DEPARTMENT OF MECHANICAL AND MANUFACTURIMG ENGINEERING

FACULTY OF ENGINEERING

UNIVERSITY OF RUHUNA

INDUSTRIAL TRAINING REPORT SUBMITTED IN PARTIAL FULFILMENT OF THE DEGREE OF THE BACHOLAR OF THE SCEINCE OF ENGINEERING 2018

MUNCHEE – CEYLON BISCUIT LIMITED

MAKUBURA, PANNIPITIYA

(17/1/2023 to 07/01/2024)

E.G.S.S. WANASINGHA (RU/E/2018/3487)

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This training experience has been incredibly valuable to me and has significantly enhanced my Skills and experience in designs, utilities and maintenance management. I am confident that I can apply the knowledge and skills I gained to future companies which I will joined future and for make my career better. Thank you again to everyone who made this training program such a success. I am truly grateful for the opportunity to learn and grow.

Sincerely,

E.G.S.S Wanasingha
EG/2018/3487
Department of Mechanical and Manufacturing Engineering.
Faculty of Engineering
University of Ruhuna.

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CHAPTER 01 – INTRODUCTION OF THE TRAINING ESHTABILISHMENT

Figure 1 : Company view (CBL, 1968)

Ceylon Biscuits Limited (CBL) is one of the fastest growing and largest conglomerates in Sri Lanka that manufactures and markets many leading brands in biscuits, confectionery, cereal, soya based products, organic fruit products and many other categories globally. Recognized as a technology and innovation led producer, CBL caters to a large overseas market and has a global presence across all continents.

Below are the main information about the company.

- Founded : 1939 · Dehiwala, Dehiwala-Mount Lavinia, Sri Lanka.
- Founder : Simon Arthur Wickramasingha
- Headquarters : Pannipitiya · Colombo · Sri Lanka
- Key people : R S A Wickramasingha · E T De Zoysa
- Owner : CBL Investments Limited · People's Leasing & Finance · Dawi Investment Trust
- Parent : CBL Investments
- Subsidiaries :CBL Foods International · CBL Natural Foods · Convenience Foods (Lanka) · Plenty Foods · CBL Exports · CBL Bangladesh · Star United

As well as some historical information about the company is mentioned below.

In the neighboring town of Rannala, the business founded CBL Foods International (CBL Foods) in 2002. The company was able to set up a bakery line and produce cakes under the Tiara brand thanks to CBL Foods. 2004 saw the start of operations at the new facility. Additionally, CBL moved its chocolate production to the new facility. (wikipedia, 2022)

In 2003, CBL sold the manufacturing site and dissolved Ritzbury India because to unfavorable distribution agreements and pricing. However, Patiala-based Bakemans, which had a 13% market share and was previously India's third-largest biscuit manufacturer, was acquired by CBL in July 2004. Cecil Food (Pvt) Limited, an organic producer of fruit juices, dehydrated coconut, cashews, and fruit goods, was bought by CBL in 2004 for a 60% share. The same year, CBL signed a contract with the Italian candy company Ferrero SpA to produce and market Ferrero goods in the area, including Nutella, Tic Tac, Ferrero Rocher, and Mon Chéri. (wikipedia, 2022)

2014 saw the launch of Star United, a grocery chain owned by CBL. There were thirty franchised supermarkets in the nation as of 2014. The business obtained a franchise license in 2017 to use the Spar brand as Spar Lanka in Sri Lanka. Ceylon Biscuits Limited and SPAR Group Ltd., South Africa, are partners in this joint venture. The first supermarket was established at Thalawathugoda, Colombo. The goal is to have 50 locations around the nation by 2023. (wikipedia, 2022)

Currently, this is one among Asia's top producers and distributors of chocolate, confections, and biscuits.

CHAPTER 02 – TRAINING EXPERIENCES – TECHNICAL

2.1 Manufacturing Process

The biscuit manufacturing process in this company is fully automated. Sending of the flour to the mixing room and after several procedures, the biscuits are release from the oven by heating. The flow chart and the details of the main steps of biscuit manufacturing are mentioned below.

- **Flour storage**
  Flour is stored inside the silos. As well as other ingredients such as sugar, oil etc. are stored the relevant places separately. Tall, steel cylinder-shaped containers. Frequently fitted with level sensors to keep an eye on the flour's ingredient level in order to preserve quality and avoid cross-contamination. Pipelines that move ingredients from the silos to the mixing room using compressed air. These techniques are effective, devoid of dust, and kind to sensitive substances.
- **Mixing**
  Throughout this process, all of the ingredients are mixed, and different mixing techniques are applied based on the kind of biscuit that will be produced. The consistency of the dough and the temperature at which it is mixed both affect biscuit quality. To produce dough, combine the ingredients in a dough mixer. Weighing systems with PLC control are computerized weighing devices ensure that ingredients are added to the mixer in precisely specified amounts. This guarantees that each batch of biscuits has the same flavor and quality.
- **Giving the shapes**
  To make sheets, the soft dough is first rolled out into a flat shape. After that, the dough sheets were crushed by a set of rollers. Now that the dough has been compacted, it is sufficiently rigid to allow toppings to be placed on top of it. Creams or other materials are poured on top of the sheets. The rotary cutter was then fed with the sheet. When the biscuits are ready to bake, they are formed using a rotary cutter, which is essentially a revolving roller with cups affixed around it. The flat dough is compressed using a gauge roll stand machine to make it slightly thin and rigid. Once more, the flat dough is slid beneath a sequence of paired rolls. A set of rollers with the appropriate shaped cups attached encircle the rotary cutter. The dough sheet can be turned into biscuits by the machine.

- **Baking**
  The oven receives the biscuits from the rotary cutter and bakes them for the predetermined amounts of time at the predetermined temperature. Here, the biscuits are heated in gas-fired and electrical ovens. These also change according to the rate of manufacturing. An oven's heating sources and conveyor are its basic components.
- **Cooling**
  The oven receives the biscuits from the rotary cutter and bakes them for the predetermined amounts of time at the predetermined temperature. Here, the biscuits are heated in gas-fired and electrical ovens. These also change according to the rate of manufacturing. An oven's heating sources and conveyor are its basic components.
- **Packaging**
  By automatically feeding each biscuit onto a film that is constantly moving, Flow Wrappers machines elegantly package each biscuit into its own packet. Diverse biscuit forms and packaging demands are accommodated by varying film kinds and speeds. Machines for Cartoons Cartooning machines place biscuits in cardboard boxes before sealing them, especially for larger biscuits or multipacks. Both automated and manual checks are used throughout the process to guarantee that the biscuits are the right size, weight, color, and texture. There are also other safety precautions in place, such as metal detectors.

2.2 Main Equipment

2.2.1 Flour unloading unit

Here used very special mechanism to unload flour from the flour container. It consists rotary valve, two filters, blower, blower tube and flexible tube. And also pneumatic lines and vibrator are used to get continues flow distribution. The main components of this unit and learning experiences are mentioned below.

- **Rotary valve –**

Figure 2 : Rotary valve

Rotary valves are using wide range of industries.

- Bulk material handling involves unloading flour to make biscuits.
- Systems for pneumatic conveying: moving powdered materials, such as plastic pellets or cement.
- Chemical processing: regulated reactant feeding and isolation.
- Food processing includes dividing liquid and solid phases, regulating product flow, and dosing chemicals.
- Energy production: regulating the flow of exhaust gases or the coal fed into boilers.

And there are so many benefits by using rotary valves.

- Leak-proof sealing: Unlike conventional stop valves, the revolving design assures little leakage.
- Metered flow control: Vanes precisely divide and control the material's flow.
- Gently handling: Because the revolving vanes reduce abrasion, this is appropriate for delicate textiles.
- Continuous operation: Able to manage material flow continuously without needing to open and close frequently.
- Self-cleaning: To avoid material accumulation on the vanes, certain designs include scraping mechanisms.

The main types of rotary valves (Anon., 2018)

- Drop-through valves allow material to pass through them straight through, without changing course.
- Blow-through valves: The material is moved along the valve's axis by a compressed air stream.

- Side-entry valves are ideal for applications with limited space since material enters and exits from the side of the valve.

2.2.2 Flour storage unit

This device has a sturdy five-silo layout that is intended for dependable and effective flour storage. Two more silos hold 52 metric tons (T) apiece, and each silo has a considerable capacity of 125 T.

Figure 3 : Flour storage silos (hippox, 2006)

Silo features. (university, 2015)

- Level Monitoring: To provide ideal inventory management and avoid overflow, four external sensors are mounted strategically on each silo to continuously monitor flour levels.

- Inside Unloading System: Every silo has an inside unloading unit with a rotating valve system. Filters are used in this effective technique to reduce the amount of dust created when transferring flour to the mixing room.
- Pressure Relief Valve: Situated atop every silo, this valve protects against the accumulation of pressure, guaranteeing both the unit's structural soundness and the safety of its occupants.

