. NUMBER

REV

ANNEX II**HAZARD PRELIMINARY ANALYSIS (APP)**

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Wood Yard							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
1	Ignition in the chip silo or biomass pile	<ul style="list-style-type: none">External ignition source	<ul style="list-style-type: none">FirePersonal accidentMaterial damagesAir quality modificationLiquid effluent from firefighting	C	II	Mn	<ul style="list-style-type: none">Area will be provided of firefighting systemFire will be duly controlled inside Wood Yard area
2	Leakage of leachate of chip pile	<ul style="list-style-type: none">Rupture of the floor of the storage area or containment system	<ul style="list-style-type: none">Modification of soil, groundwater or surface water quality.	B	II	D	<ul style="list-style-type: none">Drainage of the pile should be sent to the effluent treatment systemInstallation of groundwater monitoring wellsFrequent visual inspection of the area, which will allow quick corrective action, minimizing impact in case of floor rupture
<p>Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent</p> <p>Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic</p> <p>Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical</p>							

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Cooking, Brown pulp washing and Delignification							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
3	Ignition in the chip silo	<ul style="list-style-type: none">External ignition source	<ul style="list-style-type: none">FirePersonal accidentMaterials damageImpact on air quality	B	II	D	<ul style="list-style-type: none">Firefighting system will be installed
4	Liquor Leakage of liquor (white and / or black)	<ul style="list-style-type: none">Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impactRupture or failure of components (valve, pump, tank)	<ul style="list-style-type: none">Personal accidentLoss of productAlteration of soil and groundwater qualityAlteration of surface water quality.	D	II	M	<ul style="list-style-type: none">The area will be surrounded by retaining wallEquipment and lines with liquor will be made of stainless steel
5	Leakage of pulp	<ul style="list-style-type: none">Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impactRupture or failure of components (valve, pump, tank)	<ul style="list-style-type: none">Personal accidentLoss of productAlteration of soil and groundwater qualityAlteration of surface water quality	D	II	M	<ul style="list-style-type: none">The area will be surrounded by retaining wall
<p>Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent</p> <p>Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic</p> <p>Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical</p>							

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Cooking, Brown pulp washing and Delignification							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
6	Explosion of digester	<ul style="list-style-type: none">Overpressure	<ul style="list-style-type: none">FireballMaterials damageAlteration of air and soil quality	B	II	D	<p>The design and operation of the Digester is based on the strictest safety criteria in order to prevent accidents and explosions, such as:</p> <ul style="list-style-type: none">High level of instrumentation to allow monitoring of all process variablesPreventive maintenance in relation to the corrosion protection of the digester walls in the occasions of the general stoppingsRedundancy in interlocks at critical safety and process pointsIn addition, both the operation process and the project preparation phase are based on the full compliance with the safety requirements imposed by Regulatory Norm No. 13: Boilers and Pressure Vessels (NR-13)

Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent
Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic
Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Bleaching plant							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
7	Leakage of chemicals (sulfuric acid, sodium hydroxide, hydrogen peroxide, sulfur dioxide solution)	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve, pump, tank)	<ul style="list-style-type: none">• Personal accident• Loss of product• Alteration of soil and groundwater quality• Alteration of surface water quality	C	II	Mn	<ul style="list-style-type: none">• The area will be surrounded by retaining wall

Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent

Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic

Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Drying Machine							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
8	Leakage of pulp from bleached pulp towers	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve, pump)	<ul style="list-style-type: none">• Personal accident• Loss of product• Alteration of soil quality• Alteration of surface water quality	C	II	Mn	<ul style="list-style-type: none">• The area will be surrounded by retaining wall
9	Ignition of pulp bales	<ul style="list-style-type: none">• External ignition source	<ul style="list-style-type: none">• Fire• Materials damage• Personal accident• Alteration of air quality	C	II	Mn	<ul style="list-style-type: none">• Storage area of the pulp bales shall be provided with a firefighting system• The fire will be properly controlled within the area, there being no propagation

Frequency: **A** – Very improbable, **B** – Unprobable, **C** – Remote, **D** – Probable, **E** – Frequent

Severity: **I** – Negligible, **II** – Marginal, **III** – Critical **IV** – Catastrophic

Risk: **D** – Negligible, **Mn** – Minor, **M** – Moderate, **S** – Serious, **C** – Critical

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Evaporation Plant							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
10	Leakage (fugitive emissions) of concentrated non-condensable gases (CNCG)	<ul style="list-style-type: none">Failure on process settings	<ul style="list-style-type: none">Alteration of air quality	D	II	M	<ul style="list-style-type: none">CNCG generating sources shall be provided with a safety system consisting of flame arresters (quebra-chamas) and rupture discs for protection against explosions and accidental emissions to the atmosphereThe piping of rupture disc shall be provided with a pressure sensor so that in the event of a ruptured disc, the ON-OFF valve is immediately closed, blocking the sources and avoiding CNCG emission into the atmosphereEach source will have the emission of CNCG monitored (flow, temperature and pressure)CNCG collection lines will be individualized for better operational controlNon-condensable gases will be collected and incinerated in the recovery boilerFugitive emissions have a low flow rate, which limits their dispersion around the site

Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent

Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic

Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Evaporation Plant							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
11	Leakage of black liquor	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve, pump)	<ul style="list-style-type: none">• Loss of product• Personal accident	D	II	M	<ul style="list-style-type: none">• Chemical recovery areas will have containment walls
12	Leakage of contaminated condensate	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve, pump)	<ul style="list-style-type: none">• Loss of product• Alteration of air quality• Personal accident	C	II	Mn	<ul style="list-style-type: none">• Evaporation area will have a containment wall in all its surroundings• Implementation of high and very high level alarms with stop interlocking and deflection of condensate flows• Implantation of redundancy (additional safety) of interlocking to high level in parallel with level switch
<p>Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent</p> <p>Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic</p> <p>Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical</p>							

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Evaporation Plant							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
13	Leakage of concentrated non-condensable gases (CNCG) after the condenser	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve)	<ul style="list-style-type: none">• Formation of toxic jet• Personal accident• Alteration of air quality	C	III	M	<ul style="list-style-type: none">• Concentrated non-condensable gases (CNCG) will be collected and incinerated in the recovery boiler
14	Explosion of process methanol storage tank	<ul style="list-style-type: none">• Lightning strike over the storage tank• Operational failures in maintenance services (welding)• Failure of the inertization system of the storage tank	<ul style="list-style-type: none">• Explosion• Materials damage• Personal accident• Alteration of air quality	C	III	M	<ul style="list-style-type: none">• Tank will be equipped with SPDA (Atmospheric Discharge Protection System)• Welding services must be performed by highly qualified professionals• Tank inertization should be uninterrupted monitored until the end of maintenance
15	Leakage of process methanol to incineration points	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve, pump)	<ul style="list-style-type: none">• Formation of puddle• Personal accident• Alteration of air quality	C	III	M	<ul style="list-style-type: none">• Piping shall be enveloped• The area will be surrounded by retaining wall
Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical							

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Recovery Boiler							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
16	Explosion of recovery boiler	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Injection of weak liquor (contains lots of water)• Drag water with the gases• Failure on recovery boiler protection system	<ul style="list-style-type: none">• Materials damage• Personal accident	B	III	Mn	<p>The design and operation of the Recovery Boiler are based on the strictest safety criteria in order to prevent accidents and explosions, which are described below:</p> <ul style="list-style-type: none">• Alternative water supply through turbine driven pump;• Black liquor feed system with redundant refractometers for fuel moisture metering• Redundant smelt spreaders per nozzles• Emergency water tank located in the boiler to guarantee the cooling of the nozzles in the event of a lack of electrical energy in the mill• Dissolving tank provided with a relief system (emergency damper) to relieve possible overpressure• Emergency dedicated drainage system totally independent of the main control system (DCS)• Application of special materials in critical areas of the furnace such as curves, air vents, corners• Application of special materials in critical areas in superheaters• Adoption of chloride and potassium purge system to maintain black liquor concentrations at levels that guarantee low corrosivity• BMS (Burner Management Systems) independent of the DCS configured in dedicated PLC with redundancy• High level of instrumentation to monitor all process variables• Redundancy in critical safety interlocks <p>In addition to the above design criteria, the Recovery Boiler design will follow all recommendations of the Black Liquor Recovery Boiler Advisory Committee, a US entity formed in 1961 that establishes procedures and recommendations to increase the safety of recovery boilers, from concept, design, operation phase and maintenance.</p> <p>The sudden expansion of water will produce an increase in pressure that will deform the boiler structure but without causing an explosion. This type of incident, considering that the furnace will operate at basically atmospheric pressure there is relief at the same time producing serious damage to the boiler but without projection of an explosion. There will be an edge of the boiler called "zip corner", in which there will be rupture and the consequent relief of pressure will occur by it, due to the greater fragility of this part.</p>

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Recovery Boiler							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
17	Explosion of electrostatic precipitator	<ul style="list-style-type: none"> Excess of carbon monoxide (CO) due to process failure 	<ul style="list-style-type: none"> Materials damage; Personal accident. 	B	II	D	<ul style="list-style-type: none"> Pipes with gases that will follow to the precipitator will have a carbon monoxide (CO) detector, which in case of presence of this, will automatically and instantly turn off the precipitator, ie the system will be interlocked
18	Explosion of the dissolving tank	<ul style="list-style-type: none"> Operational failure causing nozzle clogging Failure of tank protection system 	<ul style="list-style-type: none"> Materials damage; Personal accident; Alteration of air quality. 	B	II	D	<ul style="list-style-type: none"> Design, operation, and safety requirements of the dissolving tank follow the recommendations of the Black Liquor Recovery Boiler Committee Project provides TV camera to monitor the flow of product in the nozzles; In the event of an explosion, the local is restricted to the recovery boiler area, ie it is confined The premises adopted in danger of boiler explosion (water expansion) are valid in this case as well

