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Hazards & Safety Measures in Footwear Industry - A Review

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Abstract: **Footwear are one of those products that everyone wears daily and is a basic need. India is globally the second largest footwear producer after China. India's footwear production accounts for approximately 9% of the global annual production of 22 billion pairs. The sector is fragmented and close to 75% footwear production in India being done in unorganized sector including very small, small and medium enterprises. To make the foot wares comfortable, durable, to be able to protect from injuries, or to make it look very attractive different materials are being used i.e. fabric, plastic, rubber, foams, metallic, wood, leather. During the operational activity at different sections, various hazards exists which may harm to employees & surrounding if adequate measures not ensured. In this paper hazards in Footwear Industry with control measures required to avoid any untoward incident, discussed.**

Key Words: Footwear, Shoe, Rubber, Leather, Hazard, Safety, Fire, Electrical, Mechanical, Chemical, Training, SOP.

1. INTRODUCTION

Indian Footwear Industries plays a major role in the economy of the country. Robust manufacturing set up and good manufacturing practices is the strength for quality product & high productivity. It takes time in months, years to ensure good manufacturing practices, to build up a safe working environment & maintain organization reputation. But an incident may destroy all efforts, reputation of the organization including damage to life, property & environment at large. Footwear manufacturing process is not so easy due to different activities & it involves different hazards. Inadequate Safety measures may lead to a serious incident may cause harm to human being as well as to environment due to use of different hazardous chemicals. It is the moral responsibility of an employer to ensure identification of different hazards and take adequate steps to minimize the risk due to identified hazards to ensure Zero Incident in work place. Hence a review of Hazards and Safety Measures required in footwear industry is essential to control hazards.

2. DIFFERENT DEPARTMENTS

In Footwear Industry generally different departments & sections exits for Plant operations.

- Raw Material Handling
- Logistics
- Quality Control and R&D.
- Rubber Section
- Leather Section
- Assembly Section
- Engineering (Boiler, Electrical Maintenance, Mechanical Maintenance, Water treatment Plant)
- Packaging & handling of Finished Products.
- HR & Admn (HR, Security, IT, Legal, Canteen, Training, Colony)
- Purchase & Stores
- Projects (Brown & Green field Project)
- EHS (Environment, Health, Safety, Fire)
- Accounts. Sales & Marketing

3. HAZARDS & SAFETY MESURES

There are different Hazards exits in the Footwear operations due to different activities.

- Physical Hazard
- Chemical Hazard
- Electrical Hazard
- Mechanical Hazard
- Fire & Explosion Hazard
- Occupational Health Hazard

Details activity wise identified hazards and recommended Safety measures explained.

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4.1. RAW MATERIAL HANDLING

Associated Hazards & its Effect

- Collision of Vehicles during movement & placement for loading, unloading of Material may cause serious Injury to Human being & Damage to Property.
- Fall of person during inspection of Raw material on truck or tanker may cause serious injury.
- Contact with Overhead Power cables or transmission lines may cause shock, electrocution, Fire incident.
- Overheating of vehicle engine, explosion in battery may cause fire in vehicle.
- Contact with rotating parts of conveyors during transfer for raw materials like rubber, leather, packing materials, chemicals etc.

Safety Measures

- Parking of vehicles in its designated place under supervision. Wheel chokes, Hand break, removal of vehicle key must be ensured.
- Display of warning signs & SOP's. Provision of Traffic Barriers.
- Proper traffic routing for vehicle movement.
- Adequate platform with protective railing and approach must be provided to take sample of chemicals before unloading. Ensuring use of Safety Helmet.
- Chemical transfer hose pipe must be tied properly to avoid sudden failure of hose.
- All rotating parts of Conveyors must be well guarded, and emergency stop switch must be provided at both end of conveyors.
- All electrical installation must have adequate earthing & proper insulation.
- Adequate illumination must be ensured near the unloading point during night hours.

4.2. Logistics

Associated Hazards & its Effect

- Collision of Vehicles during movement may cause serious Injury to Human being & Damage to Property.
- Slip & Fall of person during inspection of vehicle.
- Contact with Overhead Power cables or transmission lines may cause shock, electrocution, Fire incident.
- Overheating of vehicle engine, explosion in battery may cause fire in vehicle.