Figure 4 : pressure relief valve on silo top (filquip, 2010)

- Filtration System: Each silo's top is covered in a vast network of twelve filters that work to collect flour particles in the air and keep the surrounding air clean and dust-free.

Figure 5 : Filter system on silo top (ut-ec, 2004)

And below are some benefits of using these silos.

- High Storage Capacity: Five silos offer versatility for various flour kinds and serve larger production plants.
- Precise Level Monitoring: Constant observation guarantees effective inventory control by averting overfilling.
- A cleaner workspace is encouraged by internal unloading with filters and top-mounted filtering devices, which reduce dust creation.
- Safety Features: Personnel and equipment protection are given first priority with pressure release valves and appropriate access ports.

2.2.3 Oven section

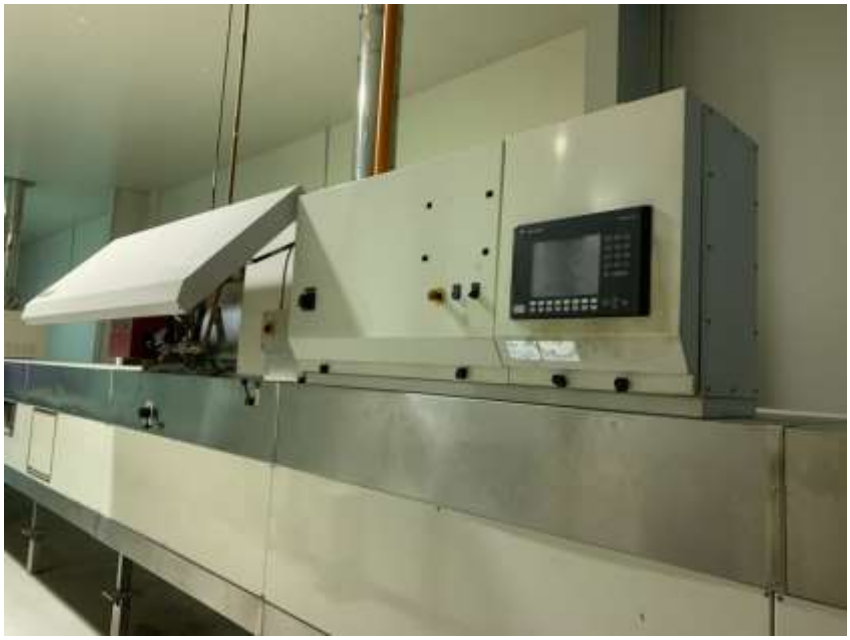

Figure 6 : Temperature controlling unit of oven (ppesales, 2005)

Figure 7 : Burner mouths of oven section (machines4u, 2009)

Below are the main components of the oven (sinofudegroup, 2023).

- Conveyor Belt: The biscuit dough is moved through the baking zones at a regulated speed by a heat-resistant, non-stick belt.
- Baking Zones: Usually, ovens are separated into a number of zones with different humidity and temperature ranges. From the initial drying to the final browning, each zone focuses on a particular step in the baking process.
- Temperature Control System: Precise temperature profiles are maintained inside each zone by sophisticated sensors and controllers, guaranteeing uniform baking quality.
- Humidity Control System: The formation and texture of crust are affected by the humidity levels that are controlled by steam injection or exhaust systems.
- Exhaust System: Proper ventilation provides a safe and comfortable working environment by eliminating moisture and volatile chemicals produced during baking.

When select an oven it should consider below factors,

- Production volume and variety: Several ovens or models with a higher capacity may be required for high-volume production.
- Type of biscuit and desired qualities: Different forms of biscuit call for different heating and baking profiles.

- Spending limit and space available: The price of an oven varies with its size, technology, and brand.
- Energy efficiency and environmental restrictions: Select ovens with energy-saving features and take local rules into account.

2.2.4 Conveying system

Figure 8 : biscuit conveying system (biscuitpeople, 2014)

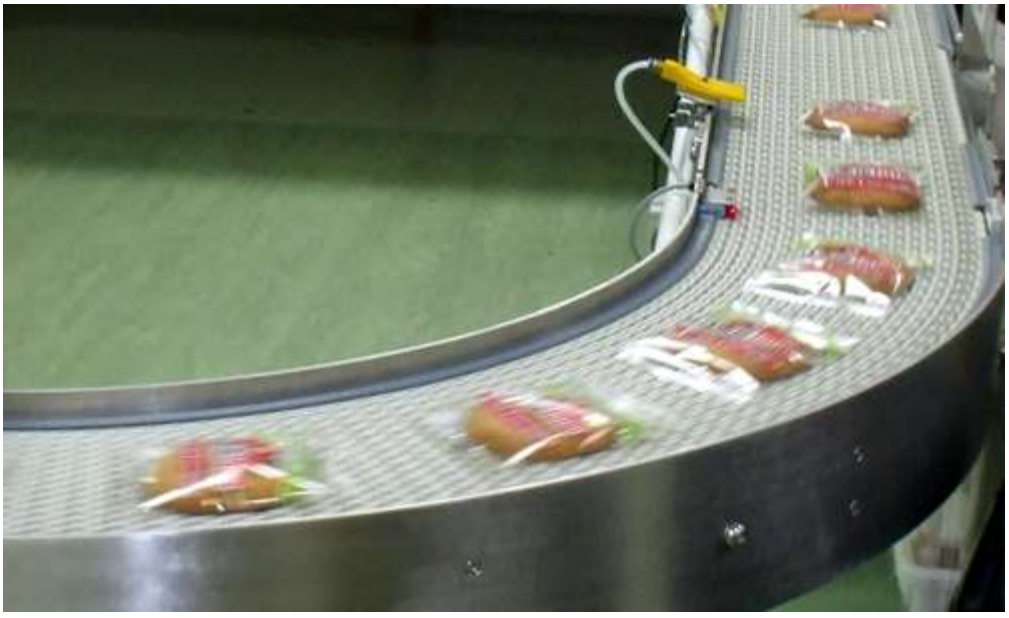

Figure 9 : biscuit packet conveying system (sesltd, 2015)

The main parts of the conveying system are discussed below.

- Electric Motor: The system is powered by an electric motor. The length, capacity, and needed speed of the belt determine its size and power rating.
- Gear Reducer: This device converts the high-speed spinning of the motor into a slower, higher-torque output that may be used to drive the belt.
- Chains and Sprockets: To transfer power from the motor to the belt, chains and spiky wheels work together. The belt's direction and speed can be changed by adjusting the sprocket and chain arrangements.
- Guides: To prevent derailment, flanges or guide rails maintain the belt centered on its course.
- Cleaning Systems: To ensure hygienic and effective operation, brushes or scrapers are used to remove debris and product residue from the belt.
- Safety switches and sensors: In the event of abnormalities, sensors can stop the system or sound an alarm. They also keep an eye on belt tension, speed, and alignment.

Types of belts

- Canvas Belts: Traditionally made and reasonably priced, canvas belts provide strong traction and are appropriate for light to medium loads. They need to be cleaned frequently and are not as resilient as other solutions.
- Belts made of plastic: Plastic belts are great for food processing situations because they are resistant to moisture and oils, making them more durable and easier to clean than canvas.
- Belts made of stainless steel: For high-volume manufacturing and delicate biscuit handling, stainless steel belts are the best option because to their improved durability and sanitation. They cost more than alternative solutions, though.

2.2.5 Packeting machines

Here main two packeting machines were available.

1. **SEMINATO machine:**

Figure 10 : seminato packaging machine (bojupacking, 2010)

Seminato is a specialist in flow wrapping machines, which are perfect for quickly packing single biscuits or small batches. Their devices are renowned for:

- Versatility: Able to quickly alter format while managing a broad variety of biscuit sizes and shapes.
- Advanced Sealing Technology: Various biscuit varieties and packing materials are catered to with ultrasonic, hot air, or cold sealing choices.
- Hygienic Design: Strict food safety laws are complied with by the stainless steel construction and easily cleaned components.
- Effective Function: Accurate product feeding, wrapping, and sealing are made possible by servo motors and PLC control systems.

2. ISHIDA machine:

Figure 11 : ishida packaging machine (soontruepackaging., 2017)

A wider variety of packaging options are available from Ishida, such as multi-lane weighers, flow wrappers, and vertical form fill seal (VFFS) equipment. Their devices are renowned for:

- Accuracy and dependability: Precise portion control and steady package weight are guaranteed by sophisticated weighing and feeding systems.
- Automation and Integration: For effective automation, there should be a smooth integration with both upstream and downstream production lines.
- Innovation and Technology: With features like robotic arm picking and vision systems, Ishida continuously pushes the envelope.
- Durability and Long-Term Performance: Sturdy design and premium parts guarantee dependable performance for many years to come.