Frequency: **A** – Very improbable, **B** – Unprobable, **C** – Remote, **D** – Probable, **E** – Frequent

Severity: **I** – Negligible, **II** – Marginal, **III** – Critical **IV** – Catastrophic

Risk: **D** – Negligible, **Mn** – Minor, **M** – Moderate, **S** – Serious, **C** – Critical

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Causticizing and Lime Kiln							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
19	Leakage of fuel oil in lime kiln feeding	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve)	<ul style="list-style-type: none">• Formation of puddle with possibility of ignition• Alteration of air quality	C	II	Mn	<ul style="list-style-type: none">• The area will be surrounded by retaining wall• Instrumentation / automation system may be interlocked if the operating parameters (pressure, temperature, pressure) change
20	Explosion of electrostatic precipitator (lime kiln)	<ul style="list-style-type: none">• Excess of carbon monoxide (CO) due to process failure	<ul style="list-style-type: none">• Materials damage• Personal accident	B	II	D	<ul style="list-style-type: none">• Pipes with gases that will follow to the precipitator will have a carbon monoxide (CO) detector, which in case of presence of this, will automatically and instantly turn off the precipitator, ie the system will be interlocked
21	Leakage of liquor	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve, pump)	<ul style="list-style-type: none">• Loss of product• Personal accident	D	II	M	<ul style="list-style-type: none">• Chemical recovery areas will have containment walls
Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical							

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Biomass Boiler							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
22	Ignition on biomass silo	<ul style="list-style-type: none">External ignition source	<ul style="list-style-type: none">FirePersonal accident	B	II	D	<ul style="list-style-type: none">Biomass silo is equipped with a fire-fighting systemFire will be properly controlled within the area of the Biomass Boiler
23	Explosion of the biomass boiler	<ul style="list-style-type: none">Rupture or hole in the pipeFailure on boiler protection system	<ul style="list-style-type: none">Materials damagePersonal accident	B	III	Mn	<p>The design and operation of the Biomass Boiler are based on the strictest safety criteria in order to prevent accidents and explosions, which are described below:</p> <ul style="list-style-type: none">Highly automated and instrumented biomass feed control system with online balance of stable and safe fuel mass for combustionAdoption of biomass feed through rotary valves to prevent flame return to storage silosApplication of special materials in critical areas in secondary superheaters (hotter zones) and tertiary superheaters (complete)BMS (Burner Management Systems) independent of the DCS configured in dedicated PLC with redundancyHigh level of instrumentation to allow monitoring of process variablesRedundancy in critical safety interlocks

Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent

Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic

Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Biomass Boiler							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
24	Explosion of electrostatic precipitator	<ul style="list-style-type: none">Excess of carbon monoxide (CO) due to process failure	<ul style="list-style-type: none">Materials damagePersonal accident	B	II	D	<ul style="list-style-type: none">Pipes with gases that will follow to the precipitator will have a carbon monoxide (CO) detector, which in case of presence of this, will automatically and instantly turn off the precipitator, ie the system will be interlocked
<p>Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent</p> <p>Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic</p> <p>Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical</p>							

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Utilities – WTP, ETAC and ETP							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
25	Leakage of chemicals in WTP, ETAC and ETP	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve)	<ul style="list-style-type: none">• Personal accident• Loss of product• Alteration of soil quality	D	II	M	<ul style="list-style-type: none">• The areas of chemical unloading and storage will have containment systems

Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent

Severity: I– Negligible, II – Marginal, III – Critical IV – Catastrophic

Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Chemicals – Sulphuric Acid (H ₂ SO ₄)							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
26	Leakage of H ₂ SO ₄ from truck unloading to consumption	<ul style="list-style-type: none">• Hose rupture• Hose disconnection• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve, pump).	<ul style="list-style-type: none">• Personal accident• Loss of product• Alteration of soil quality	D	II	M	<ul style="list-style-type: none">• Product unloading of the truck will be done in an area with containment, and any effluents sent for treatment• Equipment and lines with sulfuric acid will be stainless steel
27	Unwanted product formation	<ul style="list-style-type: none">• Shipping of sulfuric acid to another chemical tank due to operational failure	<ul style="list-style-type: none">• For the sodium hydroxide tank: pressure increase in the tank with possibility of tank rupture• For hydrogen peroxide tank: possibility of tank rupture	A	II	D	<ul style="list-style-type: none">• Unloading of sulfuric acid will be done by properly trained personnel, with verification of the type of product transported versus the destination tank• Daily schedule of product delivery schedules should be confronted. No product out of this daily list will be received• Density and composition of the product will b controlled prior to unloading

Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent
Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic
Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Chemicals – Hydrogen Peroxide (H ₂ O ₂)							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
28	Leakage of H ₂ O ₂ from truck unloading to consumption on fiberline	<ul style="list-style-type: none">• Hose rupture• Hose disconnection• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve, pump)	<ul style="list-style-type: none">• Loss of product• Personal accident• Alteration of air quality	D	II	M	<ul style="list-style-type: none">• Product unloading of the truck will be done in an area with containment, and any effluents sent for treatment• H₂O₂ storage tank will be equipped with a containment basin
29	Explosion of H ₂ O ₂ storage tank	<ul style="list-style-type: none">• Product contamination• Product heating (external fire)	<ul style="list-style-type: none">• Materials damage• Alteration of air quality	B	II	D	<ul style="list-style-type: none">• Instrumentation / automation system may be provided with interlocking in case of changes in operating parameters (pressure, temperature, flow)• The storage tanks should have a pressure relief system, with alarm indication in case of high pressure
<p>Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent</p> <p>Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic</p> <p>Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical</p>							

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Chemicals – Hydrogen Peroxide (H ₂ O ₂)							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
30	Unwanted product formation	<ul style="list-style-type: none">Shipping of H₂O₂ to another chemical tank due to operational failure	<ul style="list-style-type: none">For the sodium hydroxide tank: pressure increase in the tank with possibility of tank ruptureFor sulfuric acid tank: possibility of tank rupture	A	II	D	<ul style="list-style-type: none">Unloading of hydrogen peroxide will be done by properly trained personnel, with verification of the type of product transported versus the destination tankThe daily schedule of product delivery schedules should be confronted. No product out of this daily list will be receivedThe density and composition of the product will be controlled prior to unloading

Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent

Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic

Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Chemicals – Sodium Hydroxide (NaOH)							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
31	Leakage of NaOH from truck unloading to the pump	<ul style="list-style-type: none">• Hose rupture• Hose disconnection• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve, pump)	<ul style="list-style-type: none">• Loss of product• Personal accident• Alteration of air quality	D	II	M	<ul style="list-style-type: none">• Product unloading of the truck will be done in an area with containment, and any effluents sent for treatment
32	Unwanted product formation	<ul style="list-style-type: none">• Shipping of sodium hydroxide to another chemical tank due to operational failure	<ul style="list-style-type: none">• For the hydrogen peroxide tank: explosion or tank rupture• For sulfuric acid tank: possibility of tank rupture	A	II	D	<ul style="list-style-type: none">• Unloading of sodium hydroxide will be done by properly trained personnel, with verification of the type of product transported versus the destination tank• The daily schedule of product delivery schedules should be confronted. No product out of this daily list will be received• The density and composition of the product will be controlled prior to unloading

Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent

Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic

Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Chemicals – Oxygen Plant (O ₂)							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
33	Leakage of O ₂	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve, pump, compressor, vaporizer)	<ul style="list-style-type: none">• Personal accident	D	I	Mn	<ul style="list-style-type: none">• Instrumentation / automation system may be interlocked if the operating parameters (pressure, temperature, pressure) change
<p>Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent</p> <p>Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic</p> <p>Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical</p>							

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Chemicals – Ozone Plant (O ₃)							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
34	Leakage of ozone in compressor discharge	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve, pump, compressor, vaporizer)	<ul style="list-style-type: none">• Personal accident• Alteration of air quality• Dispersion of gases cloud	C	II	Mn	<ul style="list-style-type: none">• Instrumentation / automation system may be interlocked if the operating parameters (pressure, temperature, pressure) change

Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent
Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic
Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical

APP – PRELIMINARY HAZARD ANALYSIS							
Area: Chemicals – Sulphur Dioxide Preparation (SO ₂)							
Item	Hazard	Possible Causes	Possible Effects	Grade			Remarks and/or Recommendations
				Freq.	Sever.	Risk	
35	Leakage of sulfur dioxide from storage cylinders	<ul style="list-style-type: none">• Overpressure• Rupture of cylinders due to mechanical impact	<ul style="list-style-type: none">• Personal accident;• Alteration of air quality;• Dispersion of toxic cloud.	C	III	M	<ul style="list-style-type: none">• Storage location of the SO₂ cylinders shall be insulated, surrounded and properly signaled• Approach equipment for brigadistas• SO₂ cylinders shall be manufactured in accordance with strict safety criteria in accordance with current standards and legislation
36	Leakage of sulfur dioxide between the cylinders and the vaporizer	<ul style="list-style-type: none">• Hose rupture or disconnection;• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve)	<ul style="list-style-type: none">• Personal accident;• Alteration of air quality• Dispersion of toxic cloud	C	III	M	<ul style="list-style-type: none">• Storage location of the SO₂ cylinders shall be insulated, surrounded and properly signaled• Preventive maintenance on the hoses, lines and valves of the vaporizer feed system
37	Leakage of sulfur dioxide between the vaporizer and the absorption tower	<ul style="list-style-type: none">• Rupture or hole in the line due to:<ul style="list-style-type: none">- Corrosion- Mechanical failure- Operational failure- Mechanical impact• Rupture or failure of components (valve, vaporizer)	<ul style="list-style-type: none">• Personal accident• Alteration of air quality• Dispersion of toxic cloud	C	III	M	<ul style="list-style-type: none">• Instrumentation / automation system will be provided with monitoring of operating parameters (pressure, temperature) and, in case of change, there will be immediate intervention