Safety Measures

- Ensure vehicle in good condition. Driver with valid licence and good behavioral condition.
- Following all Traffic rules and regulations.
- Provision of suitable vehicle as per need basis of Raw materials.
- Avoid rush driving by Driver.
- Inspection of vehicle time to time to avoid failure.
- Be careful about on the way Over Head transmission lines and other cables, structures to avoid incident.

4.3. R&D and Quality Control

Associated Hazards & its Effect

- Slip & Fall of person from tanker, truck top during sampling of raw material.
- Skin infection, Burn injury, inhalation of toxic gas in laboratory during testing of different raw material quality.
- Fire and Explosion in case of reaction between chemicals.
- Busting of Autoclave due to over pressurization.
- Fire in laboratory due to failure of electrical system.
- Shock & electrocution due to contact with electricity.
- Cut injury due to contact with broken glass items.

Safety Measures

- Display of warning signs & SOP's.
- All chemicals should be identified with their name and MSDS should be made available.
- Chemicals should be used by trained Chemist.
- All glass items should be handled carefully. Broken glass items must be removed immediately.
- Use of PPE's must be ensured.
- Ensure to wash hand before taking food.
- Do not take food inside the Lab.
- Be careful about contact with hot surface and hot water.
- Compressed gas cylinders should not be kept inside laboratory. Same should be kept with chain lock under shed. All PRV should be ensured in good operational condition to avoid failure. Autoclave must be examined through competent person in every six months interval.
- Do not switch on or off any electrical equipment's with bare hand.
- Do not use any damaged electrical associates.
- Switch off electrical supply when not in use.
- Ensure adequate earthing and insulation.
- Do not operate any equipment if you are not trained.
- Ensure calibration of all measuring systems to avoid failure.

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4.4. Rubber Section

Associated Hazards & its Effect

- Slip fall of person in shop floor may cause serious incident like injury to person (fracture, dislocation, sprain, Fatal).
- Burn injury due to contact with hot rubber and other chemicals.
- Shock, electrocution, Fatal due to contact with electricity.
- Cut, Amputation injury due to contact with rotating parts of machines.
- Slip & fall and collision with structures due to poor illumination.
- Noise and vibration due to poor maintenance of machines.
- Exposure to rubber dust.
- Fire due to failure of equipment's.
- Accident during maintenance activity in case of SOP 's not followed i.e. burn, unconsciousness, fatal etc.
- Failure of lifting tools, tackles, lifting machines may cause serious injury and loss to property.
- Toppling of Fork Lift.
- Musculoskeletal injuries due to repetitive movement of body or sitting in a single location for long time.
- Suffocation due to lack of ventilation.
- Fall of rubber materials on body.
- Fall of person in banbury machine and contact with rollers of roller machine & cutting machine.
- Fire or explosion due to improper handling of Sulphur.
- Fall of band formation machine roller on leg while doing maintenance or shifting.
- Contact with hot surface of machine, steam.
- Contact with sharp edge of the hand trolley.

Safety Measures

- Use of PPE's must be ensured.
- Be careful about contact with hot surface. Display of warning signs.
- Compressed gas cylinders should not be kept inside laboratory. Same should be kept with chain lock under shed.
- All PRV should be ensured in good operational condition to avoid failure.
- All chemicals should be identified with their name and MSDS should be made available.
- Sulphur should be handled with care. Ensure display of warning signs.
- Ensure use of flame proof equipment's in Sulphur handling area. Adequate safety precautions should be taken to avoid static charge generation.
- Do not switch on or off any electrical equipment's with bare hand.
- Do not use any damaged electrical associates.
- Switch off electrical supply when not in use.
- Ensure adequate earthing and insulation.
- Do not operate any equipment if you are not trained.
- Ensure calibration of all measuring systems to avoid failure.
- Use right tools and equipment's for different activity. Ensure use of non-sparking tools.
- All low, high level alarms in the machine must be maintained in good functional condition.
- Do not allow any untrained person to operate any machine.
- No open flame source, no spark, no mobile, no photography in the area of operation must be ensured to avoid any incident.
- Ensure adequate earthing for all equipment's.
- Display of all SOP's related to Plant operation, shut down and emergency shut down must be ensured and communicated to all relevant persons in the section engaged for plant operation.
- Adequate housekeeping must be maintained to avoid any incident including fire.
- Fire prevention & protection measures must be ensured.
- Inspection of machines, trolleys, pallets and fork lifts must be ensured frequently to avoid any mishap.
- Workstations should be designed properly to avoid Musculoskeletal injuries to operators due to repetitive movement of body or sitting in a single location for long time.
- Do not do any maintenance activity while, machines are in operation.
- Ensure use of PPE's, nose mask and provision of dust extraction systems.
- Regular health check of workforce working near rubber dust generation area.