2.3 Workshop Activities and Equipment

1. **Essential machinery**
   - Lathe: With the use of controlled rotation and cutting tools, this adaptable machine forms metal and plastic. It teaches students the principles of machining while enabling them to create bespoke parts.
   - Milling machines: By precisely removing material with revolving cutters, they allow for the learning of diverse machining techniques and the creation of exquisite works of art.
   - Drilling Machine: This tool teaches students about various drill kinds and accuracy drilling, from basic holes to intricate patterns.
   - Hand Tools: For a trainee, the basic toolbox serves as an extension of their hand. Dexterity and problem-solving abilities are improved by knowing how to use wrenches, pliers, screwdrivers, and other hand tools properly.
   - Measuring Devices: Precision is essential! In order to guarantee exact dimensions and tolerances, trainees will become proficient in the use of calipers, micrometers, and other measuring tools.
   - Welding Stations: Gaining proficiency in the art of connecting metals, students will investigate and comprehend the advantages and uses of several welding processes, such as gas welding, arc welding, and brazing.
   - Grinding machines: By obtaining specific surface finishes and smoothing down sharp edges, these machines provide trainees a keen eye for detail and metalworking abilities.
2. **Activities**
   - Simple Fabrication Projects: Constructing basic machines or pieces from the ground up fosters teamwork, a sense of accomplishment, and the reinforcement of theoretical ideas.
   - Disassembly and Assembly Tasks: Disassembling and reassembling machinery, such as engines or pumps, fosters the development of analytical skills, a grasp of mechanical concepts, and troubleshooting aptitude.
   - Maintenance and Repair Simulations: By simulating malfunctions and repair scenarios, instructors can give students hands-on experience fixing problems and learning how to identify and resolve problems that arise in the real world.

- Material testing: Knowing the characteristics of various materials via hardness, tensile, and other testing techniques offers important information for choosing safe materials and using them.

3. **Others**
   - Safety consciousness: Using equipment and tools necessitates a strong safety culture. The significance of personal protection equipment, safe procedures, and danger detection are taught to trainees.
   - Collaboration and teamwork: Working on projects frequently calls for collaborating and delegating efficiently, as well as strengthening communication skills.
   - Critical thinking and problem-solving skills: In the workshop, troubleshooting equipment malfunctions, streamlining procedures, and coming up with innovative solutions to problems become second nature.

2.4 Autonomous Maintenance of FHS.

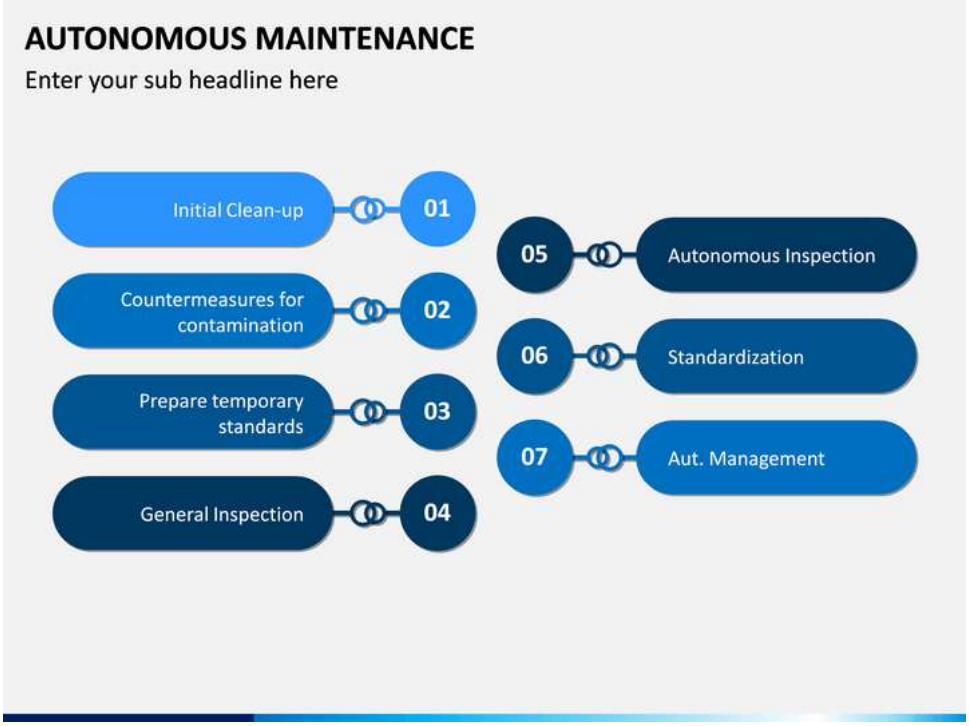

Figure 12 : autonomous maintenance steps (sketchbubble, 2020)

My contribution to the biscuit manufacturing process went beyond quick solutions because I was instrumental in the FHS's adoption and promotion of autonomous maintenance

procedures. This program focused on the vital tasks of unloading bulk flour and storing it effectively in silos. We wanted to encourage a proactive care culture and avoid any disruptions to the essential flour supply, so we gave operators and technicians the authority to assume responsibility for the system's maintenance.

Followings are the main contributions with this project.

- Customized Inspection Checklist Creation: I worked with senior technicians to develop checklists that are customized to the daily, weekly, and monthly inspections of particular FHS components. These checklists were designed to help identify potential obstructions in silo conveyors and filters, early symptoms of wear in unloading equipment such as rotary valves and pneumatic lines, and deviations from ideal moisture and temperature parameters within the silos.

  Here I prepared new checklists such as daily inspection checklist, weekend maintenance checklist, safety checklist and Engineering checklist. (**Appendix a**)
- Empowerment of Operators: I led special training sessions for FHS operators, giving them the information and abilities they need to carry out inspections, document observations, and carry out small maintenance jobs in accordance with checklists. This made it possible for them to take care of little problems like air pressure adjustments or filter cleaning before they became larger blockages or equipment breakdowns, guaranteeing continuous, smooth flour flow.
- Introduced Smart Monitoring: I took part in the introduction of fundamental condition monitoring instruments, such as vibration sensors, for vital FHS parts, such as the silo feed auger and rotary valve. By using these, Operators and technicians will able to proactively identify potential failures such as bearing wear or excessive vibration by analyzing the data from these equipment. This will allow for early preventative maintenance before the problems affected efficiency or compromised flour quality.
- Creating Proactive Routines: I worked with the maintenance team to create regular maintenance schedules that took into account the equipment requirements and inspection checklists. By ensuring regular maintenance for essential parts like silo seals and pneumatic lines, this reduced the possibility of malfunctions that might stop the production line.
- Developing a Proactive Mentality: I took an active role in encouraging the FHS team to adopt an independent maintenance culture. I made a point of stressing the value of

early problem detection, equipment health ownership, and preventative maintenance. As a result, there was a discernible change in the operators' perspective, leading to more alertness and involvement in the system's maintenance, which improved flour quality control and production efficiency.

2.5 Preventive Maintenance and Condition Monitoring

The training experience included creating and executing strong plans for preventive maintenance (PM) and condition monitoring strategies for different critical utilities in the biscuit production. Throughout the whole manufacturing process, this all-encompassing strategy reduced the chance of unforeseen disruptions, increased equipment longevity, and guaranteed peak performance.

Followings are the main contributions with this.

Detailed PM Plan Development: I worked with engineering teams to examine industry best practices, historical maintenance data, and equipment specs. As a consequence of this cooperative effort, comprehensive PM strategies were created for:

- Power Generation: Boilers, generators, and UPS systems, along with routine maintenance such as filter cleaning and component replacement.
- Wastewater Treatment Plant: Clarifiers, aeration systems, pumps, and schedule modifications based on effluent quality monitoring and influent characteristics.
- Tanks, valves, and piping systems are used in LPG storage and distribution, with a focus on leak detection and the use of safety procedures.

Integration of Condition Monitoring: I took part in the rollout of sensor-based monitoring systems at major utilities. Critical factors such as,

- The generator and UPS system's real-time power output, battery health, and operational efficiency were monitored by these devices.
- Steam pressure, fuel consumption, and emissions are all aspects of boiler performance.
- Wastewater Treatment: pH levels, dissolved oxygen (DO), and biochemical oxygen demand (BOD) to maximize treatment procedures.

2.6 Utilities.

2.6.1 Waste water treatment plant

1. Initial Treatment:

- Bar Screen: To safeguard pumps and other downstream equipment, this first line of defense gets rid of big waste like rags and plastic bags.
- Oil Tap: This particular type of valve is essential for isolating oils from oily leftovers. The automatic separation and release of accumulated oil from the wastewater stream is usually initiated by a float mechanism. It is crucial to comprehend the construction, functionality, and upkeep of this tap in order to remove grease effectively and shield the biological treatment method from damage.

2. Primary Treatment

- Sedimentation Tank: Here, wastewater settles for a predetermined amount of time, enabling sludge—or suspended solids—to settle by gravity. In doing so, the organic load is decreased and the water is ready for biological treatment.

3. Secondary treatment

- The WWTP's central component, the aeration tank, is where bacteria and other microorganisms break down the organic materials in wastewater. Air diffusers' dissolved oxygen is essential to their existence and effective biodegradation.