Frequency: A – Very improbable, B – Unprobable, C – Remote, D – Probable, E – Frequent

Severity: I – Negligible, II – Marginal, III – Critical IV – Catastrophic

Risk: D – Negligible, Mn – Minor, M – Moderate, S – Serious, C – Critical

ANNEX III

OPERATIONAL PROCEDURES

LIST OF THE MAIN PROCEDURES APPLICABLE TO THE OPERATION OF THE DISSOLVING PULP MILL

Title
Wood Yard – Operacional procedure
Cooking Plant – Operacional procedure
Delignification and brown pulp washing– Operacional procedure
Bleaching plant – Operacional procedure
Drying machine – Operacional procedure
Evaporation Plant – Operacional procedure
Recovery boiler – Operacional procedure
Causticizing and lime kiln – Operacional procedure
Water Treatment Plant (ETA) – Operacional procedure
Softening Water – Operacional procedure
Cooling Towers – Operacional procedure
Biomass boiler – Operacional procedure
Turbogenerators – Operacional procedure
Effluent treatment plant – Operacional procedure
Chemicals storage and distribution – Operacional procedure
Sulphur dioxide preparation – Operacional procedure
Oxygen and Ozone plants – Operacional procedure
General safety and health work rules – Procedure
Environmental and occupational safety and health management
Security signage – Procedure
Use of personal protective equipment – EPI – Procedure
Services in electricity – Procedure
Work at height – Procedure
Works on confined spaces – Procedure

Title
Work Release – Procedure
Attendance and management of emergencies – Procedure
Formation and training of fire and emergency brigades – Procedure
Attendance of fire and explosion – Procedure
Chemical emergency attendance – Procedure
Attendance in emergencies in electrical systems – Procedure
Firefighting equipment and chemical leakage – Procedure
Facilities project, workplaces and new services
Identification and evaluation of environmental aspects and impacts
Identification of legislation and other applicable legal requirements
Identification of hazards, risk assessment and determination of controls
Accident and incident treatment, investigation and communication
Document elaboration and control
Critical evaluation of Directors
Management systems audit
Control of records
Corrective action (treatment of anomalies) and preventive action
Training and developing

ANNEX IV
MODIFICATIONS MANAGEMENT

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1. OBJECTIVE

Establish guidelines for measures to be taken to prevent potential risks to health, safety and the environment, when associated with changes in the various areas of production process at LD Celulose dissolving pulp mill.

The objective of this Procedure is to provide a systematic analysis of possible risks introduced by modifications, identification of risk reduction measures and formal approval before they are effectively carried out in the system.

2. DEFINITIONS

2.1 Modification

A modification occurs whenever some engineering characteristic of the process or equipment (mechanical, electrical, fluid, instrumentation and control, structural, etc.) or its operating conditions (temperature, pressure, flow, process variable security limits, quantities produced, etc.) is changed.

Permanent Modification

It is the one for which there is no prediction of a return to the previous condition (before the modification), and is thus definitely incorporated into the system.

Temporary Modification

It is the one for which a date of return is fixed to the previous condition (before the modification) of the system, being, therefore, only a temporary alteration of the operational conditions.

2.2 New Project

Any design of a new equipment or system to be introduced on the premises of the company.

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3. DEVELOPING

The modifications will be related to any types of changes in the items described below that may occur in activities or services and that may represent some potential health, safety and environmental risk:

- Equipment / facilities;
- Lay out;
- Process variables (pressure, temperature, flow, etc.);
- Personnel (change of roles and responsibilities);
- Material (composition, properties, packaging);
- Operating, handling, transport, maintenance, stopping / starting procedures.

The modifications may originate from:

- Analysis of expansion, reform or modification project;
- Analysis of accidents and incidents;
- HSMT area reports, such as PCMSO and PPRA;
- Request from interested parties;
- Requests for studies by the Engineering Team.

Both planned and unplanned (as identified) changes in activities, processes and products, whether temporary or definitive, focusing on any of the items identified above and characterized as modifications, will relate in their study:

- Risk analysis mechanisms related to the execution and implementation of the modification, such as: FMEA, HAZOP, evaluation and control worksheets for

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risk factors, environmental aspects and impacts, occupational hazards and risks, among others;

- Risk mitigation controls identified, including emergency scenarios - prevention / elimination, mitigation / mitigation;
- Definition of the responsibilities of both analysis and approval, as well as control of the execution and closure of the modification;
- Authority levels associated with modifications;
- Records applicable for managerial analysis and possible future proof.

No modification can be initiated without having taken the necessary measures and that all the functions involved are previously communicated.

Management of modifications should be performed, tested, inspected and / or audited during and after implementation as a way of ensuring the effectiveness of mitigation controls. In this specific stage, the responsibility, authority and communications applicable to the modification will be left to the change manager exclusively, and this process can be delegated through formalization.

3.1 Permanent and Temporary Modifications

Two distinct types of modification are considered in this document: permanent modifications and temporary modifications.

Both types may be responsible for major accidents, so both should be subject to the procedures specified in this management element. However, for a temporary modification, it may not be necessary to complete all the steps required for a permanent modification. For example, in the case of a temporary change, the documentation of the equipment or process (engineering flowcharts, process flowcharts, etc.) need not be changed.

For a temporary modification, the date on which the modification will be undone and the process or equipment returned to the normal condition (prior to modification) must be specified.

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The renewal of the period of validity of a temporary modification should be analyzed to see if the protective measures are being maintained as recommended in the initial approval.

3.2 Analysis and Approval of a Modification

Before a modification is implemented, the requesting Supervisor shall arrange for a Preliminary Hazard Analysis (APP) of the requested modification. The APP may be performed by a team or only a single responsible technician, depending on the complexity of the modification.

3.3 Analysis and Approval of a New Project

Before a new project is approved, the Supervisor in the area that will receive the new equipment / system should arrange for a Preliminary Hazard Analysis (APP) of the new project. The APP should be carried out by a team composed of individuals who have experience in the design, operation and maintenance of similar equipment / systems.

ANNEX V

TRAINING

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1. OBJECTIVE

The purpose of this procedure is to promote the training and development of the professionals of LD Celulose, aiming to reach the needs of the company, through the search for performance.

2. DEFINITIONS

2.1 Competencies

It is the result of applying a set of knowledge, skills and attitudes that generate superior performance.

2.2 Competencies Management

Process that identifies the competency profile of the position, allowing the analysis of professional development actions.

2.3 Development Actions

Resources that aim at the development of skills. Examples: technical visits, face-to-face training, participation in projects, etc.

2.4 Profile

Basic qualifications of training, experience, training and skills that professionals must present to perform a particular position in LD Celulose.

2.5 Requirements

Requirements of training and / or knowledge essential for the performance of the specific activities of each position, considering applicable legislation, management systems, among others.

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3. ACTIVITIES

3.1 Profile

The professionals of LD Celulose will be qualified on a profile basis, which will include training requirements, experience, training or legal records and skills.

The position profile will be established by the coordinators, together with the Human Resources team.

3.2 Requirements

The coordinators will be responsible for defining and updating the requirements for each position in their area, with the support of the Human Resources team.

3.3 Competency Evaluation and Identification of Training Needs and Development

- The initial assessment of the professional's competences will be made during the selection process, from the profile defined for the position;
- The identification of training and development needs will be carried out through competency evaluations carried out by the coordinator and / or through requirements;
- In the case of legal requirements, the identification of training needs may be associated with the position or the professional.

3.4 Enabling Training and Development Actions

- To make feasible the training and development plan, the following will be considered: area strategy, target public, availability of professionals, applicable legislation, environmental aspects and impacts, and occupational safety and health risks;
- The planned and unplanned development actions during the year will be analyzed by the manager, together with the Human Resources team, and will be planned for the following year, if necessary.

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3.5 Evaluation of Effectiveness

The efficacy assessment aims to confirm that the expected results of the requesting area will be obtained.

3.6 Awareness

The awareness of LD Celulose professionals will be made to ensure that professionals are aware of the relevance and importance of their activities and how they contribute to achieving the company's goals and objectives.

The awareness will be made by the coordinators or Human Resources staff through training, meetings, panels located at strategic points of the company, e-mail, and / or other appropriate means, which will include:

- Roles and responsibilities in achieving compliance with LD Celulose's policy, complying with the procedures and potential consequences of its non-compliance and management system requirements, including emergency preparedness and response requirements;
- Significant, actual or potential environmental impacts of your activities, as well as the environmental benefits of improving your personal performance in your area of work;
- Actual or potential hazards and risks of your activities, as well as the benefits to HSMT, resulting from the improvement of your personal performance in your work area.

3.7 Indicators

Indicators of hours of training, investment and others when relevant will be considered.