4.5. Leather Section

Associated Hazards & its Effect

- Slip fall of person in shop floor may cause serious incident like injury to person (fracture, dislocation, sprain, Fatal).
- Burn injury due to contact with hot surface or steam.
- Shock, electrocution, Fatal due to contact with electricity.

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- Cut, Amputation injury due to contact with rotating parts of machines.
- Slip & fall and collision with structures due to poor illumination.
- Noise and vibration due to poor maintenance of machines.
- Exposure to leather dust.
- Fire due to overheating of equipment's.
- Accident during maintenance activity in case of SOP 's not followed i.e. burn, unconsciousness, fatal etc.
- Failure of lifting tools, tackles, lifting machines may cause serious injury and loss to property.
- Toppling of Fork Lift.
- Musculoskeletal injuries due to repetitive movement of body or sitting in a single location for long time.
- Suffocation due to lack of ventilation.
- Fall of leather materials on body.
- Contact with cutting machine.
- Contact with hot surface of machine, steam.
- Contact with sharp edge of the hand trolley.

Safety Measures

- Use of PPE's must be ensured.
- Be careful about contact with hot surface. Display of warning signs.
- Compressed gas cylinders should not be kept inside laboratory. Same should be kept with chain lock under shed.
- All PRV should be ensured in good operational condition to avoid failure.
- Do not switch on or off any electrical equipment's with bare hand.
- Do not use any damaged electrical equipment's
- Switch off electrical supply when not in use.
- Ensure adequate earthing and insulation.
- Do not operate any equipment if you are not trained.
- Ensure calibration of all measuring systems to avoid failure.
- Use right tools and equipment's for different activity.
- All low, high level alarms in the machine must be maintained in good functional condition.
- Do not allow any untrained person to operate any machine.
- No open flame source, no spark, no mobile, no photography in the area of operation must be ensured to avoid any incident.
- Ensure adequate earthing for all equipment's.
- Adequate housekeeping must be maintained to avoid any incident including fire.
- Fire prevention & protection measures must be ensured.
- Inspection of machines, trolleys, pallets and fork lifts must be ensured frequently to avoid any mishap.
- Workstations should be designed properly to avoid Musculoskeletal injuries to operators due to repetitive movement of body or sitting in a single location for long time.
- Do not do any maintenance activity while, machines are in operation.
- Display of all SOP's related to Plant operation, shut down and emergency shut down must be ensured and communicated to all relevant persons in the section engaged for plant operation.
- Ensure use of PPE's, nose mask and provision of dust extraction systems.
- Regular health check of workforce working near leather dust generation area.

4.6. Assembly Section

Associated Hazards & its Effect

- Slip fall of person in shop floor may cause serious incident like injury to person (fracture, dislocation, sprain, Fatal).
- Burn injury due to contact with hot surface or steam.
- Shock, electrocution, Fatal due to contact with electricity.
- Cut, Amputation injury due to contact with rotating parts of machines.
- Slip & fall and collision with structures due to poor illumination.
- Noise and vibration due to poor maintenance of machines.
- Exposure to rubber & leather dust.
- Fire due to failure of equipment's.
- Accident during maintenance activity in case of SOP 's not followed i.e. burn, unconsciousness, fatal etc.
- Failure of lifting tools, tackles, lifting machines may cause serious injury and loss to property.
- Toppling of Fork Lift.
- Musculoskeletal injuries due to repetitive movement of body or sitting in a single location for long time.
- Suffocation due to lack of ventilation.
- Contact with cutting machine.
- Contact with hot surface of dryer machine, steam.
- Contact with sharp edge of the hand trolley.
- Exposure to different chemicals like adhesives, toluene.