My involvements and contributions,

- My participation in the WWTP helped to ensure that wastewater discharge met environmental laws.
- I promoted the reuse of wastewater for non-critical applications through optimization efforts, which helped minimize water use.
- Taking part in oil tap maintenance reduced the possibility of damaging the delicate biological treatment process and guaranteed effective grease removal.

2.6.2 Boilers

Figure 13 : industrial boiler (ieselship, 2021)

Here, following things are studied.

- Knowing the benefits and subtleties of using gas, oil, or even biomass to power steam boilers.
- Combustion Efficiency: One important lesson learned was to maximize heat output and minimize emissions by optimizing fuel combustion. This required examining the properties of the flue gas and modifying the burner settings to guarantee full combustion and environmental compliance.
- Production and Distribution of Steam: It was essential to comprehend the complex system of steam pipes and valves that distributed the pressurized steam throughout the oven area. In order to heat buildings efficiently and save energy, I now know to keep an eye on steam pressure, flow rates, and condensate return.
- Preventive maintenance and safety procedures: boiler safety was crucial. To reduce downtime and guarantee safe operation, I received training in emergency shut-down procedures, routine inspections, and preventive maintenance programs.

2.6.3 LPG storage and distribution

Although flour forms the basis for biscuits, liquefied petroleum gas (LPG) provides the energy needed to turn it into golden treats. During my training, I learned about the exciting

world of LPG distribution and storage at the biscuit plant, which makes sure that there is a constant supply of this clean-burning fuel to power baking.

Here the technical expertise are mentioned below.

- Storage Tank Management: Through direct experience, I developed an understanding of the design, safety measures, and inspection processes of bulk LPG storage tanks.
- Vaporizer Operation: It was important to comprehend how liquid LPG was turned into vapor for distribution. I gained experience using vaporizers, making sure the gas flow and pressure were sufficient to suit the needs of the oven area.
- Safety and the Piping Network: Careful attention was needed to the complex network of pipelines that supplied LPG throughout the factory. To guarantee safe fuel supply, I received training in pipeline safety procedures, leak detection techniques, and appropriate valve operation.
- Rules and Compliance: Handling the intricacies of LPG rules and safety requirements naturally became second nature. I gained knowledge on how to put the right policies in place to reduce negative environmental effects and adhere to legal requirements.

My contributions related to this

- Organize fuel supplies: One of my main responsibilities included coordinating timely deliveries and ideal tank levels with LPG suppliers.
- Arrange and carry out upkeep: Reliability of the fuel supply was greatly enhanced by taking part in the planning and implementation of preventive maintenance for storage tanks, vaporizers, and pipes.
- React to crises: I actively took part in putting emergency response plans into place in the event of unplanned leaks or system failures, guaranteeing a prompt resolution and lowering possible hazards.

2.6.4 Generators and UPS system

- Types of Generators and How They Work: I looked at the many generator types used in the plant, from giants powered by natural gas to diesel workhorses. It became essential to comprehend their fuel systems, emission control techniques, and operating principles.

- UPS Systems for Sensitive Electronics: UPS systems are responsible for safeguarding sensitive equipment, such as data servers and control systems. I investigated their internal operations, battery care, and setup to provide the longest runtime possible during power outages.
- Rigid safety and preventive maintenance procedures are necessary for both UPS systems and generators. I became an expert in emergency shutdown protocols, routine inspections, and preventive maintenance plans to ensure their dependability and efficiency.

2.7 Hopper Designs for Seminato Machine

2.7.1 Biscuit collecting hopper

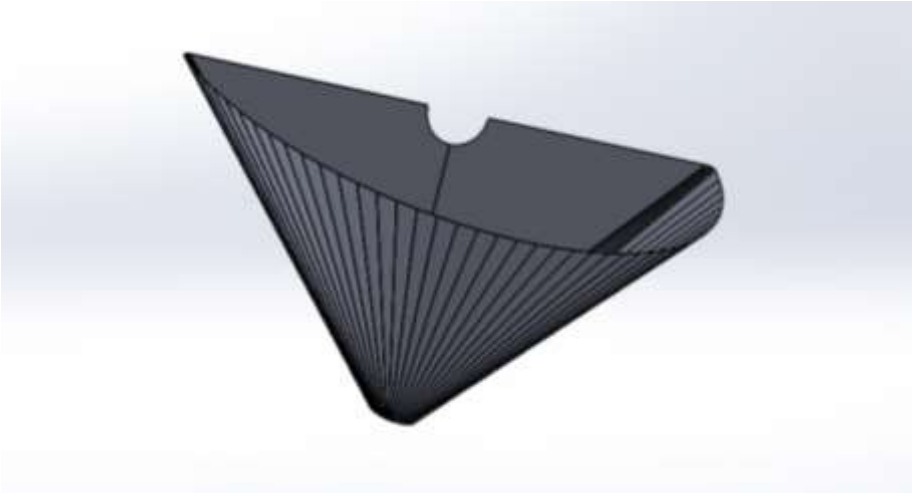

Figure 14 : Biscuit collection hopper for seminato machine

My training involves actively looking for ways to enhance systems, not just watching them as they were. During my work with the Seminato cookie packing machine, one such event occurred. One of the challenges was the top hopper that was in place, which was in charge of feeding biscuits to the conveyor. Because of its extreme verticality, biscuits dropped straight into the conveyor, resulting in breakage and uneven packaging. And I followed below steps.

1. Identifying the problem.
    - Steep drop: The high drop distance caused by the vertical design put biscuits under a lot of impact stress when they arrived at the conveyor.
    - Direct contact: As the biscuits fell, they tipped over and struck one another, which increased the possibility of breaking and chipping.

- Inconsistent packaging: The uneven bounce and landing on the conveyor caused variations in biscuit placement, which had an impact on packing effectiveness and appearance.

2. Designing solutions
    - Angle adjustment: I suggested adding a mildly inclined slope to the hopper to lessen its verticality. As a result, the biscuits experienced a lower impact force and a shorter drop distance.
    - Internal baffles: By placing the baffles in the hopper strategically, you can minimize tumbling and prevent collisions as the biscuits go down the hill.
    - Controlled discharge: By installing a controlled discharge device at the hopper's base, biscuits would be sent to the conveyor in a steady and even flow, increasing packing accuracy.
3. Impact and validation
    - Decreased breakage: By minimizing biscuit damage during transfer and implementing a controlled flow, the smoother descent improved product quality and decreased waste.
    - Better packaging: More efficient and aesthetically beautiful packaging resulted from the biscuits being positioned consistently on the conveyor, which raised consumer satisfaction.
    - Reduced breakage meant fewer stoppages for picking up broken biscuits, which raised uptime and production efficiency.
4. Beyond design
    - Construction of the prototype: In order to verify the operation and efficacy of the modified hopper, I worked with specialists to build a smaller version.
    - Data analysis: Throughout the test runs, I kept a careful eye on the new hopper's performance and collected useful information to confirm its influence on biscuit breaking and packing effectiveness.
    - Implementation strategy: In collaboration with the production teams, I created a strategy to minimize interruption and downtime by smoothly integrating the new hopper into the Seminato machine.

2.7.2 Biscuit removing hopper

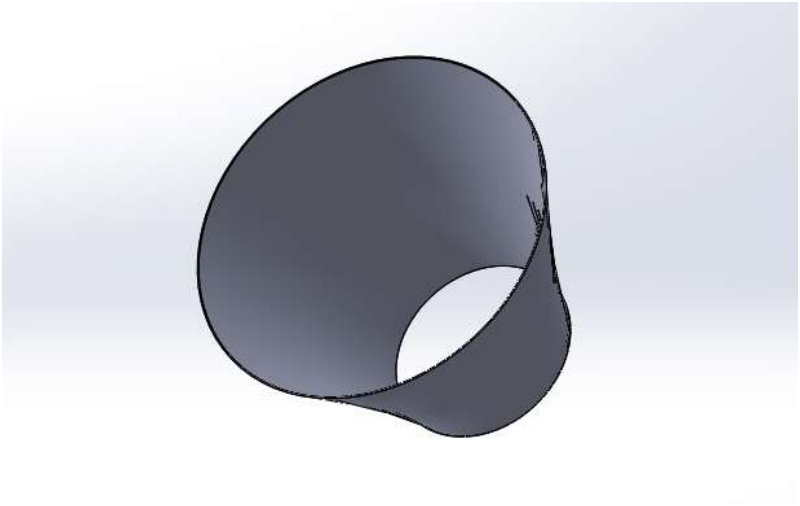

Figure 15 : biscuit removing hopper for seminato machine

In addition to streamlining the flow of biscuits into the Seminato, I addressed inefficiencies in the removal hopper. Congestion and uneven transfer were brought on by its small size and strange tilt. My suggestion was, I change the base to reduce overflows and rebuilt the mouth for smooth, gravity-assisted discharge. This simplified the process of removing biscuits, increasing manufacturing productivity, reducing downtime, and maintaining product quality.

CHAPTER 03 – TRAINING EXPERIENCES – MANAGEMENT

3.1 SHEQ Concept

My education went beyond the technical to help me grasp the significance of the SHEQ (Safety, Health, Environment, and Quality) principles. I was able to support the biscuit factory's dedication to ethical and sustainable production because to this holistic viewpoint.