ANNEX VI**INVESTIGATION OF ACCIDENTS AND INCIDENTS**

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	INVESTIGATION OF ACCIDENTS E INCIDENTS	Date	24/06/2018
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1. OBJECTIVE

This procedure aims to describe the systematic treatment and investigation of incidents and accidents arising from the activities, products and services of LD Celulose.

2. DEFINITIONS

2.1 Accident

Unwanted and unexpected event, resulting in occupational injury or illness, property damage, and other losses.

2.2 Accident at Work

This is caused by the exercise of work at the service of the company, causing bodily injury or functional disturbance that causes death, loss or reduction of capacity for work, permanent or temporary. The classification of occupational accidents is described below:

2.2.1 Accident with Removal

Event that prevents the injured person from returning to work until the day following its occurrence.

2.2.2 Accident without remoteness

Event that causes injury or functional impairment of a light nature, which does not prevent the injured from returning to work within a maximum period of 24 hours. Also included as non-dismissal accidents are those that require the performance of a medical act.

2.3 Accident Outside Work

Event that occurs outside the company's premises and the exercise of work (for example, at home, on the street or at leisure), causing the professional bodily injury or functional disturbance.

2.4 Accident with Property Damage

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Event that causes interruption of production or damage to facilities, equipment or property owned by LD Celulose, within or outside the limits thereof.

2.5 Incident

Unwanted and unexpected event, which under slightly different circumstances, could result in an accident.

2.6 Immediate Causes

It is the conditions or practices below the standards that give rise to the accident.

2.7 Basic Causes

These are personal factors or work environments that give rise to conditions or practices minor of the standards.

2.8 CIPA

Internal commission of accident prevention

2.9 Emergency

It is any unforeseen situation that endangers the life, health, environment and / or property of the company, requiring immediate corrective actions to control and / or minimize consequences.

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3. DESCRIPTION OF ACTIVITIES

3.1 Matrix of Responsibilities

Description	Responsible
Completion of the accident and incident registration form and disclosure to company leaders	SESMT Professionals
Incident analysis and implementation of corrective or preventive actions	Operation coordinators, HSMT
Information of the actions taken to the professional who issued the Communication	Operation coordinators, HSMT
Investigation of an accident or incident and definition of the respective measures and corrective actions	Mill Manager, with the support of HSMT, CIPA professionals and others involved, called as needed.

3.2 Initial Treatment and Record of Accidents and Incidents

- All incidents and accidents with and without leave, except those for simple medical care, must be notified by the HSMT professional within 24 hours of the first working day following the event.
- All accidents and high potential incidents should be analyzed, investigated and their causes duly determined by applying the root tree methodology, considering the identification of the immediate and basic causes.

3.3 Actions in case of anomalies

3.3.1 Absence of Communication

In the absence of communications, area coordinators should initiate corrective action, in conjunction with the HSMT Team.

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3.3.2 No Occurrence of Analyzes Pertaining to Communication

Failure to carry out analyzes shall be subject to evaluation at HSMT meetings.

3.3.3 Failure to comply with the Plan of Action Unleashed by Accident and Incident Analysis and Investigation

Failure to carry out analyzes shall be subject to evaluation at HSMT meetings.

ANNEX VII
EMERGENCY ACTION PLAN (PAE)

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1 OBJECTIVE

The purpose of this paper is to present the Emergency Action Plan (PAE), which is an integral part of the Risk Management Program (PGR) of LD Celulose.

This Plan was carried out in order to provide quick and efficient responses to possible emergency situations that have the potential to cause internal damage, as well as external repercussions to the limits of the company, thus allowing for the minimization of possible damage to people and assets, as well as impacts to the Company.

The emergency procedures presented here are related to the hazards and respective accident scenarios raised in the Risk Analysis Study (EAR).

This PAE addresses the procedures to be adopted in emergency situations associated only with the dissolving pulp mill operation, since the risks during the implementation phase are restricted only to internal damages, associated with work safety, remembering that the EAR had as objective the hazards related to the operation.

LD Celulose shall periodically actuate the PAE, through simulations of emergency situations, aiming at the awareness and commitment of all its employees and third parties aiming at a correct application of the procedures contained therein and implemented through specific training.

In addition to the definition of emergency procedures, the present Plan has a specific structure in order to:

- Define the responsibilities of those involved in responding to emergency situations, through a specific organizational structure to deal with accidents;
- Promote the integration of emergency response actions with other institutions, thus enabling the launching of integrated and coordinated activities, so that the expected results can be achieved.

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2 DEFINITIONS

Accident: any event that has caused the following consequences, individually or in combination: personal injury to persons (employees and third parties); damage to health (employees and third parties); property damage; damage (injury) to the environment; impacts on the operation of the business; impacts on the institutional image; legal impacts.

Accidental Hypothesis: Type of occurrence identified in the risk assessment and which creates accidental scenarios.

Accidental scenarios: identification of the accidental hypotheses that may occur due to the activities involved.

Alarm: signal to warning of some imminent danger.

Area Abandonment Procedure: provides steps for the safe abandonment of the locality by employees, contractors and visitors so that there is no abuse and consequent accidents, which can aggravate the emergency situation.

Cause: fact or chain of facts, of human or material origin, that proceed and conditioning the materialization of a risk with potential for the generation of damages.

Chemical emergency: an unforeseen situation associated with any stage of the process of transporting, handling, processing or disposing of chemicals, with actual or potential characteristics of causing damage to persons, the environment or facilities.

Crisis: it is by nature a period of tension. Whether caused by accidents or by corporate problems (such as a strike, for example), the crisis has a great potential for attrition in relations with different publics and poses a real risk to the company's image and reputation.

Emergency: is a combination of facts, due to defects in equipment, failures in process control, natural phenomena (storms, lightning, floods), or human faults, which can result in fire, explosion, spills or chemical leakage, accidental air emission, accidental discharge into the water and soil, or any accident with injury, damage to property, the environment and the community.

Emergency brigade: team composed of employees from different areas, properly trained to prevent and combat emergencies.

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Emergency Brigade Team: collaborators that compose the Emergency Brigade, trained in theory and practice with the purpose of avoiding and controlling occurrences and / or worsening of an emergency.

Emergency response: triggering of coordinated and integrated actions, through mobilization of human resources and materials compatible with the presented scenario, aiming to control and minimize damages to people and assets, as well as possible environmental impacts.

Environment: surroundings where the pulp mill operates, including air, water, soil, natural resources, flora, fauna, humans and their interrelationships.

Environmental accident: an unwanted and unexpected event that affects, directly or indirectly, the physical integrity and health of the exposed people, causes damages to the public and / or private property, as well as impacts to the environment.

Environmental impact: Any adverse or beneficial environmental change that results in all or part of LD Celulose's activities.

Escape route: considered safer route where people from areas already affected by the emergency or likely to be evading.

Explosion: chemical reaction, with total and instantaneous release of the energy of the oxidizing mass, causing heat and pressure surge.

Fire: chemical reaction (combustion) with uncontrolled release of energy, whose extent and magnitude - threatens lives and / or the environment and / or facilities / machines / processes.

Gravity potential: projection of the worst case scenario due to an accident or potential incident.

Hypothesis: (1) Set of ideas that presents the probable explanation for a given phenomenon. (2) Formal statement of the expected relationships between at least one independent variable and one dependent variable. (3) In research the hypotheses become questions to be answered with clarity through the work done.

Incident: Unintended and unexpected event, which under slightly different circumstances could result in accident.

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Industrial Firefighter: Professional trained and qualified in the prevention and combat to emergencies.

Leakage: Leakage is understood as any abnormal situation that results in the release of product, not necessarily associated with an emergency situation.

Meeting point: place considered safe, where employees and other people who have their work places affected by an emergency must meet, waiting for abandonment order or return to work unit.

Overflow: A situation where a chemical spills from your container, vessel, piping or tank, in an uncontrolled way that creates risks to people, the environment or the facility.

Population: Set of organisms of the same species that occupy a certain area and in general is isolated in some way from other sets. Attributes of a population: birth and death rates, sex ratio, age distribution, immigration and emigration.

Radiation: (1) Any of the physical processes of emission and propagation of energy, either by of surge phenomena or by particles with kinetic energy. (2) Energy that propagates from one point to another in space or material environment.

Risk: Measure of damage to human life, resulting from the combination of the frequency of occurrence and the magnitude of the losses or damages (consequences).

Risks related to safety, health and the environment: it is the probability of damage to the health and physical integrity of workers, environment, community and property, resulting in human / material losses, penalties, interdiction and / or suspension of activities.

Simulated Exercise: Practical training in emergency care.

Spill: Any release, whether sudden or not, of a chemical, usually in a liquid or solid state, to soil, subsoil, water, surface or atmosphere that could endanger the physical integrity of persons and / or cause environmental damage.

Security: A state in which the risks of probable damage to persons and property are limited to an acceptable limit.

System: Junction of interrelated elements forming a single whole.

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Toxic Substance: Biogenic poison that affects the functioning of cells, tissues, organisms and systems.

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3 CARACTERÍSTICAS GERAIS DAS INSTALAÇÕES

3.1 Activity

The project is characterized as an industrial activity, belonging to the industrial production activities of Pulp and Paper, classified according to the CNAE-IBGE (Classification of Economic Activities - Brazilian Institute of Geography and Statistics), 17.10-9 - MANUFACTURE OF PULP AND OTHER PASTES FOR THE MANUFACTURE OF PAPER.

3.2 Location

The dissolving pulp mill will be located in the municipality of Indianópolis and Araguari (MG), along Highway BR 365, 35 km away from Uberlândia.

The following figure shows the location of the project.