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Safety Measures

- Use of PPE's must be ensured.
- Be careful about contact with hot surface. Display of warning signs.
- Compressed gas cylinders should not be kept inside laboratory. Same should be kept with chain lock under shed. All PRV should be ensured in good operational condition to avoid failure.
- Do not switch on or off any electrical equipment's with bare hand.
- Do not use any damaged electrical equipment's.
- Switch off electrical supply when not in use.
- Do not operate any equipment if you are not trained.
- Ensure calibration of all measuring systems to avoid failure.
- Use right tools and equipment's for different activity.
- All low, high level alarms in the machine must be maintained in good functional condition. Do not allow any untrained person to operate any machine. Ensure adequate earthing for all equipment's.
- No open flame source, no spark, no mobile, no photography in the area of operation must be ensured to avoid any incident.
- Adequate housekeeping must be maintained to avoid any incident including fire. Fire prevention & protection measures must be ensured.
- Inspection of machines, trolleys, pallets and fork lifts must be ensured frequently to avoid any mishap.
- Workstations should be designed properly to avoid Musculoskeletal injuries to operators due to repetitive movement of body or sitting in a single location for long time.
- Do not do any maintenance activity while, machines are in operation.
- Display of all SOP's related to Plant operation, shut down and emergency shut down must be ensured and communicated to all relevant persons in the section engaged for plant operation.
- Ensure use of PPE's, nose mask and provision of dust & fumes extraction systems.
- Regular health check of workforce working near leather dust generation area.
- Safe handling of adhesive & toluene.
- Precautions to avoid eye injuries by wearing safety glasses.
- Use of flame proof electrical systems & non-sparking tools to avoid fire incident.
- Display of MSDS, Safety signs for creating awareness.

4.7. Engineering

Associated Hazards & its Effect

- Slip fall of person in shop floor may cause serious incident like injury to person (fracture, dislocation, sprain, Fatal). Slip & fall and collision with structures due to poor illumination.
- Burn injury due to contact with hot water, steam, chemicals.
- Shock, electrocution, Fatal due to contact with electricity.
- Cut, Amputation injury due to contact with rotating parts of machines.
- Exposure to hazardous chemicals.
- Failure of hoses used for transfer of oil, chemicals may cause burn injury or blunt injury.
- Failure of lifting tools and tackles may cause serious injury and damage to property.
- Incident in case of failure to strict work permit system requirements during maintenance work.

Safety Measures

- Use of PPE's (Safety shoes, Safety helmet, cotton hand gloves, leather apron, safety goggles) must be ensured.
- Be careful about contact with hot surface and hot water.
- Do not switch on or off any electrical equipment's with bare hand.
- Do not use any damaged electrical associates.
- Ensure adequate earthing and insulation.
- Use right tools and equipment's for different activity.
- Ensure work permit & adequate isolation before start of any critical routine and non-routine maintenance job.
- Ensure use of quality items with proper specification for maintenance of machinery and plant systems.
- Ensure inspection of lifting tools, tackles, machines, pressure parts, pipe lines, portable power tools, hand tools before use and ensure routine inspection.
- Ensure use of insulated tools and insulated ladders during electrical maintenance activity.
- Training to workforce. Display of warning signs and Safety instructions.
- Adequate illumination in the shop floor.
- Replacement of damaged / defective equipment's.
- Calibration of all measuring systems.
- Ensuring proper housekeeping to avoid fall hazard.
- Do maintenance of any work after releasing load or stored energy.

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- Proper keeping of compressed gas cylinders.
- Diversion of smoke to atmospheres through stack.
- Examination of PRV, Pressure vessels, lifting tools, tackles through competent person.
- Participation in Onsite emergency plan and mock drill.
- Proper colour coding of pipe lines.
- Compressed gas cylinders should be kept with chain lock and with proper identification under shed.
- Ensure adequate guarding on rotating parts of equipment's. Siren Pull cord and emergency push bottom switch for conveyor operation.
- Acoustic enclose for DG to control noise pollution.
- Adequate safety measures related to confined space work.
- Ensuring monitoring of oxygen level & other toxic gas if any in confined space.