Safety

- Encouraging Safe Practices: I took an active part in safety training sessions to make sure that emergency response protocols, danger identification, and appropriate PPE usage were ingrained in routine operations.
- Putting Risk Assessments into Practice: Working with teams, I assisted in putting risk assessments into practice in a variety of production areas, proactively identifying and reducing possible safety concerns.
- Promoting Continuous Improvement: In order to promote a culture of accident prevention and continuous improvement, I fought for the significance of reporting near misses and safety concerns.

Health

- Ergonomic Workstations: In order to reduce the risk of musculoskeletal strain and fatigue, I assisted in the design and implementation of ergonomic workstations while working with production teams.
- Hygiene and Sanitation Awareness: I took part in encouraging good hygiene habits and making sure that sanitation guidelines were followed all the way through the manufacturing process.
- Initiatives for Mental Health: Understanding the value of mental health, I helped the factory establish support systems and a good work-life balance.

Safety

- Resource Efficiency: Throughout the course of several manufacturing phases, I investigated and put into practice methods for cutting down on energy and water usage, improving waste management, and lowering pollution.

- Responsible Material Sourcing: In order to reduce my environmental impact, I evaluated and promoted the use of sustainable sources for ingredients and packaging materials.
- Environmental Compliance: I took part in making sure the factory complies with pertinent environmental laws and actively looked for ways to make improvements.

Quality

- Quality Control Procedures: To maintain constant product quality and customer satisfaction, I took part in the implementation and monitoring of quality control procedures throughout the manufacturing chain.
- Data Analysis and Continuous Improvement: In order to spot any quality problems early on and work with teams to find solutions, I gained experience analyzing quality control data.
- Client Input and Innovation: In order to keep our offerings competitive and meet changing client preferences, I took part in integrating customer input and trends into quality improvement and product development projects.

3.2 5S Implementation

I was able to put the potent 5S principles—Sort, Set in Order, Shine, Standardize, and Sustain—to use here. This trip not only completely changed our workspace, but it also produced an incredible accomplishment: placing second in the company-wide 5S competition.

Our engineering office wasn't in the best of shape when it first opened. Paperwork piled high on desks, tools strewn about carelessly, and important documents hidden away in jumbled filing cabinets. The disarray made things less productive, efficient, and morale-boosting.

Equipped with the 5S instruments, we set off on a life-changing adventure:

- **Sort:** We cleared desks and shelves of extraneous objects with ruthlessness. Old manuals, abandoned machinery, and unnecessary documents were recycled or disposed of appropriately.
- **Set in Order:** There was a place for everything that remained. Redesigned filing systems, labeled toolboxes containing tools, and digitalized document digitization for convenient access were implemented.

- **Shine:** We took on the filth head-on, thoroughly cleaning every surface and getting rid of years' worth of collected dust. This enhanced workplace hygiene in addition to improving aesthetics.
- **Standardize:** We created distinct visual cues and procedures to ensure that the newly created order is maintained. It became commonplace to have color-coded labels, standardized storage options, and easily accessible cleaning materials.
- **Sustain:** Consistency is the foundation of 5S. To make sure the changed state persisted, we implemented continuous improvement techniques, team responsibility, and routine audits.

There was no denying the results of our 5S efforts:

- Enhanced Efficiency: As a result of better resource accessibility and organization, we saw an increase in work completion times.
- Improved Cooperation: The uncluttered area promoted improved teamwork and communication, which resulted in a more efficient project workflow.
- Enhanced Morale: It was evident that a well-kept, functioning, and orderly workspace positively affected staff satisfaction and morale.

3.3 Preparing Of a Training Schedule (**Appendix b**)

This program offered a chance to support the advancement of upcoming engineers in addition to personal development. Acknowledging the breadth of knowledge that existed within the biscuit plant, I set out to design an extensive curriculum for students studying mechanical engineering. With great care and attention to detail, this curriculum was designed to give students a comprehensive understanding of many facets of the manufacturing process and the information and abilities they would need to succeed in the workplace.

The training schedule encompasses a wide range of essential areas, ensuring students gain practical experience in,

- **Manufacturing processes:** Discover the ins and outs of biscuit manufacturing by delving into the mixing, baking, and chilling, packing, and quality control processes.
- **Infrastructure and Utilities:** Dive into the complex world of infrastructure and learn how to maintain and operate systems such as air compressors, boilers, chillers, gas unloading units, flour unloading units, power distribution via UPS and generators, and sewage and effluent treatment plants.

- **Mechanical Workshops and Tool Rooms:** Learn the fundamentals of tool operation and machining by gaining practical experience in the Engineering Tool Room and Mechanical Workshop.
- **Digital Tools and Systems:** In today's business environment, being familiar with ERP systems such as SAP is essential. Training on using SAP for production scheduling, material management, and quality control is scheduled.
- **Safety and Compliance:** Handling fire hydrant systems, conducting engineering audits, and comprehending fire safety protocols foster a strong safety culture and an awareness of compliance requirements.

3.4 Quotation Analysis

3.4.1 UPS Analysis

Here I analyzed the UPS systems for the company to select the better brand.

- Riello MHE 300 transformer type: This UPS uses transformer-based technology and has a 300 kVA capacity. It is priced at Rs. 28,525,250 and comes with a 2-year warranty.
- Socomec DELPHYS GP 2.0/300KVA: This UPS has a capability of 300 kVA and uses a 3-level inverter technology. It costs Rs. 20,493,524 (62800 US dollars) and comes with a 3-year guarantee.
- Fully IGBT based Reillo NXE 300 UPS: This 300 kVA UPS is powered by IGBT technology. It is priced at Rs. 15,056,000 and comes with a 5-year warranty.

That also includes some other information about the UPS options, such as the country of manufacture, the type of battery bank, the backup time, and the maintenance requirements.

Then I was able to find feasible solutions for below mentioned problems.

- Which UPS option is the most cost-effective?
- Which UPS option has the longest backup time?
- Which UPS option is the most reliable?
- Which UPS option is the easiest to maintain?

Then I decided some answers for above mentioned problems.

- The Socomec DELPHYS GP 2.0/300KVA is the most cost-effective option, at Rs. 20,493,524.

- The Reillo NXE 300 (Fully IGBT based) has the longest backup time, at 10 minutes at full load.
- The Reillo MHE 300 transformer type is the most reliable option, with a warranty of 2 years.
- The Reillo NXE 300 (Fully IGBT based) is the easiest to maintain, with only 3 PMs per year required.

3.4.2 Robot arm supplier analysis

In order to maximize productivity and optimize operations, Plant 9 must choose the best provider for robot arms. Four possible options are assessed in this analysis based on important variables such as:

- Technical Specifications: Controller capabilities, reach, and payload capacity are examined.
- Cost: A comparison is made between the estimated costs of each robot arm, including CIF Colombo delivery.
- Remarks: The study offers important information about the advantages, disadvantages, and compatibility of each provider for Plant 9's needs.

Below are the some recommendations.

Kawasaki (Techmast Automation) is the suggested provider. Numerous elements lend support to this decision:

- Proven Performance: The RS005L model has proven its dependability and appropriateness for comparable jobs by operating successfully in Plant 6.
- Reputable Components: Kawasaki, Japan is the source of important parts like controllers and actuators, guaranteeing both performance and quality.
- Competitive Price: At Rs. 13,171,533.35, the provided price is within a fair range.
- Robust Local Support: The technical know-how and post-purchase support provided by Techmast Automation are considered adequate.

It is not advised to purchase Yasakawa or Universal Robots for the following reasons:

- Yasakawa (Rotex): The advantages are outweighed by the higher price of Rs. 14,740,000 and worries about reliability and maintenance expenses.

- Universal Robots (Techfield Sri Lanka): Although the robots' performance is satisfactory, there are issues with excessive maintenance costs and the regional representative's lack of responsiveness.

Additionally, Efort Industrial Robot is not advised. Although its performance does not meet Plant 9's needs, its cheaper price of Rs. 11,856,800 may look alluring. This could have an impact on the intended output rates.

Final suggestion - The best option for Plant 9 is to select Kawasaki from Techmast Automation since it provides a good mix of dependable performance, affordable pricing, and excellent local service. Before making the choice, it's crucial to take into account other factors including long-term support, spare part availability, and training.

3.5 Data Analysis

3.5.1 Oven temperature

Here, I set out to find any possible temperature problems that might be influencing productivity and product quality. I analyzed data with a sharp eye and a reliable infrared (IR) meter.

Graphing the Thermal Environment:

In order to conduct my investigation, I carefully measured the temperature at several crucial points:

- Bearing temperatures: Monitoring the heat produced by essential oven bearings to ensure smooth operation.
- Determining probable hotspots or unequal heat distribution that may affect the consistency of the baked product outside the oven.
- Temperature of the environment: Being aware of how the surrounding factors affect oven performance.