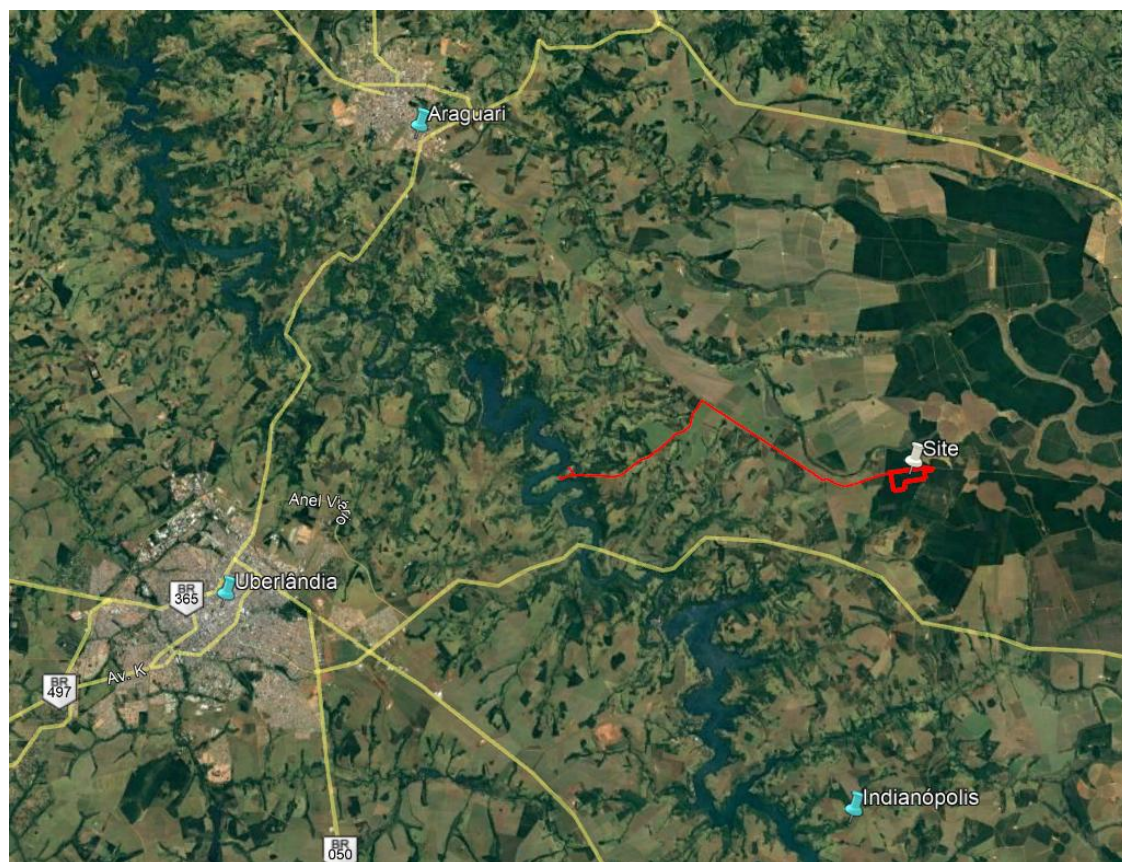


Figura – Mill site location. Source: Google Earth, 2018.

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3.3 Layout

The Layout of the dissolving pulp mill is presented in the following figure.

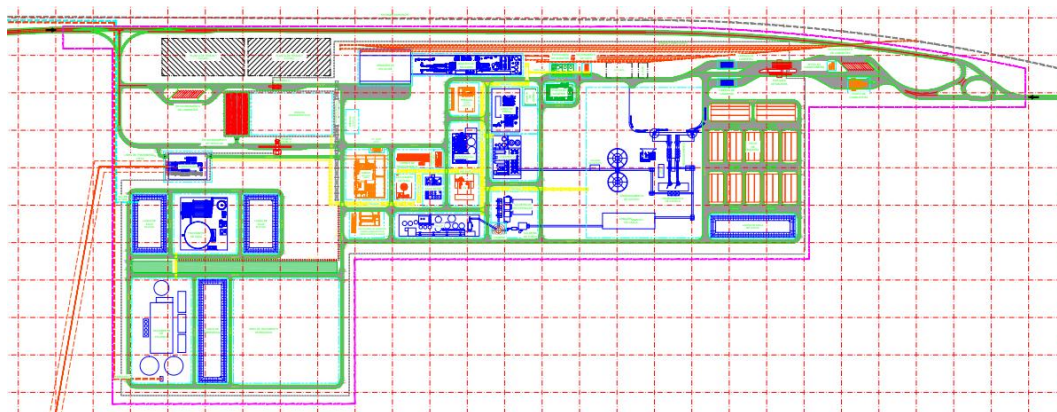


Figura – Layout da fábrica de celulose solúvel. Fonte: Google Earth, 2018.

3.4 Operation Time and Employees

The operating regime of the dissolving pulp mill will be 24 hours a day, 7 days a week and 12 months a year. The production period will be approximately 352 days, considering the annual general maintenance stoppage of the equipment.

The total workforce necessary for the dissolving pulp mill operation will be around 500 people. The working day of the employees of the industrial area will take place in 3 work shifts of 8 hours each. In the administrative area the working day will be 8 hours and will take place during business hours.

3.5 Productive Capacity

The main activity of the plant is the production of dissolving pulp of LD Celulose in the state of Minas Gerais, which forecasts a production of 540,000 tons per year of dissolving eucalyptus pulp.

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3.6 Dissolving Pulp Mill Description

The un-barked logs will be transported to the debarking, washing and chipping lines, which will chip the logs into chips. The chips will be stored in silos and then transported to the cooking plant.

The chips will have controlled dimensions, which will allow the penetration of the chemical products during cooking, which will facilitate the softening of the wood and the separation of the fibers, separating them from the lignin, producing the “brown pulp”.

Next, a pre-bleaching of the pulp will be carried out, through a physical-chemical process, using as main reagent the oxygen. The objective is to reduce the consumption of chemical reagents in the bleaching and to generate less organic load for the effluent.

Bleaching is a purification process that aims to remove most of the undissolved residual lignin. The goal is to obtain high degree of whiteness. For this, more selective chemical reagents and milder working conditions will be used.

The bleached pulp then will be transported to the drying and baling section, where sheet formation will occur, to ensure greater homogeneity and to avoid machine breakdowns or product irregularities. The pressing aims to remove the water by mechanical action, to consolidate position of the fibers and to give greater resistance for the wet sheet to pass through the drying. In drying, water will be removed by evaporation through the application of heat to the pulp sheet. At the exit of the dryer, the sheets will be cut, weighed and baling.

Chemical Recovery

The kraft pulp mill, in which the production of dissolving pulp is included, has a system that allows the recovery of the chemicals used to obtain the pulp.

Recovery begins with evaporation of the black liquor, raising the dry solids content from 15% to about 80%.

After evaporation, the liquor will be sent for incineration in the recovery boiler. In the boiler, the organic matter present in the liquor will be incinerated, leaving a melt, formed by the inorganic compounds that will be sent to the causticizing.

In the causticizing, the clarification of the green liquor will occur, and later the white liquor will be obtained.

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3.7 Product Destination

The outbound of pulp production will be 100% carried out by railway, which will be destined to the Port of Espírito Santo or Port of Santos/SP.

4 ACCIDENTAL SCENARIOS

The Risk Analysis Study (EAR) pointed out the scenarios of accidents likely to occur at the facilities in several operations carried out at LD Celulose.

Based on these scenarios, the possible consequences were estimated and the vulnerability analysis was carried out to estimate the areas potentially subject to the harmful effects of accidental releases of the products handled by the company.

In the vulnerability analysis, it was selected the initiating events that origin the accidental scenarios.

These events are associated with releases of flammable substances and toxic substances in the operations involved in the manufacture of bleached eucalyptus pulp.

Based on the results of the simulations carried out for the different accidental scenarios, it was possible to define the areas that are potentially affected by the physical effects (thermal radiation from fires, overpressure caused by explosion and toxic clouds generated by the release of toxic substances), those whose ranges are larger, if they occur.

The table below lists the simulated accidental hypotheses and the respective release sites.