4.8. Packing & Handling of Finished Products.

Associated Hazards & its Effect

- Slip fall of person in shop floor may cause serious incident like injury to person (fracture, dislocation, sprain, Fatal). Slip & fall and collision with structures due to poor illumination.
- Shock, electrocution, Fatal due to contact with electricity.
- Cut, Amputation injury due to contact with rotating parts of machines.
- Fall of materials.
- Hitting with trolley, Powered industrial vehicles
- Fire in packing materials, insulations, overheating of machines and failure of electrical systems.
- Injury due to fall of packaging material rolls.
- Fire in Packing materials.
- Cut injury due to contact with sharp points of different machines.
- Exposure to leather and rubber dust while finishing the shoe.
- Toppling of fork lift nay cause injury.
- Blockage of emergency exits may cause incident.
- Improper keeping of items may cause injury during movement of workforce.
- Exposure to different chemicals and polish.
- Musculoskeletal injuries due to repetitive movement of body or sitting in a single location for long time.
- Eye strain due to inadequate illumination.
- Cut injury due to contact with sharp edge of pallets.
- Injury to leg due to poor handling of hand trolleys.
- Suffocation due to poor ventilation in shop floor may cause occupational health issues.

Safety Measures

- Use of PPE's (Safety shoes, Safety helmet, cotton hand gloves, safety goggles) must be ensured.
- Do not switch on or off any electrical equipment's with bare hand.
- Do not use any damaged electrical associates.
- Ensure adequate earthing and insulation.
- Ensure work permit & adequate isolation before start of any critical routine and non-routine maintenance job.
- Training to workforce. Display of Safety instructions and posters. Implementation of 6S Practices.
- Proper maintenance of pressure control systems.
- Calibration of measuring systems.
- Proper maintenance of hand trolley & industrial powered trucks, Fork lifts.
- Proper housekeeping and hygiene practices.
- Ensure provision buddy red light system in the shop floor to alert workforce in case of any emergency.
- Fire protection systems. Provision of smoke detectors and alarms.
- All packing section machines must be maintained in well operational condition with safety systems.
- SOP's for different machine operation to be displayed & communicated to all relevant persons.
- All interlocks installed in critical machines must be maintained adequately to avoid failure. Do not by pass any interlocks.
- Smoke detectors must be installed in all packing item storage rooms.
- Timely disposal of wastes must be ensured to avoid fire incident.
- Damaged insulation on pipe lines must be replaced immediately.
- Emergency power supply must be provided in the packing section to avoid any incident.
- All machines safety systems must be checked prior to operation and regular inspection of all machines must be ensured to avoid any incident.
- Do not operate any machine if found in over heating condition.
- Adequate seating arrangements and designing work sequence to reduce musculoskeletal issues.
- Health checkup of employees.
- Provision of dequate illumination to avoid eye strain.
- Ensure emergency exits should be kept free from obstructions.
- Marking movement areas on floor & fixing of emergency route direction lights.

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4.9. HR & Administration and Accounts.

Associated Hazards & its Effect

- Slip fall of person in shop floor may cause serious incident like injury to person (fracture, dislocation, sprain, Fatal). Slip & fall and collision with structures due to poor illumination.
- Shock, electrocution, Fatal due to contact with electricity.
- Cut injury due to contact with broken glass.
- Fire due to overheating of electrical systems, AC's, Printer, Xerox machine, micro oven etc in office.
- Fire in LPG facility inside canteen.
- Insect bite during Gardening activity.
- Injury due to Public unrest.

Safety Measures

- Safety instructions to workforce.
- Proper housekeeping.
- No work to be carried out without valid work permit.
- Ensuring electrical safety measures.
- Display of SOP's, road safety signs and safety poster.
- Fire protection systems.
- Adequate illumination in case working during night hours.
- Proper maintenance of Electrical installations and server room.
- Switching off AC's, PC's, Xerox machine, printers, lights when not required.
- Adequate emergency preparedness at Unit to handle any emergency.
- Adequate training to employees.
- Behavioral based training & statutory related training programs for employees.
- Provision of PPE during gardening activity.
- Proper maintenance of Fire protection systems.
- Ensuring statutory Compliances.