These measurements were carefully taken, then turned into eye-catching graphs that told the oven's thermal tale.

A Look inside the Charts:

By examining the graphs, I was able to identify trends and possible problems:

- Variations in bearing temperature: Small variations in temperature in particular bearings may indicate wear or lubrication problems that need to be looked into further.
- Hotspots or cold zones: An uneven distribution of temperatures across the oven's body may cause uneven baking and issues with the quality of the final product.
- Influence of ambient temperature: A correlation between high temperatures outside and oven performance may call for modifying cooling systems or setting parameters.

Not only did my study produce insights, but it also spurred action:

- Recommendations for maintenance: I recommended preventive maintenance to avert possible failures based on bearing temperature data.
- Oven control modifications: In order to attain the best baking conditions, uneven temperature distribution necessitated adjusting heating components and airflow patterns.
- Environmental considerations: I suggested changing the ventilation system or the operation schedule to reduce the impact of ambient temperature, as I was aware of its effects.

CHAPTER 04 – PRACTICE OF PROFESSIONAL STANDARDS AND ENGINEERING ETHICS

4.1 Professional standards

Below are the professional standards from this organization.

- Competence: Engineers are only required to provide services in their specific fields of knowledge and experience.
- Public safety: The health, safety, and welfare of the general public must come first in all engineering choices and activities.
- Integrity: The core principles that govern all engineering relationships are honesty, truthfulness, and fairness.
- Maintaining trust and preventing conflicts of interest require engineers to protect sensitive information they are entrusted with. This is known as confidentiality.
- Sustainability: It is crucial to take into account how engineering projects will affect the environment and to encourage sustainable practices for the benefit of future generations.

4.2 Engineering ethics

Below are the learnt engineering ethics from this organization.

- Beneficence: Strive to do well and avoid causing harm through work.
- Non-maleficence: Do no harm to people, the environment, or society through engineering decisions.
- Autonomy: Respect the autonomy of individuals and communities impacted by work.
- Justice: Strive for fairness and equity in the distribution of benefits and burdens of projects.
- Sustainability: Consider the long-term environmental and social impact of your work.

CHAPTER 05 – ENVIORNMENTAL AND SUSTAINABILIY

5.1 Key Environmental impacts.

- Resource Consumption: Grinding flour, combining ingredients, baking, chilling, and packing all use a lot of water and energy during the biscuit-making process. It should be a top focus to identify the precise locations with high usage and offer alternatives for reduction.
- Waste Generation: The sector produces a range of wastes, such as wastewater, packaging materials, and food scraps. It's critical to put waste reduction techniques into practice, such as reducing leftovers, looking into biodegradable packaging, and efficiently treating wastewater.
- Effects on the Supply Chain: Beyond the confines of our factory, our environmental impact is widespread. Reducing deforestation and biodiversity loss can be achieved by sourcing products that are farmed sustainably, such as palm oil certified by the Roundtable on Sustainable Palm Oil (RSPO).

5.2 Current sustainable practices

- Energy Efficiency: We can explore initiatives like replacing old equipment with energy-efficient models, optimizing production processes, and implementing heat recovery systems to reduce energy consumption.
- Water Conservation: Implementing water-saving measures in cleaning and cooling processes, rainwater harvesting, and treating wastewater for reuse can minimize water usage.
- Waste Reduction: Minimizing scrap by optimizing recipes, employing automated cutting processes, and exploring repurposing options for scraps like converting them into animal feed or biofuel are effective strategies.
- Sustainable Packaging: Switching to biodegradable or compostable packaging materials, reducing packaging size, and implementing recycling programs for used packaging can significantly reduce waste.

CHAPTER 06 – SUMMERY AND CONCLUSION

6.1 Summery

The factory was more than simply a symphony of whirring machinery and rising dough. It was a furnace where theory and practice collided, satisfying my insatiable curiosity. I immersed myself in the complex dance of biscuit making, carefully solving the puzzles surrounding every phase. However, my voyage extended beyond baking pans and blending basins. I was an organization champion who used the 5S principles like a conductor's baton to turn the engineering office from a waste of space into a productive refuge that helped us place second in the company competition. Additionally, I created a bridge of knowledge for aspiring engineers by painstakingly creating a detailed training program that guided them through the complex operations of the plant and gave them the tools they needed to successfully negotiate the rewards and challenges of their chosen career path. However, I learned more than just the technical. I studied the foundational ethics of engineering, realizing how difficult it is to strike a balance between responsibility and advancement, safety and creativity. This was not only a voyage to perfect a biscuit; it was also a quest to comprehend the workings of a responsible engineer, with lessons engraved not just in dough but also in my own essence. And today, emboldened by this diverse experience, I march into the future prepared to create a better society, one skillfully designed solution at a time, rather than just items.

6.2 Conclusion

My industrial training experience at CEYLON BISCUIT LIMITED is definitely deserving of the designation "excellent." It exceeded my expectations much and gave me essential knowledge, skills, and a moral foundation that will be the cornerstone of my engineering career.

This evaluation results from my training's diverse components. I was more than just an observer of manufacturing processes; I was a part of the complicated dance of making biscuits, from the first kneading of dough to the last golden bake. I was able to fully understand the intricacies of industrial production and have a great regard for the attention to detail and workmanship required thanks to this practical learning that was driven by my own interest.

The manufacturing floor evolved from a place of technical mastery to a furnace of personal development. By implementing the 5S principles, the engineering department became an efficient refuge, which led to our remarkable performance of placing second in the corporate competition. This cooperative success demonstrated the value of cooperation and a strong work ethic in addition to validating my efforts.

Above all, my training experience covered the foundational ethics of engineering. I gained an appreciation for the fine balance that exists between accountability and advancement, creativity and security. It's not just about making the ideal biscuit; it's about developing into an engineer who thinks through the effects of every choice, improving not just the factory floor but the entire globe. Knowledge sharing was occasionally hampered by departmental communication breakdowns. Putting in place cross-departmental workshop initiatives could promote more cooperation and knowledge sharing. The significance of ethical decision-making in engineering practice could also be reinforced by including ethical debates and case studies in training courses.

All in all, my industrial training at CEYLON BISCUIT LIMITED is a symphony of knowledge, resonating with the sound of machinery, the companionship of coworkers, and the steadfast dedication to moral duty. I bring with me the rough hands of a craftsman, the cooperative nature of a conductor, and the unshakable dedication of an engineer driven by moral values. This program was about building an engineer for a better tomorrow, not simply for machines. It wasn't just about cookies.

REFERENCES

Anon., 2018. *Types of Rotary Valve: Application, Components, Limitations (Rotary Airlock Valve).* [Online]
Available at: https://engineeringlearn.com/types-of-rotary-valve-application-components-limitations-rotary-airlock-valve/
[Accessed 23 01 2023].

biscuitpeople, 2014. *conveying systems.* [Online]
Available at: https://www.biscuitpeople.com/product/453-conveying-systems
[Accessed 23 01 2024].

bojupacking, 2010. *seminato packing machine.* [Online]
Available at: https://www.bojupacking.com/packing-machine-for-biscuit/
[Accessed 23 01 2024].

CBL, 1968. *Ceylon biscuit limited.* [Online]
Available at: https://www.cbllk.com/media/2021/5/asd-1614143348-1-1620992769.jpg
[Accessed 23 01 2023].

filquip, 2010. *material handling equipment.* [Online]
Available at: https://www.filquip.com.au/products/materials-handling-equipment/silo-pressure-relief-valves/
[Accessed 23 01 2024].

hippox, 2006. *flour storage silos.* [Online]
Available at: https://www.hippopx.com/en/storage-silos-storage-flour-grain-storage-137755
[Accessed 23 01 2023].

ieselship, 2021. *ngineering-knowledge-general/marine-boilers.* [Online]
Available at: https://dieselship.com/marine-technical-articles/marine-engineering-knowledge-general/marine-boilers/boiler-basics/
[Accessed 23 01 2024].

machines4u, 2009. *ovens.* [Online]
Available at: https://www.machines4u.com.au/view/advert/Ovens/379132/
[Accessed 23 01 2024].

ppesales, 2005. *biscuit baking oven.* [Online]
Available at: http://www.ppesales.com.au/biscuit-baking-oven.html
[Accessed 23 01 2024].

sesltd, 2015. *food processing conveyer.* [Online]
Available at: http://www.sesltd.co.nz/food-processing.php
[Accessed 23 01 2024].

sinofudegroup, 2023. *The Ultimate Guide To Industrial Biscuit Ovens.* [Online]
Available at: https://sinofudegroup.com/en_za/the-ultimate-guide-to-industrial-biscuit-ovens/
[Accessed 23 01 2024].

sketchbubble, 2020. *presentation autonomous maintenence.* [Online]
Available at: https://www.sketchbubble.com/en/presentation-autonomous-maintenance.html
[Accessed 23 01 2024].

soontruepackaging., 2017. *ishida multihead weigher.* [Online]
Available at: https://www.soontruepackaging.com/snacks-potato-chips-packing-machine-food-packaging-with-ishida-multi-head-weigher.html
[Accessed 23 01 2024].

university, o. s., 2015. *silo storage and advanteges.* [Online]
Available at: https://forages.oregonstate.edu/oregon/topics/storage/silos
[Accessed 23 01 2024].

ut-ec, 2004. *milling and paste plant.* [Online]
Available at: https://ut-ec.com/products/milling-and-pasta-plants/flour-storage-silos/filters-for-silo-cepi
[Accessed 23 01 2024].