Nº hypothesis	Description of accidental hypothesis	Area
1	Leakage of concentrated non-condensable gases (CNCG) after condenser	Evaporation Plant
2	Explosion of process methanol storage tank	Evaporation Plant
3	Leakage of process methanol to incineration points	Evaporation Plant

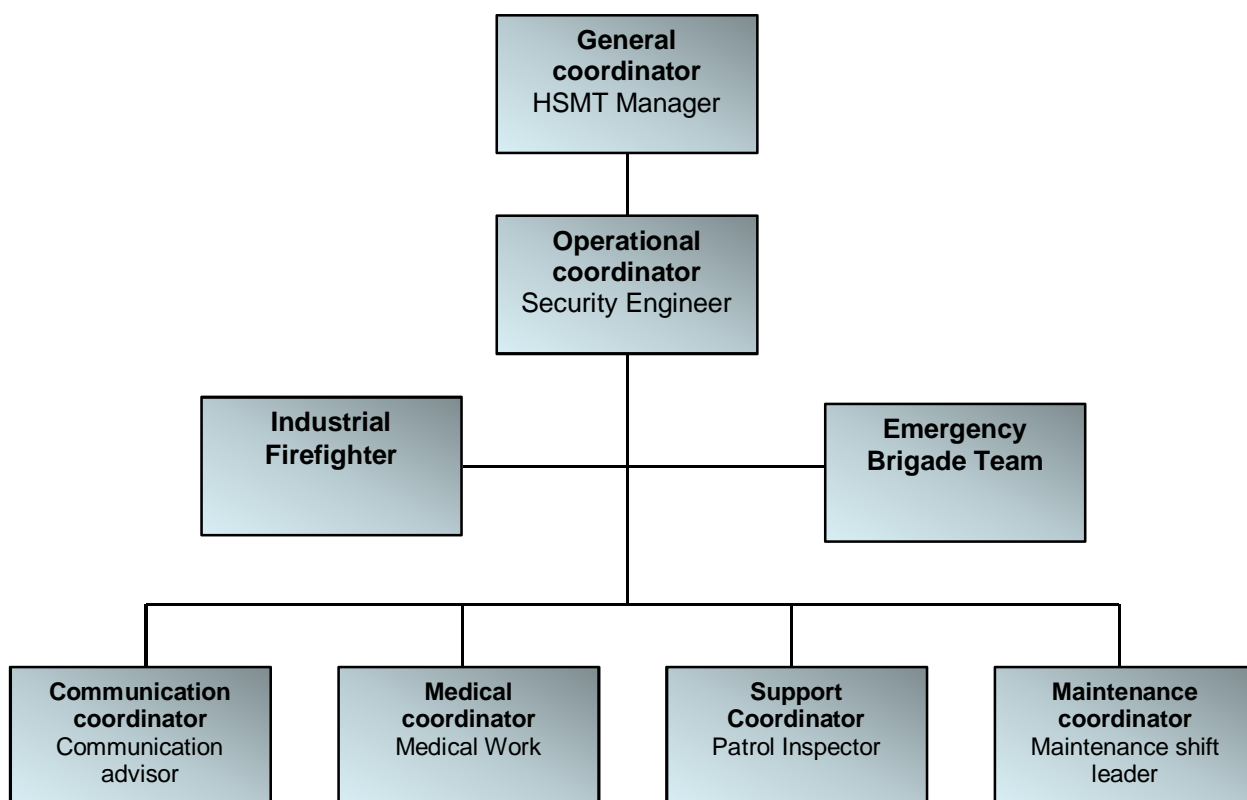
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Nº hypothesis	Description of accidental hypothesis	Area
4	Leakage of ozone in compressor discharge	Chemicals – Ozone Plant (O ₃)
5	Leakage of sulfur dioxide from storage cylinders	Chemicals – Sulphur Dioxide Preparation (SO ₂)
6	Leakage of sulfur dioxide between the cylinders and the vaporizer	Chemicals – Sulphur Dioxide Preparation (SO ₂)
7	Leakage of sulfur dioxide between the vaporizer and the absorption tower	Chemicals – Sulphur Dioxide Preparation (SO ₂)

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5 ORGANIZATIONAL STRUCTURE AND RESPONSIBILITIES OF PAE

The Emergency Action Plan (PAE) was structured in such a way as to enable quick and efficient action to be taken. Thus, in order to enable prompt response to emergency situations, with potential to cause external impacts to the limits of LD Celulose, the Plan will be coordinated at different levels, according to the organizational structure presented in the following figure.



Following are the attributions and responsibilities of the coordinations, groups and teams that compose the organizational structure of the plan.

General Coordinator of PAE (or Coordinator Emergency Management Group – GEE)

The role of PAE General Coordinator will be exercised by the HSMT Manager, who will be in charge of the general supervision of the work and communication with the company's management, external audiences and press agencies. Thus, the following attributions will be attributed to him:

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- Assume the general direction of the actions necessary for the mitigation of environmental impacts, ensuring that there are no losses and damages;
- Communicate, when necessary, the occurrence to the Plant Manager;
- Direct the information to the Communication Coordinator, so that they can be passed on to the newspaper;
- Provide the necessary human resource and material resource for emergency response.

Operational Coordinator

The Operational Coordinator, whose function is exercised by any of the pulp mill coordinators, will be responsible for the direct action in the emergency responses, by the activation of the Industrial Firefighter, coordinating the actions triggered by the Emergency Brigade and the auxiliary services, necessary to cope to the emergency situation. Therefore, you will be responsible for:

- Evaluate the situation and risks according to the scenario presented (inside and outside the company);
- Evaluate the need for mobilization of external assistance;
- Report the occurrence to the General Coordinator;
- Decide, with the support of the team, the strategy and procedures to be triggered for emergency control and mitigation of environmental impacts;
- Activate the area abandon alarm if there is justifiable risk;
- Determine the release of all telephone lines;
- Obtain meteorological information and pass it on to the Brigadistas and Industrial Firefighters in order to optimize the performance of the teams;
- Establish communication way with the other companies of the Industrial Plant;
- Communicate the area of Corporate Work Medicine and Safety, as well as the management levels;
- Coordinate the entire logistics operation in support of the Fire and Emergency Brigade;
- Delegate assignments to group members;
- Request internal and / or external resources;

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- Declare the termination of emergency care, inspect the affected area and record the occurrence, with a view to investigating and eliminating potential causes.

Communication Coordinator

The activities of the Communication Coordinator will be carried out by the communication analyst. It is up to him to notify and keep up to date the media. His attributions will be as follows:

- Follow up the actions triggered by the Plan, together with the General Coordinator, in order to disseminate official notes and schedule any interviews with the newspaper;
- Comply with the determinations of the PAE Operational Coordinator;
- Advise the Board on the aspects of institutional communication;
- Schedule interviews and conferences related to the event;
- Meet the demands of journalism;
- Define, together with the local Director for newspaper service;
- Prepare a communication to the community about the event that occurred;
- Evaluate, together with the PAE General Coordinator and the environmental coordinator, which institutions and associations should be communicated.

Medical Coordinator

The activities of the Medical Coordinator shall be carried out by the occupational medical, and in their absence shall be performed by the nurse, the nursing technician or by the nursing assistant on duty. It will be responsible for the local assistance of eventual victims of the emergency situation, as well as in isolated and / or evacuated places. Thus, its attributions will be:

- Provide the necessary first aid for the preservation of the life and health conditions of any victims;
- Orientate victims to regional hospitals (if necessary).

Support Coordinator

The activities of the Support Coordinator shall be carried out by the team of patrimony staff, and in their absence by another person designated. Will be its attributions:

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- Keep the telephone system free for emergency requests (Fire Department, Civil Defense, Police, etc.);
- Follow the order of the Operational Coordinator to remove vehicles from isolated areas;
- Orient drivers on the procedures to be adopted;
- Make sure the presence of visitors is close to the control of the ordinances.

Maintenance Coordinator

The activities of the Maintenance Coordinator shall be exercised by the shift leader of Maintenance, and in his absence by another person to be appointed by him. It is the duty to appoint and join the appropriately qualified staff to carry out possible repairs or emergency operations, whenever necessary. Will be its attributions:

- Prepare and request materials needed to repair damaged equipment, in order to minimize possible impacts caused by the emergency;
- Provision of power outage and supply of water;
- Monitor and inform the Operational Coordinator of the time spent on repairs.

Emergency and Firefighting Brigade Team

The Emergency and Firefighting Brigade Team will be composed of properly trained company employees, divided between the various areas of the company, and industrial firefighters who take turns in order to be at least one present in the company at any time.

The brigade team will be selected among the employees indicated by the coordinators. The Emergency and Fire Brigade is responsible for the direct combat to the emergency, acting under the coordination of the PAE General Coordinator.

It shall be the responsibility of every component of the Emergency and Fire Brigade:

- Activate the evacuation alarms of the areas and the teams of readiness, by radio or telephone;
- Check the exact location and type of emergency, assessing their extent;
- Acting in response actions, leading and mobilizing the necessary resources;
- Analyze the possibility of spreading the emergency, acting in the reduction of possible consequences;

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- Request additional resources from the Operational Coordinator;
- Keep the Operational Coordinator informed about the occurrence and actions taken in the care;
- Mobilize the resources available for first aid and remain ready for any intervention if necessary;
- If there are victims, provide the first services until the arrival of medical team.

Firefighters

This team will be formed by civilian firefighters, who will be properly trained to carry out their duties, which will take place 24 hours a day, every day of the year. Thus, this Team will:

- Activate the evacuation alarms of the areas and the teams of readiness, by radio or telephone;
- Check the exact location and type of emergency, assessing their extent;
- Acting in response actions, mobilizing the necessary resources;
- Request additional resources from the Operational Coordinator;
- Mobilize the resources available for first aid and remain ready for any intervention if necessary;
- If there are victims, provide the first services until the arrival of medical teams.

Other Employees

Employees who will not take direct action in emergency response actions should follow the instructions of the coordinators, leaving the company if necessary. To do so, they must adopt the following measures:

- Turn off all electronic devices, lights, air conditioners, equipment;
- Wait for evacuation order with calm, following the instructions of the brigade team and firefighters;
- Communicate the area brigade about the occurrence;
- Do not use a telephone, leaving lines free for emergency communications;
- Orientate and lead visitors calmly to the emergency exit, releasing it immediately (if this can be done safely).