4.10. Stores and Purchase

Associated Hazards & its Effect

- Slip fall of person in shop floor may cause serious incident like injury to person (fracture, dislocation, sprain, Fatal). Slip & fall and collision with structures due to poor illumination.
- Fall of material.
- Cut injury due to contact with broken glass.
- Hitting with trolley, Powered industrial vehicles
- Fire in packing materials, insulations, overheating of machines and failure of electrical systems.
- Fire in compressed gas cylinders.
- Splashing of chemical during unloading of chemicals from tanker.
- Fall of person from truck, tanker during inspection of material.
- Wearing of PPE's.

4.11. Projects (Green Field & Brown Field)

Associated Hazards & its Effect

- Slip fall of person in shop floor may cause serious incident like injury to person (fracture, dislocation, sprain, Fatal). Slip & fall and collision with structures due to poor illumination.
- Hand / Finger Cut, amputation, blunt injury.
- Fire and explosion, loss of property.
- Electric shock, Electrocution.
- Fatal in case fall of person.
- Collapse of building / structures.
- Collision of vehicles. Road accidents.
- Fall of person in excavation pits.
- Exposure to steel rods.
- Failure of lifting tools, tackles, lifting machines.
- Insect bite.
- Fire in compressed gas cylinders.

Safety Measures

- Safety instructions to workforce. Site Tool box talks.
- Inspection of equipment's before use. Use of right tools for the job.
- Compressed gas cylinders should be kept with chain lock and with proper identification under shed.
- No work to be carried out without valid work permit.
- Ensuring electrical safety measures. Display of warning sign & barricading of the site.
- Inspection of all equipment's before use.
- Fire protection systems.
- Deployment of qualified person for supervision of the job. Approval of design drawing.
- Adequate illumination in case working during night hours.
- Ensure examination of lifting tools, tackles and lifting machines through competent person.
- Proper housekeeping practices.
- Proper stacking of materials.
- Ensuring use of required PPE's (Safety helmet, safety shoes, safety goggles, nose mask,
- Road safety practices.
- Strict enforcement of Safety rules and regulations.

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4.11. Environment, Health, Safety & Fire

Associated Hazards & its Effect

- Slip fall of person in shop floor may cause serious incident like injury to person (fracture, dislocation, sprain, Fatal). Slip & fall and collision with structures due to poor illumination.
- Hand / Finger Cut, amputation, blunt injury.
- Fire and explosion, loss of property.
- Electric shock, Electrocution.
- Collision of vehicles. Road accidents.
- Busting of Fire extinguishers during hydrotest.
- Exposure to smoke and fire during Firefighting.
- Expose to Ammonia and corrosive chemicals during handling emergency in case of leakage.
- Exposure to Hazardous waste.

Safety Measures

- Safety instructions to workforce.
- Inspection of equipment's before use. Use of right tools for the job.
- Proper housekeeping.
- No work to be carried out without valid work permit.
- Ensuring electrical safety measures. Display of warning sign & barricading of the site.
- Proper maintenance of Fire protection systems.
- Adequate illumination in case working during night hours.
- Ensuring use of required PPE's (Safety helmet, safety shoes, safety goggles, nose mask,
- Adequate emergency safety measures. Mock drill, Fire drill must be conducted for awareness among employees.
- Provision & maintained all emergency safety equipment's like BA set, Safety showers, portable gas detectors, safety touch, hand siren etc. in good condition.
- Compliance to all legal requirements related to EHSF.
- Regular inspection and audit of different sections.
- Implementation of 6S practices.
- Ensuring Proper investigation of all incident for timely CAPA.
- Implementation of new practices & innovative measures to improve safety culture and to avoid incidents.
- Review of HIRA sheets, all existing safety systems and practices to take adequate measures if required.

5. CONCLUSION

Safety is essential due to Moral, Legal & Economical reason in any industrial premises. It is the moral responsibility of employer to safe guard their most valuable asset i.e. employees. To ensure successful plant operation involvement of different well-trained technical staff, robust equipment's, good quality raw materials, proper maintenance of equipment's with broadly formulated standard operating procedure should be adopted

Hazard identification and control measures according to identified hazard is a vital tool for eliminating incidents in footwear industries.

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