APENDICES

Appendix a

Table 1 : Flour unloading daily inspection checklist

Flour Unloading Operation - Daily cleaning and inspection checklist.

මෙම සඳහන් සියල්ල කාර්යයෙහි නියුතු යන්ත්‍ර ක්‍රියාකරු විසින් පිරවිය යුතුය.

	යන්ත්‍ර ක්‍රියාකරුගේ නම හා දිනය.	පැමිණි වේලාව.		පිටවූ වේලාව.	
	පරීක්ෂාව	ඔව්	නැත	ඔව්	නැත
01	පරිශ්‍රයේ බිම පෙදෙස්, බිත්ති හා අදාළ සියලු දෑ පිරිසිදුව ඇත.				
02	පිරිසිදු කිරීමට යොදන උපකරණ අදාල ස්ථානයේ තබා ඇත.				
03	හයිඩ්‍රොලික් පද්ධතියේ යම් ආකාරයක කාන්දුවීමක්, අධිකව මල බැඳීමක් හෝ කිසියම් අදෘශ්‍ය සතතක බවක් දැනගත නොහැක.				
04	මීයන් හෝ වෙනත් සත්ව කොට්ඨාසයන් සිටින බවට සාක්ෂි නොමැත.				
05	රාත්‍රී ඒකකයේ ඇති Emergency Light ක්‍රියාත්මක තත්වයේ ඇත.				
06	පරිශ්‍රයේ අදාළ කාර්යයන්ට අවශ්‍ය නොවන කිසිදු උපකරණයක් ගබඩා කර නොමැත.				
07	යුනිට්ය ක්‍රියාත්මක විට විද්‍යුත්කෝලයේ පිටි සහිත බවක් දැනගත නොහැක.				
08	ගිනි නිවීමේ අයිතමයන් අදාළ ස්ථානයේ නිසිපරිදි තබා ඇත.				
09	අතිරේකව ඇති ෆිල්ටර්ස් අදාළ ස්ථානයේ පිරිසිදුව තබා ඇත.				
10	පිටි සාම්පල් පරීක්ෂා කරන machine එක පිරිසිදුව ඇත.				
11	භාවිතා නොකරන සයිලෝස් වල කරාම හා නල භාවිත නොකරන අවස්ථාවන්හි වසා තබා ඇත.				
12	සයිලෝස් ඇතුළත පිටි කාන්දුවක් පෙනෙන්නට නොහැක හා පිරිසිදුව ඇත.				
13	සියලු නියුමැටික් ලයින් පිරිසිදුව හා ක්‍රියාත්මක තත්වයේ ඇත.				

අමතර කරුණු හා අමතරව සිදුකළ දෑ:

ඉහත සියලු දෑ පරීක්ෂා කර සහතික කරන ලදී. (යන්ත්‍ර ක්‍රියාකරුගේ නම හා අත්සන)	

Table 2 : flour unloading safety checklist

Flour Unloading Operation – Safety checklist.

මෙම පත්‍රයේ සඳහන් සියල්ල කාර්යයෙහි නිරතුර යන්ත්‍ර ක්‍රියාකරු විසින් පිරවිය යුතුය.

	යන්ත්‍ර ක්‍රියාකරුගේ නම හා දිනය.		ආරම්භක වෙලාව	
			ඔව්	නැත
01	ඔව් සමඟ සන්නෙවිමරය හිසි අයුරින් ආධාරක තබා රැඳීම් එක ඔක ස්ථානගත කර ඇත.			
02	රැඳීම් එක ඔක ඇති ආධාරකය වස හිසි පරිදි ඔන් ඇතුළත් කොට ඇත.			
03	Bottle screws තුන හිසි පරිදි සන්නෙවිනරයට සම්බන්ධකර ඇත.			
04	සුයිම් මුවරය සන්නෙවිනරයෙන් හිසි පරිදි ඉවත් කොට ඇත.			
05	කරාවරි වැල්වය අදාල සියළු ඇණ දමා සන්නෙවිනරයට හිසි ආකාරයටම සවි කර ඇත.			
06	ඔව් පමණ් කරන නල හිසි ආකාරයටම සම්බන්ධ කර ඇත. අනෙක් නල වසා දමා ඇත.			
07	පයිප්ලයිනයේ පද්ධතියේ කිසියම් කිසියම් කාන්දුවක්, හානිදායක් හෝ කිසියම් අදාළයක් වාර්තා නොවේ.			
08	සම්පීඩිත වායු පීඩනය 5 bar මට්ටමේ ඇත.			
09	ප්‍රතිටය අසල ඇති පීඩන මානයේ පීඩනය 0.6 – 0.7 අතර පවතී.			
10	පයිප්ලයේ තුල ඔව් කාන්දුවීම් හෝ කිසියම් අදාළ සහගත බවක් දැනගත නොහැක.			
11	ඔව් බැම් සිදු කරන අතර තුර කිසිදු කාන්දුවීමක් හෝ අදාළ සහගත බවක් හඳුනා ගත නොහැක.			
12	සන්නෙවනරයේ ඇති සියලුම ඔව් පයිප්ලයි වෙත යැවූ පසු හිසි අයුරින් රැඳීම් එක පහත් කොට Emergency light එකෙහි ක්‍රියාකාරිත්වය තහවුරු කරන ලදී.			
13	සම්බන්ධකර ඇති සියලු නල හා වයර්ස් හිසි පරිදි ගලවා ඉවත් කර ඇත.			
		අවසාන වූ වෙලාව		

විදහස් කරුණු

- යන්ත්‍ර ක්‍රියාකරු හා උදවිකරු ආරක්ෂිත ආරක්ෂිත අමතරියෙන් පැළඳ සිටිය යුතුය.
- යම් හදිසි අවස්ථාවක් ඇති වූ විට වහාම ප්‍රතිටය නතර කර අවසාන ක්‍රියාවලිය ගත යුතුය.

අමතර කරුණු හා අමතරව සිදුකල යුතු:

ඉහත සියලු දේ පරීක්ෂා කර තහවුරු කරන ලදී.

(යන්ත්‍ර ක්‍රියාකරුගේ නම හා අත්සන)

Table 3 : flour unloading weekend maintenance checklist

Flour Unloading Operation – Weekend checklist.

මෙම පත්‍රයේ සඳහන් සියල්ල කාර්යයෙහි නියුතු යන්ත්‍ර ක්‍රියාකරු විසින් පිරවිය යුතුය.

	යන්ත්‍ර ක්‍රියාකරුගේ නම හා දිනය				Checked by UE
	ක්‍රියාව		ඔව්	නැත	
01 02 03	සියලු බිම් කොටස් සෝදා vacuum cleaner මගින් පිරිසිදු කරන්න.				
	බිත්ති, දොරවල්, හා අනෙකුත් ස්ථාන වල මකුළු දැල් බැඳී ඇත්නම් ඒවා පිරිසිදු කරන්න.				
	ඩ්‍රම් එකෙහි තත්වය පරීක්ෂා කර අවශ්‍ය වේ නම් ග්‍රීස් යොදන්න				
04 05 06 07	රොටරි වැල්වය කන්ටේනරයට සම්බන්ධ කරන අඩුව පරීක්ෂා කර පිරිසිදු කරන්න.				
	රොටරි වැල්වයේ ඇති ෆිල්ටර් බෑග් ගලවා ඉවත් කොට vacuum cleaner මගින් පිරිසිදු කරන්න.				
	අවශ්‍ය වූ විට නව ෆිල්ටර් බෑග් යෙදීම සිදු කරන්න.				
	සියලු තල, කරාම හා සම්බන්ධිත ස්ථාන ගලවා ඇතුලත හා පිටත පිරිසිදු කරන්න.				
	බ්ලෝවර් කාමරය පිරිසිදු කොට එහි ඇති අදාළ උපකරණයන් ක්‍රියාත්මක තත්වයේ ඇති දැයි පරීක්ෂා කරන්න.				
08 09 10 11 12 13	විදුලි බල්බ සහ අදාල විදුලිත් උපාංග පිරිසිදු කර පරීක්ෂා කරන්න.				
	සයිලෝ අභ්‍යන්තරයේ ඇති බිත්ති, පුනීලය හා බිම පිරිසිදු කරන්න.				
	සයිලෝ අභ්‍යන්තර පුනීලයේ ඇති ෆිල්ටර් 4 ගලවා පිරිසිදු කරන්න				
	පුනීලයේ ඇති ගේට් එකට ලිහිසිකාරක යොදා පිරිසිදු කරන්න.				
	පුනීලය හා සයිලෝ අභ්‍යන්තරයේ වෙනත් කාන්දුවීම් වැනි දෝෂ සහගත බවක් ඇතිදැයි පරීක්ෂා කරන්න.				
	සයිලෝ ඉහළ ඇති ෆිල්ටර්ස් 12 ගලවා පිරිසිදු කරන්න. අවශ්‍ය නම් නව ෆිල්ටර්ස් යොදන්න.				
	සයිලෝ ඉහල ඇති PRESSURE RELIEF VALVE පිරිසිදු කර පරීක්ෂා කරන්න.				
	ෆිල්ටර්ස් 2 පිරිසිදු කරන්න . අවශ්‍ය නම් නව ෆිල්ටර්ස් යෙදීම සිදු කරන්න.				
	මෙම පුනීලය පිරිසිදු කර ක්‍රියාත්මක තත්වය පරීක්ෂා කරන්න.				
	කිසියම් දෝෂයක් තිබේදැයි පරීක්ෂා කරන්න.				