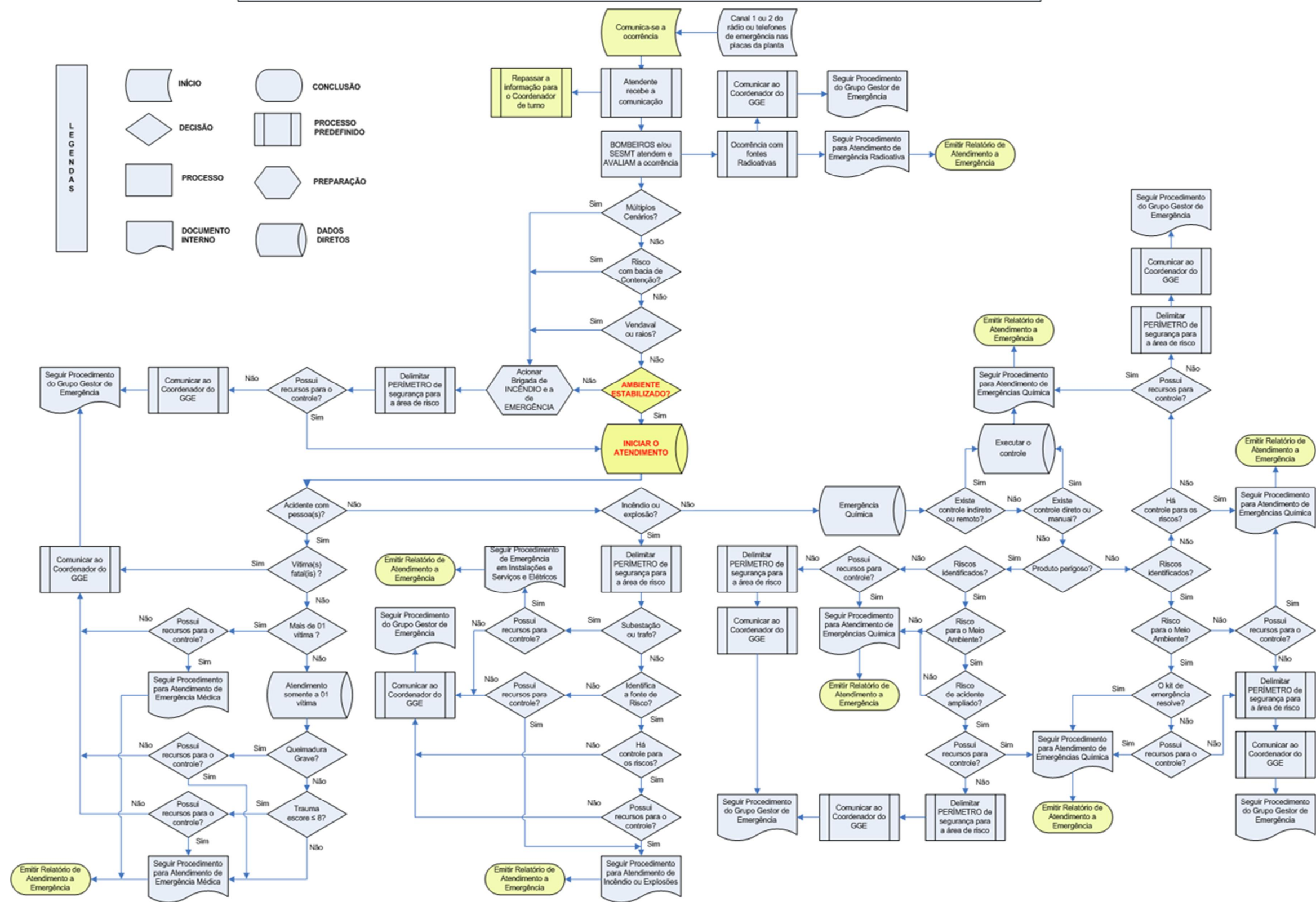
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6 ACTUATION FLOWSHEET

The following figure presents a general basic flowchart for integrated emergency response.

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FLUXOGRAMA BÁSICO PARA ATENDIMENTO INTEGRADO DE EMERGÊNCIAS



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7 COMMUNICATION IN EMERGENCY CASES

In case of emergency any employee should proceed as follows:

- Communicate the area brigade member or shift supervisor on the observed situation;
- Once the situation is identified, should assess the extent of the occurrence, and from this analysis decide whether or not to trigger the area alert alarm. If the area alert alarm is triggered, the panels located in the industrial fire department will indicate that there is an emergency situation in that area;
- Through any telephone, the brigade or shift supervisor should call the Fire Department;
- When being attended by industrial firefighters, inform the exact location of the occurrence, its name, the type of occurrence and whether there are victims or not. It will be up to the person who answers the communication to request additional information and clarifications that they deem necessary;
- The industrial firefighters and the PAE General Coordinator, after evaluating the situation, may request or not to activate the evacuation alarm for the area or the entire company;
- If the area alert alarm is triggered, all employees in the area should calmly start the emergency stop procedure of the operations involved, thus turning off all equipment and waiting for further instructions;
- If the area evacuation alarm is triggered, the brigade members of the Emergency Brigade should advise all area personnel to leave their stations and go to the nearest Meeting Point, always running against the wind through the visualization of the wind chimes installed in several points, and through the use of the Routes Escape indicated in the panels that will be distributed in the different areas of the company.

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7.1 Internal Communication Channels

The following table presents the contacts of the main professionals that should be activated in cases of emergency.

Occupation	Internal phone	Mobile
Healthy and Security Manager		
Mill manager		
Mill coordinators		
Safety engineer		
Emergency Brigade		
Medical		
Communication and Social Responsibility		
Communication analyst		

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7.2 External Communication

During an occurrence the need for support from outside agencies may arise. The contact telephones of the external agencies are in the following table.

Institution	Telephone
Emergency	
Medical Assistance Office	
Hospital	
Fire Department	
Military police	
Civil Police	
Federal Highway Police	
State Highway Police	
State Highway Police	
State Environmental Agency	
Municipality Civil Defense	
Federal Police	
Military Forest Police	
Indianópolis City Hall	
City Hall of Araguari	

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8 PROCEDURES FOR EMERGENCY COMBAT

8.1 Combating Emergencies involving Toxic / Flammable Substance present in Concentrated Non-Condensable Gases (CNCG) and Methanol

8.1.1 Basic Procedures

In any emergency situation involving the release of CNCG or methanol into the environment, some basic aspects regarding personal safety should be considered; thus, the first people who attend the event should adopt the following procedures:

- Approach carefully, using chemical protective clothing and wearing self-contained breathing apparatus;
- Avoid contact with the product (touching or inhaling);
- Isolate the local;
- Request the activation of the PAE, to mobilize its components and the necessary resources.

The first combat to the emergency should be triggered by the area operators and / or brigade members present in the place of the occurrence, using the available resources.

8.1.2 Combat Procedures

In situations involving CNCG or methanol leakages the following procedures should be triggered:

- Activate the alarm;
- Try to stop the leakage if this can be done safely, adopting, among others, the following measures:
 - ✓ Isolate and evacuate the area of the accident, according to the specific procedures for this operation;
 - ✓ Stop chemical recovery;
 - ✓ Close valves for the insulation of reservoirs or pipes;
 - ✓ Adopt measures to control the leakage:
 - Eliminate sources of ignition in the isolated area and paralyze the equipment that may present a risk of ignition of the product;

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- Make a constant monitoring of the flammability indices in the isolated area, especially in places of possible confinement;
- Use mist of water to reduce vapor clouds;
- Do not direct water to the source of the leakage if it is on fire;
- In case of fire, the fire should only be extinguished if the leakage has been paralyzed or if the flames reach equipment that could be affected by the direct action of the fire;
- Employees involved in local emergency response should wear chemical protective clothing and self-contained breathing apparatus.

8.2 Combat to Emergency involving Toxic Gases (Ozone and Sulphur Dioxide)

8.2.1 Basic Procedures

In any emergency situation involving the release of toxic gases into the environment, some basic aspects regarding personal safety should be considered; thus, the first people who attend the event should adopt the following procedures:

- Approach carefully, using chemical protective clothing and wearing self-contained breathing apparatus;
- Avoid contact with the product (touching, stepping on or inhaling);
- Isolate the local;
- Request the activation of the PAE, to mobilize its components and the necessary resources.

The first combat to the emergency should be triggered by the area operators and / or brigade members present in the place of the occurrence, using the available resources.

All transfer operations, line pumping, maintenance or even inspection should be discontinued, subject to safety procedures.

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8.2.2 Combat Procedures

In situations involving leakages of toxic gases the following procedures must be triggered:

- Confirm the leak situation - process situation;
- Confirm the leakage by informing the panel to stop the pumping;
- Inform the fire brigade to activate the brigade meeting alarm;
- Wear personal protective equipment: self-contained breathing apparatus, gloves, boots and splash-proof clothing;
- Isolate the site and restrict unauthorized access to the site of the leak;
- Guide the withdrawal of people present;
- Stop the sector until the end of the emergency.

The Emergency / Fire Department will be responsible for:

- Identify the source of the leak by using self-contained sets and appropriate protective clothing;
- Close the valves by the operators of the area properly equipped with accompaniment of the firefighters;
- Control the mist cloud gas from the hydrant network or the monitor guns;
- Chemical foam can be used to quench leaks;
- Check the direction of the wind and communicate the other companies of the site; guiding the traffic of people and vehicles.

8.3 Combat to Emergency involving Fire and Explosion

8.3.1 Initial Procedures

It will be up to the HSMT Team and / or firefighters and / or fire brigade or emergency leader and / or shift coordinator - to establish primary occurrence and control assessment, isolating people from hazards and hazards, primarily identifying:

- If there are victim involvement, possible forms of care, availability of resources and safe conditions for relief;

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- Risks to the environment and facilities, possible forms of care, availability of resources and safe conditions for relief;
- Existing accesses, creation of new points and eventual strategic points of escape or retreat;
- Local ventilation conditions (convection, conduction, irradiation);
- Fire load;
- Risk of explosion.
- Determine to the maintenance area the displacement of 01 (one) electrician technician for each of these sites which will remain in these until emergency termination communication:
 - ✓ location of the incident, including fire valve;
 - ✓ fire pumps house;
 - ✓ electric room of the general distribution.

In the possible scenarios, it is still necessary to identify interferences or risks associated with:

- Other facilities, warehouses, buildings, workshops;
- Warehouses of fuels or flammable substances;
- Boilers;
- Power cabins or electrical substations;
- Electrical networks;
- Gas;
- Pipes;
- Steam lines;
- Pipes or channels;
- Passages of pedestrians, vehicles and machines.

The following actions should be taken to ensure the positioning and approximation of resources and materials:

- Stabilization of the scenario for emergency response;
- Isolation of security of the area of risk, identifying it;

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- It must provide for the safe entry and exit route for people and equipment;
- Establish the organization of the teams and their respective assignments;
- Inform group leaders of the expected action and limits of each activity.

The following activities should be provided in relation to logistical and technical support:

- Establish reserve groups in order to intervene in support situations for rescuers or in interventions in situations not initially foreseen;
- Move and park all vehicles so that they can move freely out of the area.

8.3.2 Basic Procedures

- Any approach should be performed in pairs - properly equipped and monitored at a distance by support teams and be preceded by the monitoring of the environment conditions of oxygen, carbon monoxide, carbon dioxide and explosive levels with intrinsically safe equipment;
- Distribute observers at strategic and safe points in the perimeter of the security area in order to maintain visual and / or radio contact with the person in charge of the operation so as to assist in the management of the actions, and there should be regular exchange in these positions;
- Interruption of the electric current, in the sinister zone;
- Establishment of water curtain with frame of hose lines at strategic points.

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9 DISCLOSURE WAY AND TRAINING OF PAE

The form of disclosure of the PAE will be carried out through theoretical or practical training. Thus, the following table shows the trainings to be carried out, the frequency of completion, the contents, the areas where the trainings are applicable, as well as who will be the coordinators for their development.

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Table – Related trainings of PAE

Training	Minimum Frquency	Training Contents	Application Area	Coordinator
Initiation to PAE	Admission of new employees and new third parties	General explanation of the contents of the Plan	All employees and third parties	HSMT
Emergency simulations	Twice per year	<u>Scenarios involved:</u> <ul style="list-style-type: none"> • Large amounts of toxic / flammable substance present in concentrated non-condensable gases (CNCG) and methanol; • Leakage of toxic gases (ozone and sulfur dioxide); • Fire / explosion; • Leakage of chemicals (liquid and gaseous); • Accident with bodily injury or sudden illness. 	Areas involved in the scenarios	HSMT
PAE Recycling	Twice per year	Recycling of Plan contents	All employees and third parties	HSMT
Review of PAE	On the occasion of the review of the PAE	Indication and justification of the review of the PAE (in the case of a recent accident, by observation in the emergency simulation and / or other reasons)	Areas involved in review	HSMT

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10 KEEPING OF PAE

The PAE should be constantly updated in terms of trigger lists and resources. Likewise, the plan should be reviewed and improved, considering the results obtained in training or in response to possible accidents.

It shall be the obligation of all LD Celulose employees to promptly comply with the provisions of this plan.

The training of the PAE or training of people to act in emergency situations should be evaluated and documented in order to subsidize the updating and improvement of the plan.

In addition to the initial training, the Brigade Members will receive 8-hour maintenance training on a semi-annual basis at pre-defined times.

The resources used in training or attendance to eventual emergencies should be promptly replaced, with the proper authorization of the General Coordination of the Plan.

Any alteration or updating of the PAE must be previously approved by the General Coordinator and, subsequently, the internal and external modifications should be widely disseminated.

The PAE General Coordinator, together with a team established by him, shall review, evaluate and review the entire structure of the PAE to satisfy or determine the following conditions:

- Updates judged necessary after the occurrence of a real emergency situation or a simulation;
- Procedural changes due to the identification of new emergency scenarios;
- Changes of contacts, telephones and support entities.

ANNEX VIII
AUDIT OF MANAGEMENT SYSTEMS

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1. OBJECTIVE

The purpose of this procedure is to establish the guidelines, responsibilities and criteria for the planning, realization and monitoring of the results of internal audits, in order to comply with regulatory standards and comply with the requirements established in:

- Environmental management system
- Occupational Health and Safety Management System
- Risk Management Program (PGR): CETESB Standard P4.261

2. DEFINITIONS

2.1 Audit

Systematic, independent and documented process to obtain objective evidence and to evaluate them to determine the extent to which the audit criteria are met.

2.2 Audit Criteria

A set of policies, procedures or requirements used as a reference against which objective evidence is compared.

2.3 Evidence of Audit

Records, presentation of facts or other verifiable information relevant to the audit criteria.

2.4 Non-Compliance

Failure to meet a specified requirement in management systems.

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3. DESCRIPTION OF ACTIVITIES

3.1 Conduct of Audits

Application of the method that will constitute, in the respective sequence: planning, auditing, records of non-compliances, final report and corrective action report, monitoring and verification of effectiveness of actions.

3.2 Planning

3.2.1 Program

The planning and management of the audits (scheduling, dates of performance, teams of auditors and processes to be audited) will be defined by the management system team.

Internal audits will be performed by trained and qualified auditors of LD Celulose. When necessary, LD Celulose may use external resources to perform audits, provided they have the competence for the scope to audit in each system. The execution of audits by external consultants should follow the same standards of LD Celulose.

3.2.2 Frequency of Audit

Internal audits will be conducted annually. This periodicity may be altered depending on the results of internal audits carried out, taking into account:

- Non-conformities related to legal requirements, applied to the Environmental Management System;
- Verification of the effectiveness of the actions of the previous audit;
- Adequacy of management systems in specific areas;
- Significant changes in processes.

3.2.3 Responsibilities

The Management System team will prepare the internal audit defining the audit plan that will be communicated to those responsible for the areas / processes to be audited.

The Management System team will have the following activities:

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- Prepare the audit plan;
- Communicate the audit schedule to the processes involved;
- Ensure that the resources needed to conduct the audits are provided;
- Ensure implementation of the audit program;
- Ensure that audit program records are kept on the server;
- Disseminate internal audit results;
- Perform a critical analysis of the audit results;
- Evaluate competence and provide training to internal auditors.

3.2.4 Scope of Audits

- Environmental management system;
- Occupational Health and Safety Management System and CETESB Standard P4.261. These audits will contemplate all the requirements of the standards adopted by LD Celulose, and will meet all the requirements that make up the PGR, according to the guidelines of the CETESB Standard P4.261. The table below shows the correspondence between the requirements of the standards adopted by LD Celulose and the CETESB standard P4.261.

CETESB P4.261 Standard (PGR)	Standard adopted by LD Celulose
9.1.2 – Hazards identification	Requirement – Identification of hazards, risk assessment and determination of controls
9.1.3 - Review of the Risk Analysis Study or hazard identification	Requirement – Identification of hazards, risk assessment and determination of controls Requirement - Investigation of Incidents, Nonconformities and Corrective and Preventive Actions
9.1.4 – Operational procedures	Requirement - Documentation Requirement - Documents control
9.1.5 - Modifications management	Requirement - Hazard Identification, Risk Assessment and determination of controls, Legal requirements and other requirements
9.1.6 - Maintenance and assurance of integrity	Requirement – Resources, roles, responsibilities, accountability and authorities Requirement –

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CETESB P4.261 Standard (PGR)	Standard adopted by LD Celulose
	Operational Control
9.1.7 - Training of human resources	Requirement – Resources, roles, responsibilities, accountability and authorities
9.1.8 - Investigation of incidents and accidents	Requirement – Incident investigation, nonconformity, corrective action and preventive action
9.1.9 – Emergency Action Plan (PAE)	Requirement –Preparedness and Response of Emergency of the Standard
9.1.10 - PGR Audit	Requirement – Internal Audit

3.2.5 Conducting the Audit

3.2.5.1 Kick-off Meeting

The audit team should use the kick-off meeting to:

- Present the audit team;
- Present the purpose of the audit;
- Inform the scope of the audit;
- Confirm the audit schedule;
- Present the audit criteria;
- Clarify doubts of auditees;
- Confirm confidentiality rules.

3.2.5.2 Execution of Audit

The use of interviews constitutes one of the ways used to obtain information, representing one of the most usual techniques in the audit.

During the execution of the audit, the evidence should be collected through document analysis, observation of activities and situations, in sufficient quantity to determine the conformity of the audited system with respect to the audit criteria. The evidence should be analyzed critically in comparison to the audit criteria.

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Verifications or findings based on evidence may lead to the issuance of non-compliance and opportunities for improvement (observations).

3.2.5.3 Conclusion

Following the completion of the entire audit agenda, the lead auditor will conduct a meeting with the auditors to confirm nonconformities, complete the records and the final audit report. The audit team will hold a closing meeting with the audited area to report:

- Positive points verified;
- Opportunities for improvement;
- Non-compliance.

3.2.6 Results of Audit

The audits will result in a report with the findings made and the indication of conformities, nonconformities and observations detected. This report will be prepared by the audit team.

When minor nonconformities are recorded, they should be corrected and treated within a maximum period of one year or until the next internal audit.

In case of registration of major nonconformities the correction must be carried out in a maximum period of three months.

The person in charge of the process should provide the investigation of the cause, establish the applicable corrective / preventive action, define those responsible for implementation and monitor the progress of actions.