අමතර කරුණු හා අමතර වැඩ සිදුකල දෑ:

ඉහත සියලු දෑ පරීක්ෂා කර සම්පූර්ණ කරන ලදී. (යන්ත්‍ර ක්‍රියාකරුගේ නම හා අත්සන)	
ඉහත සියලු දෑ නිවැරදි ආකාරයටම සිදු කර ඇත. (UE. Mr. Samantha)	

Table 4 : flour unloading unit Engineering checklist

Flour Unloading Operation Annual Engineering Checklist

Date	
Main inspector	
Sub inspector	

Components	Inspections	Condition		Remark
		ok	not	
Unloading unit	Rotary valve torque measurement and vibration monitoring analysis			
	Filter pressure drop monitoring			
	Vibration motor performance analysis			
Ramp and hydraulic unit	Structural integrity test			
	Foundation stability leveling survey			
	Working conditions of safety devices			
	Pressure testing of hydraulic system connecting			
	Pump performance analysis			
	oil analysis			
	Valves and control system testing			
	Cylinders and seals testing			
Pneumatic system	Leak detection testing			
	Airflow and pressure testing			
	Joint and connection inspection			
Pipes	Material integrity testing			
	Flow and leak analysis			
	Internal diameter measurement			
Silo	Structural integrity testing			
	Vibration monitoring analysis			
	Sensor condition testing			
	Dust concentration measurement			
	Filter pressure drop monitoring			
	Filter dust particle analysis			

	Pressure relief valve testing			
	Safety equipment testing			
	Torque measurement and vibration analysis of rotary valve			
	Alignment and straightness of feed screw			
	Material flow rate analysis of feed screw			
	Pressure drop monitoring and air flow analysis of filters			

Important:

- Urgent issues: Emphasize any critical findings that require immediate attention due to safety concerns or potential for significant downtime. Prioritize repairs or actions to address these issues first.
- High-risk areas: Highlight areas with potential for long-term risks if not addressed, such as structural weaknesses, inefficient components, or inadequate safety measures. Recommend further investigation or preventative maintenance to mitigate these risks.
- Must follow all the safety features during all the operations.

Further details:

Inspected by	Designation	Date	Signature

Final review by	

Appendix b

Table 5 : Training schedule for Mechanical Engineering trainees

Focused area	Place	Activities	Week No	Learning Objectives	Week Assessment	Monthly Evaluations
Manufacturing Process	Plant 1,2	Visit the Oven section, biscuit making and packeting unit and Identify the procedures and main Equipment	1	Identification of the main types, functions, components of an Oven, Gearmotors,Chain & sprockets, bearings, belt and pulleys, Pneumatic systems, canvas, robots and maintenance.	Report No 01	
Manufacturing Process	Plant 3,4	Visit the Oven section, biscuit making and packeting unit and Identify the procedures and main Equipment	2	Identification of the main types, functions, components of an Oven, Gearmotors,Chain & sprockets, bearings, belt and pulleys, Pneumatic systems, canvas, robots and maintenance.	Report No 02	
Utilities	Sewage & Effluent treatment Plant	Visit the FTP and Identify the waste water treatment method, piping systems and available mechanisms etc.		Identification and study about types of wastes, treatment processes, sludge management, oil tap, monitoring and control. As well as Environmental considerations.		
Manufacturing Process	Plant 5,6	Visit the Oven section, biscuit making and packeting unit and Identify the procedures and main Equipment	3	Identification of the main types, functions, components of an Oven, Gearmotors,Chain & sprockets, bearings, belt and pulleys, Pneumatic systems, canvas, robots and maintenance.	Report No 03	
Utilities	Gas unloading unit	Visit the Gas unloading unit and identify the types of gases, unloading methods, safety, distribution methods and main components	4	Identify about the regulations and safety standards, gas properties and hazards, equipment, monitoring and inspections, emergency procedures.	Report No 04	**Presentation No 01**
Utilities	Flour Unloading unit	Visit the Flour unloading unit and get the idea about the mechanism used, components, and maintenance.	5	Identification of the mechanism used and main components like rotary valve, filters, blower, pneumatic systems also safety and maintenance.	Report No 05	
Manufacturing Process	Plant 7,8	Visit the Oven section, biscuit making and packeting unit and Identify the procedures and main Equipment	6	Identification of the main types, functions, components of an Oven, Gearmotors,Chain & sprockets, bearings, belt and pulleys, Pneumatic systems, canvas, robots and maintenance.	Report No 06	
Manufacturing Process	Plant 9 & mixing room	Visit the Oven section, biscuit making and packeting unit and Identify the procedures and main Equipment	7	Identification of the main types, functions, components of an Oven, Gearmotors,Chain & sprockets, bearings, belt and pulleys, Pneumatic systems, canvas, robots and maintenance.	Report No 07	

Utilities	Power distribution- UPS & Generator	Visit the power distribution unit and identify the main components, methods and maintenance. Etc.	8	Identification of the Power distribution unit in a factory like types battery bank, maintenance, operations.	Report No 08	**Presentation No 02**
Utilities	Boiler unit	Visit the Boiler section and get the idea about the distribution method and safety, maintenance.	9	Identification of the steam generation & distribution of a factory such as Boiler operations, main elements, maintenance and safety.	Report No 09	
Engineering tools	Engineering Tool room	Visit the Engineering tools and watch and identify the tools and equipment using in Engineering.	10	Identification of the Engineering tools.	Report No 10	
Engineering Workshop	Mechanical Workshop	Visit the mechanical workshops and get the knowledge of welding, lathe, milling etc. and safety.	11	Identification the machines and get the knowledge about the processes & safety	Report No 11	
Utilities	Chiller System	Visit the Chiller system and get the knowledge of the system.	12	Identification of components, operations, safety and maintenance.	Report No 12	**Presentation No 03**
Engineering tools	Engineering Store	Visit the Engineering store and get the idea about store management	13	Knowledge of stores operations (Material issuing, material purchasing, material storing)	Report No 13	
Utilities	Air compressor	Visit the air compressor unit and Identify the method and distribution.	14	Knowledge of Basic operations of the equipment, safety, maintenance (Start up, shutdown, Emergency,etc)	Report No 14	
Engineering Management	Maintenance management	Visit and study about the maintenance procedures and related things in Unloading unit, gas unit and boiler unit	15	Knowledge about the preventive maintenance, condition monitoring, checklists and maintenance related things	Report No 15	
Utilities	Transformers	Visit the study about the transformers and distribution method.	16	Identification of the Electricity distribution of transformers.	Report No 16	**Presentation No 04**
Engineering Workshop	Electrical Workshop	Visit and study about main electrical processes in the workshop.	17	Identification and get the basic Electrical knowledge.	Report No 17	
Engineering Management	SAP System & Engineering Audit	Study about the SAP system and Engineering Audit by visiting some plant.	18	Get the Knowledge of SAP system such as notifications, maintenance planning, Equipment hierarchy and BOM	Report No 18	
Utilities	Air handling unit.	Visit and get the knowledge about the air conditioning system in the entire factory. Such as distribution method, processes etc.	19 20	Knowledge of the AHU in a factory and get the idea about the duct system, type main components, safety, maintenance.	Report No 19	**Presentation No 05**
Engineering Management	Maintenance management	Visit and study about the maintenance procedures and related things in water treatment plants and generator room.	21	Knowledge about the preventive maintenance, condition monitoring, checklists and maintenance related things	Report No 20	

Utilities.	Fire hydrant system	Visit and study about the fire hydrant system.	22	Get the knowledge about the fire hydrant such as function and purpose, safety, operations and maintenance..	Report No 21	
Engineering Management	Maintenance management	Visit and study about the maintenance procedures and related things in In plant machineries.	23	Knowledge about the preventive maintenance, condition monitoring, checklists and maintenance related things	Report No 22	
Engineering Management	Entire Factory	Find the things should be changes in the factory, plant wise and section wise and prepare a report	24	Introduce the suggestions and improvements by using the learnt things.	Report No 23	**Presentation No 06**